Food Price Inflation, household characteristics, and Poverty: Empirical Evidence from South West Ethiopi:

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Abstract

Sustained price increases directly worsen a household's well-being by leading to greater deprivation, while underlying demographic and economic factors gradually make poverty more deeply entrenched and persistent over time. This study explores how rising food prices and household characteristics affect poverty in Ethiopia's Southwest, using data from the Household Consumption and Expenditure Survey. The research first uses the Quadratic Almost Ideal Demand System model to understand how households shift their consumption patterns in response to price change. Then, it calculates the additional money households would need to maintain their pre-price change consumption levels under three hypothetical inflation scenarios and assesses the impacts on the poverty measures. Second, the study employs a logistic regression to identify the key household characteristics that influence poverty. The findings indicate that if prices rise by 30%, households would require an additional 29% income just to keep their consumption at previous levels. This would cause the poverty rate, gap, and severity indices to increase by 17%, 6%, and 3% respectively, with food poverty measures seeing increases of 19%, 8%, and 3%. The regression analysis also reveals that poverty in the region increases with family size but decreases as income grows. These results emphasize the need for development programs to shift their focus towards rural areas, ensuring that the rural poor can also benefit from economic growth. To help the poor cope with immediate food price inflation, food aid or cash transfers could serve as effective short-term strategies. However, a more sustainable and lasting solution involves boosting food production and improving productivity by encouraging private investment in food crop sectors.

Key Words: *CV, inflation, QUAIDS, poverty, welfare, Southwest Ethiopia*

Introduction

Poverty is a severe shortfall in achieving a basic standard of living, resulting from limited resources, economic shocks and lack of entitlements (Haughton & Khandker, 2009). In pursuit of global goals to eradicate poverty through inclusive and sustainable economic growth, Ethiopia has initiated various development programs [2]. Ethiopia's progress towards poverty reduction has been marked by a significant economic growth rooted in agricultural sector (WB, 2020). Between 2004 and 2017, the economy registered a remarkable double-digit growth, averaging 10.5 percent annually (MoF, 2020). The national poverty rate dropped from 42% in 2000 to 24% in 2016, and the food poverty index decreased from 42% to 25% over the same period (PDC, 2018). Nevertheless, the welfare gains have been largely confined to urban areas and higher-income groups, leading to uneven poverty reduction. Between 2000 and 2016, urban areas experienced substantially larger drops in both general and food poverty rates compared to rural areas. This growing rural-urban disparity is evidenced by a rising rural Gini coefficient, ultimately weakening the overall impact of economic growth on poverty reduction (WB, 2020). Poverty reduction efforts face persistent challenges due to a combination of macroeconomic pressures, such as food price inflation, and underlying household demographic and economic characteristics. Ethiopia faces one of Sub-Saharan Africa's highest inflation rates, largely due to its heavy reliance on rain-fed agriculture, which leaves the food sector highly vulnerable to climate variability and frequent food shortages (Nguyen et al., 2017; Kuma & Gata, 2023).High food inflation significantly reduces household purchasing power, especially for low-income majority who spend a large portion of their budget on food (Ali, 2022). This leads to limited consumption of diverse and quality food items, pushing the "near-poor" into poverty and worsening conditions for those already deprived (Binti Ismail et al., 2022). Consequently, persistent food price surges pose a severe threat to household welfare and deepen overall deprivation. Recent studies, such as Basnayake et al. (2022), Odusanya et al.(2016), Bachewe & Headey (2018) , SEZGİN and SEZGİN(2021), and Zehra and Fatima, (2022) have verified inflation driven poverty hypothesis.

Ethiopia's poverty, much like in other developing nations, is a result of the complex interaction between household demographics and economic characteristics. Geographic location significantly impacts poverty risk, as urban areas benefit from better infrastructure and market access while rural regions consistently lag due to a severe lack of essential services (WB Institute, 2005). Gender inequality is another critical factor; cultural norms and labor market discrimination limit women's access to productive resources, making female-headed households particularly vulnerable. Furthermore, education and income directly correlate with poverty reduction: higher educational attainment boosts earning potential, and greater household income from diverse livelihood activities directly reduces poverty likelihood. Finally, household structure also plays a crucial role; both the age of the household head (balancing productive years with the vulnerability of advanced age) and household size and composition (e.g., higher dependency ratios in larger, younger households) significantly influence a household's poverty status. The household demographic and economic characteristics significantly contribute to poverty by making people more vulnerable. This connection is thoroughly supported by numerous studies, including those by Teshome & Sharma (2014), PDC (2018), Teka et al. (2019), and Anteneh (2020).

While macroeconomic shocks can abruptly reverse achievements in poverty reduction, demographic and economic factors contribute by entrenching poverty over time. However, there’s limited understanding of these effects in Ethiopia due to a scarcity of research. Only a handful of studies, including those by Alem and Köhlin (2014), Ali (2022), Klugman et al. (2007), Shimeles and Delelegn (2013), Tefera et al. (2012), and Ulimwengu (2009), have investigated the welfare impacts of higher food prices. Similarly, there is a significant dearth of literature investigating persistent nature of poverty in the South West region.

This study tackles key knowledge gaps about poverty in Ethiopia's southwest, a region known for extreme poverty, food insecurity, and high inequality (PDC, 2018; WB, 2020). We specifically explore both transient and persistent drivers of poverty. Our first main goal is to quantify the monetary cost and poverty consequences of food inflation. This is critical because low-income groups are highly vulnerable to price changes (Odusanya et al., 2016), rising food costs worsen already precarious household well-being, and sustained food inflation can reverse hard-won gains in poverty reduction. Our second objective is to pinpoint the specific household characteristics that cause poverty to persist. The insights from this research will help create better strategies to keep households from falling back into extreme poverty and shorten how long they experience it.
The introduction is followed by descriptions of methods and the data in section 2. Section 3 presents the empirical results and discussion in a greater depth, while Section 4 sums up the discussions with a conclusion and policy implications.

Materials and Methods

This research uses two distinct econometric approaches. First, we'll quantify how food price inflation affects poverty and welfare. Second, we'll use a logistic model to independently identify the factors that determine poverty.

Demand system, Compensating Variation and Poverty indices

This approach, used to study how food price inflation affects poverty, involves three main steps. First, we estimate the food demand system to get **elasticities**, after addressing any econometric challenges. The second step uses **compensated price elasticities** to calculate the **compensating variation (CV)** that results from the price increase of each food item. Finally, the third step involves setting **benchmark poverty lines** and then, based on the previous results, analyzing how food price inflation impacts **poverty indices**.

Quadratic Almost Ideal Demand System model

The study employed the Quadratic Almost Ideal Demand System (QUAIDS) as the analytical framework defined by:

$$w_i = \alpha_i + \sum_{j=1}^{k}\delta_{ij}D_j + \sum_{i=1}^{n}\gamma_{ij}lnP_j + \beta_i\, ln\left(\frac{m}{a(P)}\right) + \frac{\lambda_i}{b(p)}ln\left(\frac{m}{a(p)}\right)^2 + \varepsilon_i \qquad (1)$$

Where w_i is the expenditure share of the i[th] food group, D_j *is demographic variables (sex, household size, household head age, household head education and residence of household,* P_j is the price of the j^{th} good, *m* is the total expenditure on six group of foods(namely cereals, pulses, roots, fruits and vegetables, animal products and drinks), $lna(p) = \alpha_0 + \sum_{i=1}^{n}\alpha_i lnP_i + \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{n}\gamma_{ij}lnP_i lnP_j$, is a transcendental price index given, $b(p) = \prod_{i=1}^{n}P_i^{\beta_i} = \exp(\sum_i \beta_i lnP_i)$, *is a* Cob- *Douglass price aggregator* , $\lambda(p) = \sum_i^n \lambda_i lnP_i$, is a differentiable, homogenous function , α_i is the constant coefficient in the i[th] share equation, δ_{ij}, γ_{ij}, β_i and λ_i are the parameters to be estimated; and ε_i is error term. Instead of prices, a unit value is calculated for each group by dividing the purchase value by the quantity. As a result, the price of a commodity is a weighted average of the commodity prices of the group, the weights being the average budget shares of each item.

The demand theory imposes restrictions on the QUADS model to satisfy the following properties: adding up of budget shares$\left(\sum_{i=1}^{n}w_i = 1;\ \sum_{i=1}^{n}\alpha_i = 1; \sum_{j=1}^{k}\delta_{ij} = 0\ \sum_{i=1}^{n}\gamma_{ij} = \sum_{i=1}^{n}\beta_i = \sum_{i=1}^{n}\lambda_i = 0\right)$, Homogeneity of zero degree in price $\left(\sum_{i=1}^{n}\gamma_{ij} = 0\right)$, and Slutsky symmetry $\left(\gamma_{ij} = \gamma_{ji}\right)$

Censoring and endogeneity are the two econometric issues with cross-sectional household-level data. The study adopted a two-step econometric technique for handling the censoring problem proposed by Shonkwiler and Yen (1999). The first step obtains consistent estimates for d_i; the probability that a household consumes the food item by using probit model as below:

$$w_i^* = x_i^{i}\beta_i + u_i \ , \ d_i^* = z_i'\alpha_i + v_i \qquad (2)$$

$$d_i = \begin{cases} \text{if } d_i^* > 1 \\ ootherwise \end{cases}$$

$$w_i = d_i w_i^*$$

Where, d_i is a dichotomous variable that takes 1 if the household did consume the good i and 0 otherwise; w_i^* and d_i^* are unobserved, latent counterparts.x_is and z_is are respectively household prices and demographics;$\alpha_i$and$\beta_i$are unknown parameters to be estimated;u_i and v_i are error terms.

Denoting Φ(.) and ϕ(.) respectively for the cumulative and density functions of standard normal distribution derives expectation for observed budget share as:

$$w_i^* = \Phi(z_i'd_i)w_i + \varphi\phi(z_i'd_i) \qquad (3)$$

Where zs are observed characteristics The second step replaces d_i with estimates to recover the parameters of demand system.

To overcome endogeneity, we augment the censored demand system (3) by residuals, its square and cubic terms by estimating reduced form expenditure model with OLS:

$$w_i^* = \Phi(z_i'\alpha_i)\left\{\alpha_i + \sum_{j=1}^{k}\delta_{ij}D_j + \sum_{i=1}^{n}\gamma_{ij}lnP_j + \beta_i ln\left(\frac{m}{a(P)}\right) + \frac{\lambda_i}{b(p)}ln\left(\frac{m}{a(p)}\right)^2 + \sum\tau\acute{v}_{\ i}\right\}$$

$$+\delta_i\varphi\phi(z_i'\alpha_i) \qquad (4)$$

Moreover, to reduce the risk of heteroskedasticity, we used the log form of variables. Finally, equation (4) is estimated by an iterative feasible generalized nonlinear least squares method (IFGNLS) proposed by Poi (2012). The estimator enforces linearity in parameters and restrictions on demand equations. We derive expenditure and price elasticities by differentiating (4) with respect to lnm and lnp_j, as follows:

$$\epsilon_i = \frac{\partial w_i^{*}}{\partial lnm} = \Phi(Z_i{}'\alpha_i)\left(\beta_i + \frac{2\lambda_i}{b(p)}\left\{ln\left[\frac{m}{a(P)}\right]\right\}\right) \quad (5)$$

$$\epsilon_{ij} = \frac{\partial w_i^{*}}{\partial lnp_j} = \Phi(Z_i{}'\alpha_i)\left\{\gamma_{ij} - \epsilon_i\left(\alpha_j + \sum_{i=1}^{n}\gamma_{jk} lnP_k\right) - \frac{\lambda_i}{b(p)}\left\{ln\left[\frac{m}{a(P)}\right]\right\}^2\right\} \quad (6)$$

The expenditure elasticities are given by $E_i = \frac{\epsilon_i}{w_i^*} + 1$, Marshallian price elasticities are derived as, $E_{ij}{}^u = \frac{\epsilon_{ij}}{w_i^*} - \vartheta_{ij}$, where ϑ_{ij} is Kronecker delta defined as $\vartheta_{ij} = \begin{cases} 1 \; for \; i = j \\ 0 \; otherwise \end{cases}$, and the Hicksian (compensated) price elasticities are expressed as, $E_{ij}{}^c = \frac{\epsilon_{ij}}{w_i^*} + E_i w_i^*$.

Compensating variation

To investigate the impacts of food inflation on household welfare, we use compensating variation. Assuming the price changes from P^0 to P^1 , the CV in terms of expenditure function is defined as:

$$CV = e(P^1, U^0) - e(P^0, U^0) \quad (7)$$

A positive CV value indicates welfare loss and a negative value vice versa. The term $e(P^1, U^0)$ can be approximated by the second order Taylor expansion and Following Yu (2014), the CV when a price of specific food changes while the prices of others are fixed can be expressed as:

$$CV \cong \sum_i h_j^0 \triangle p_j + \frac{1}{2}\sum_i\sum_i\left(\frac{\partial h_k^0}{\partial p_j}\right)(\triangle p_i)^2 \quad (8)$$

Where $\frac{\partial^2 c(P^0, U^0)}{\partial p_k \partial p_j} = \frac{\partial h_k^0}{\partial p_j}$, h_k^0 is the Hicksian demand for good k. A constant money metric utility implied by percent of additional expenditure and prices change is obtained as:

$$\frac{CV}{m_0} \cong \sum_i w_i \triangle lnp_i + \frac{1}{2}\sum_i\sum_i \varepsilon_{ip}{}^c w_i (\triangle lnp_i)^2 \quad (9)$$

Where , p_i is price of the item, $\varepsilon_{ip}{}^c$ is the compensated own price elasticity.

Poverty Indices

Following Caracciolo *et al.* (2014) and Prifti *et al.* (2017), we draw a new poverty line by adding the CV values obtained in equation (9) to the original poverty line. We then compare the new poverty lines with the original poverty lines to investigate the impacts of food price inflation on poverty measures.

The study employed the Foster-Greer-Thorbeck (FGT) indices developed by Foster *et al*. (1984), defined by:

$$P_\alpha = \frac{1}{N}\sum_{i=1}^{Q}\left(\frac{Z-Y_{ih}}{Z}\right)^{\alpha} I(Z \geq Y_{ih}) \quad (10)$$

Where; P_α is the poverty measure $(\alpha = 0, 1, 2)$ representing head count, gap and severity indices respectively, N is population size, Q is the number of poor households, Z is poverty line , Y_{ih} is household's per capita expenditure(either food or total); and $I(Z \geq Y_{ih})$ an indicator function, which is 1 if $Z \geq Y_{ih}$, and 0 otherwise.

The poverty headcount index is the share of the poor in the population whose per capita expenditure Y is less than the poverty line Z. The poverty gap index is the mean distance of the poor from the poverty line which is measured in terms of resources that would be needed to lift all the poor out of poverty through perfectly targeted cash transfers.The poverty severity index is the measure of the inequality among the poor as the square of the gap index.

The logistic regression Model

Let define the probability that the i th household being poor as P_i conditional on a set of $X' = (x_1, x_2, \ldots . . x_k)$ explanatory variables. Where P_i satisfies the requirement $0 \leq P_i \leq 1$. We could write the binary response model as:

$$Y_i = P_i + \mathcal{E}_i \quad ; i = 1, 2, 3 \ldots . n \quad (11)$$

Where Y_i is a binary response Y_i=1 if the household is poor and Y_i=0 if th household is non-poor. $\mathcal{E}_i$ is error term, and P_i is the logistic function is given by:

$$P_i = \frac{exp(Z_i)}{1+exp(Z_i)} \quad (12)$$

Where $Z_i = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k$

The log-odds of households falling into poverty conditional on X' could be written as:

$$E(Y_i = 1|X) = \log\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k \quad (13)$$

Variables and Hypothesis

Poverty is common in the rural areas. To account for this, we use a location variable: 1 for urban homes and 0 for rural. Because rural is the baseline, we expect an urban location to be negatively linked with poverty, suggesting that rural households are more susceptible to it. Household size refers to the number of family members and can have either a positive or negative relationship with the likelihood of being poor.

The age of the household head and its squared value represent experience. We anticipate that older household heads will have both negative and positive associations with poverty. Household head literacy is a dummy variable: 1 for an educated head, 0 otherwise. We predict that an educated household head will reduce the chances of the household being poor. Household head gender is a dummy variable, with 1 for male-headed households and 0 for female-headed. In Ethiopia, women are often disadvantaged in leadership roles, so female-headed households are generally more likely to be poor.

For household income, this study uses food expenditure as a stand-in for total spending to address specific econometric issues of concerns. We hypothesize that higher food expenditure (as a proxy for income) will be negatively associated with poverty.

Data and sources

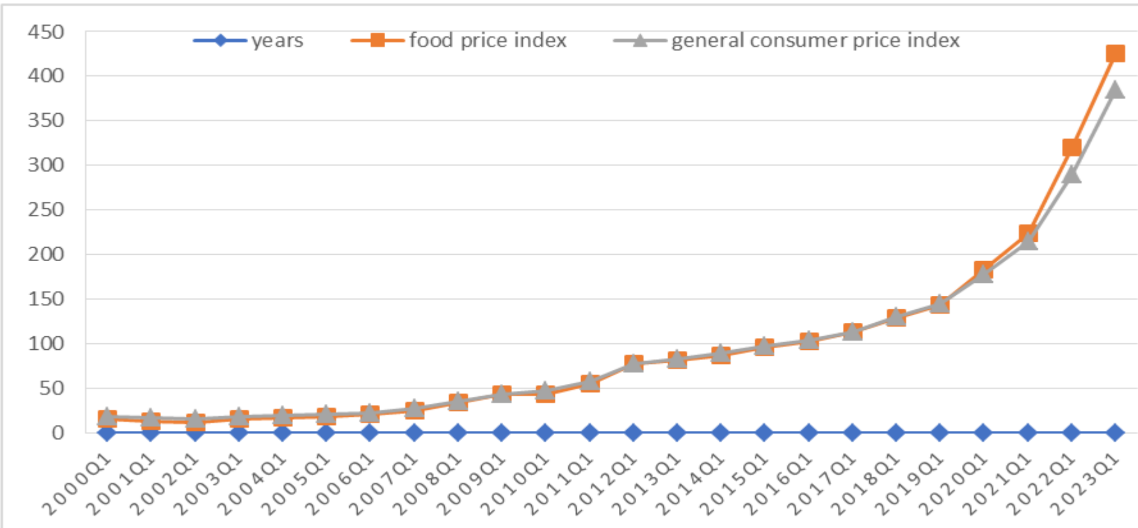
Household Income and Expenditure Survey (HICES) data which was collected by Ethiopia's Central Statistical Authority (CSA) in 2016was used as the main data of the study. After purging the original data of any potential outlier observations that could skew the results, consistent 519 households were extracted for the South West region. Besides, monthly time series of consumer price index from Food and Agricultural Organization (FAO) web page was used as supplementary data.

Results and Discussions

Inflation dynamics

As shown in Figure 1, both food and non-food prices have been on a continuous upward trend since 2004, with more recent sharp increases. By the first quarter of 2023, the food and non-food price indices were 27 and 21 times higher, respectively, than their 2000 levels. Food prices have consistently outpaced the overall price level, notably in 2008-2009, 2011-2012, 2017-2018, and continuously since 2020. These spikes often align with sharp increases in global commodity prices as well as domestic demand and supply issues (Bachewe & Headey, 2017). Significantly, food prices are the primary driver of general inflation in Ethiopia, accounting for 57% of inflationary pressures, with cereals alone contributing 23% (Durevall et al., 2013).

Figure 1 Price indices

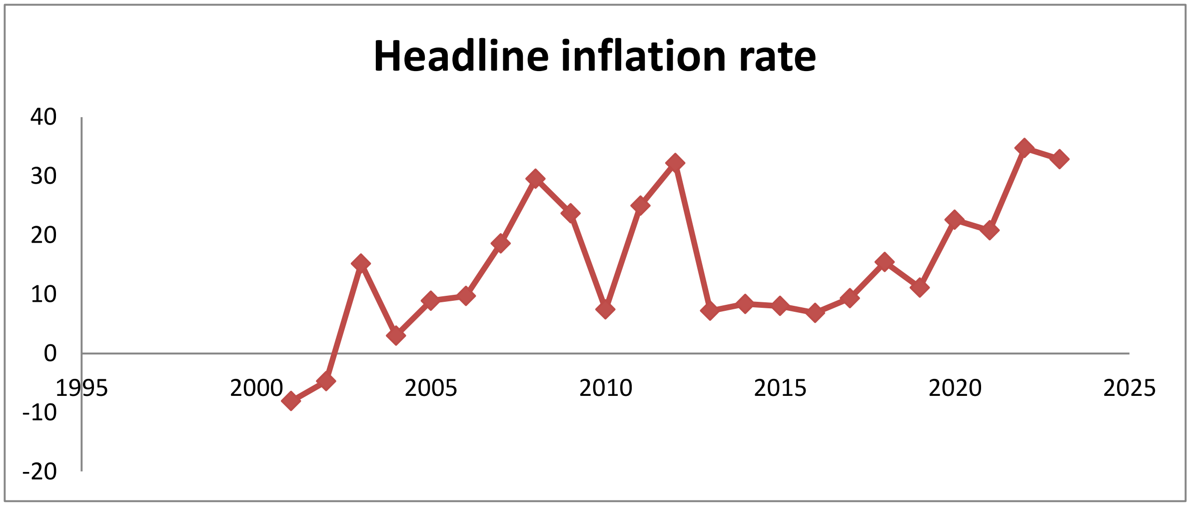


Source: author computation from FAO Data

Ethiopia has been struggling with significant inflation for years, with the **headline rate averaging 14.70% annually** and mostly remaining in double digits since 2000 (Figure 2). While not always consistent, inflation has recently surged at an alarming, persistent pace. For example, headline inflation hit a record 34.73% in early 2022, a sharp rise from 11.13% in March 2019, with food prices accounting for a significant portion of this increase (11.44% of the 13.93% annual rise, given food's 54% weight). Indeed, food price inflation itself reached an all-time high of 43.47% in early 2022**,** up from 22.27% a year prior.

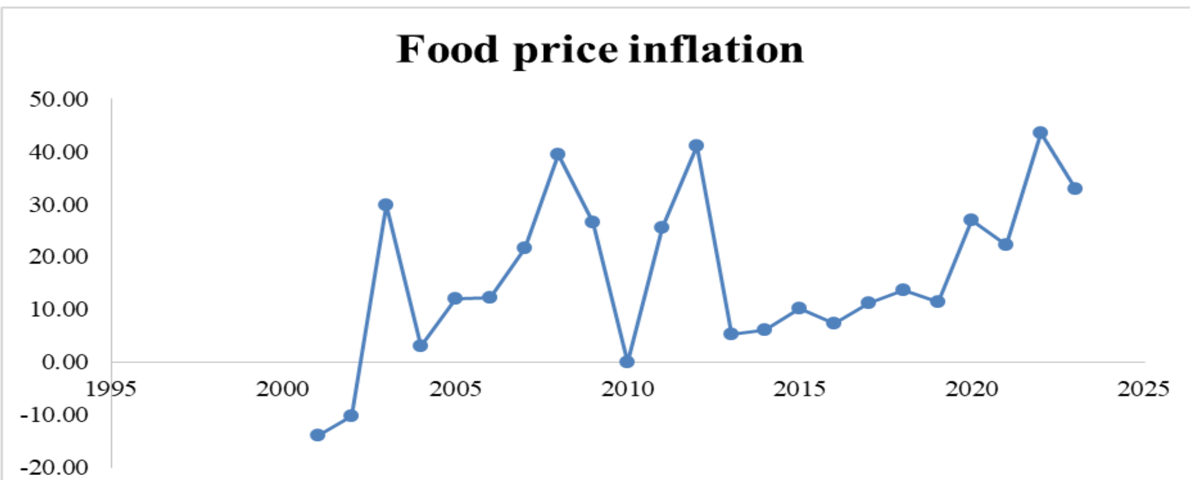
Despite some fluctuations, food prices have climbed steadily since 2010 (Figure 3), increasing by an average of 16.38% annually since 2002 and accelerating dramatically since 2018. This is primarily due to rising costs across various food categories like oils, cereals, and vegetables (NBE, 2023). All regions of Ethiopia are expected to see drastic rises in food inflation, though the intensity will vary, influencing how households adjust their consumption based on their unique circumstances (Ulimwengu et al., 2009).

Figure 2: headline inflation



Source: author computation from FAO Data

Figure 3: food price inflation



Source: author computation from FAO Data

Poverty

The study adopted national poverty lines as set by the Ethiopian authorities, which are based on the same data. Food poverty is defined as the cost of a daily consumption bundle providing 2,200 kilocalories, valued at national average prices. Absolute poverty further accounts for essential non-food needs like education, health, and housing. The absolute poverty line is derived by dividing the food poverty line by the food share of the poorest 25% of the population. For 2016, Ethiopia's official food and absolute poverty lines were 3,781 ETB and 7,184 ETB, respectively

(PDC, 2018), with the latter aligning with the international $1.25/day threshold. However, to better reflect varying costs of living, this study also constructed different poverty lines for rural and urban areas, following Stifel and Woldehanna (2016). This resulted in annual per-capita absolute poverty lines of 6,284 ETB for rural, 10,005 ETB for urban, and 7,184 ETB for regional (overall) populations. The corresponding food poverty lines were 3,302 ETB, 4,234 ETB, and 3,781 ETB, respectively.

As can be observed from Table 1, 30% of the households in the region live below the poverty line and 34% are food poor, with rural households being significantly more vulnerable than urban ones; these findings align with previous studies (PDC, 2018; Goshu, 2019; WB, 2020). This study assessed **income and food consumption inequality** using the **Gini coefficient** (where 0 is perfect equality and 1 is perfect inequality). **Table 1** reveals a **high level of inequality** among households in the region. The Gini coefficient for **total expenditure is 94%**, and for **food consumption, it is 50%**. This inequality is more pronounced in rural areas than in urban centers. These figures are notably higher than those reported in previous studies by PDC (2018) and the WB (2020).

Table1: Poverty indices

Benchmark Absolute poverty Index	Regional	Rural	Urban
Head count index(α=0)	0.30	0.34	0.22
gap index(α=1)	0.09	0.10	0.05
severity index(α=2)	0.04	0.04	0.02
Gini-coefficient	0.94	0.97	0.53
Benchmark Food insecurity index			
Head count index(α=0)	0.34	0.34	0.26
gap index(α=1)	0.10	0.10	0.08
severity index(α=2)	0.05	0.05	0.04
Gini-coefficient	0.66	0.58	0.69
Gini-coefficient (food consumption)	0.5	0.57	0.32

Source: own computation from CSA data

Descriptive Statistics analysis

Table 2 highlights stark demographic differences between poor and non-poor households. Across both locations, more people live in poor households than in non-poor ones. Poor rural households spend 15% more on food than their non-poor counterparts, while poor urban families allocate more income to non-food items due to higher housing and transport costs. Educational attainment is significantly lower in rural households, with only 53% regional literacy. Rural residents average a 2^{nd} -grade education, compared to a 7^{th} -grade average in urban areas. Consequently, poverty is more common in households led by less educated individuals. Finally, while male household headship is common practice across the region, poverty incidence is notably higher among older households in both rural and urban settings.

Table 2 also offers valuable insights into food consumption patterns, highlighting expenditure percentages and zero consumption rates during the survey recall periods. Households in Ethiopia's Southwest region allocate nearly half their budget to cereals and drinks, which are intensely consumed favourites. Non-poor households spend more on animal products and drinks, while poor households prioritize other items. Animal products, despite their nutritional value, are largely unaffordable for the poor. As a result, pulses and oils serve as more accessible protein substitutes. Although fruits and vegetables are common, they remain less affordable for the poor, who instead heavily consume root crops across the region. These findings align with research by Darmon and Drewnowski (2015), Binti Ismail et al. (2022), and Obiora et al. (2023), all of whom noted that poor households often consume less expensive, lower-quality diets.

Table2: demographic characteristics of households

	Rural =296			Urban =223			Regional =519		
Variables	Poor	Non-poor	Total	Poor	Non-poor	Total	Poor	Non-poor	Total
family size	5.94	4.13	4.74	5.79	3.09	3.67	5.73	3.67	4.28
age	41	39	39	36	35	36	39	37	38
Sex (male=1)	0.77	0.71	0.73	0.71	0.69	0.69	0.77	0.68	0.71
Literacy(literate=1)	0.36	0.37	0.36	0.77	0.75	0.75	0.42	0.58	0.53
Years of schooling	1.59	1.91	1.80	5.91	6.88	6.67	2.18	4.64	3.89
Food expenditure share	0.55	0.54	0.55	0.40	0.45	0.44	0.53	0.49	0.502
budget shares and zero expenditures (in brackets) by food groups									
W1=Cereals	0.23	0.22	0.23(0.04)	0.33	0.27	0.28(0.02)	0.26	0.25	0.25(0.03)
W2=Pulses & oils	0.18	0.15	0.16(0.07)	0.14	0.14	0.14(0.11)	0.17	0.14	0.15(0.09)
W3=Root crops	0.17	0.13	0.15(0.22)	0.08	0.06	0.07(0.41)	0.15	0.10	0.11(0.30)
W4=Fruits & vegetables	0.14	0.15	0.15(0.03)	0.17	0.12	0.13(0.07)	0.14	0.14	0.14(0.05)
W5=Animal products	0.08	0.14	0.12(0.47)	0.12	0.18	0.17(0.31)	0.08	0.16	0.14(0.40)
W6=Drinks	0.20	0.21	0.21(0.01)	0.16	0.22	0.21(0.004)	0.20	0.21	0.21(0.01)

Expenditure and Price elasticities

We analysed expenditure and price elasticities using the censored QUADS model in STATA (Table A1). Expenditure elasticity measures how much demand for an item changes with a percentage change in income. Our findings show that pulses, fruits, and vegetables are necessities (elasticities between 0 and 1), meaning demand for them increases less than income. Conversely, animal products are considered luxuries (elasticities above 1) across both rural and urban areas (Table 2), as consumers seek more of these as their income rises (Tefera et al., 2012; Yekin, 2022).

Table3: Expenditure and own price elasticities

	Expenditure elasticities			Uncompensated own price elasticities			compensated own price elasticities		
Variables	Rural	Urban	Regional	Rural	Urban	Regional	Rural	Urban	Regional
W1	1.09*	0.89*	0.83*	-0.74*	-0.69*	-0.74*	-0.48	-0.55	-0.51
W2	0.71*	-0.53*	0.55**	-0.71*	-0.23*	-0.59*	-0.59	-0.33	-0.51
W3	0.67*	0.28	0.14*	-0.30*	-0.08	-0.84*	-0.22	-0.29	-0.22
W4	0.80*	1.39*	0.86*	-0.78*	-0.77*	-0.71*	-0.66	-0.84	-0.59
W5	2.89*	1.16*	3.05*	….	….	…..	…	…	…
W6	0.77*	1.93*	1.03*	…	…	…	…	-0.70	…

*& **Denote significances at 1 & 5% respectively

Price elasticities (Tables A2 and A3, summarized in Table 3) reveal how consumption patterns react to price changes. As expected, all significant coefficients are negative and less than one, meaning that higher prices lead to a proportionally smaller decrease in the quantity of goods consumed. Similarly, the less elastic compensated price elasticities show that consumers tend to switch to cheaper alternatives when prices rise. Overall, expenditure elasticities (how much demand changes with income) have a greater impact than price elasticities across all items. This limited response to price changes for diverse categories like animal products and drinks suggests that the variety of items within these groups can obscure individual price effects.

Welfare effects of food price inflation

We analysed the welfare impact of food price inflation based on three hypothetical scenarios: 20%, 30%, and 40% with uniform price increases across all food groups. These calculations, using compensated own-price elasticity, highlight the specific impacts of key food items (Yu,

2014) and are presented in Table 4. All CV values are positive, indicating welfare losses due to food price inflation. For instance, a 20% price increase in cereals, drinks, and pulses reduces household welfare by 4.7%, 4.1%, and 2.9%, respectively. Overall, a 20% increase across all food groups necessitates 19.3% more income for households to maintain their prior consumption levels. As expected, higher food inflation demands proportionally larger additional income to sustain pre-shock consumption. A40% inflation, for example, would increase the cost of maintaining pre-shock utility by 8.9% for cereals, 8.3% for drinks, and 5.4% for pulses, leading to an overall 37.2% rise in the cost of maintaining pre-shock utility as a share of food expenditure. The welfare impacts of food inflation vary by location, with a higher burden falling on rural households due to differing budget shares (Weber ,2015; Faharuddin et al., 2022).

Table4 : Compensating Variation

Overall				Rural			Urban		
	20%	30%	40%	20%	30%	40%	20%	30%	40%
W1	0.047	0.069	0.09	0.042	0.062	0.080	0.042	0.062	0.080
W2	0.029	0.042	0.054	0.029	0.043	0.056	0.030	0.045	0.058
W3	0.022	0.034	0.043	0.028	0.042	0.053	0.029	0.044	0.058
W4	0.026	0.037	0.047	0.027	0.039	0.049	0.027	0.038	0.048
W5	0.028	0.042	0.056	0.023	0.035	0.046	0.023	0.035	0.047
W6	0.041	0.062	0.083	0.042	0.062	0.075	0.045	0.069	0.096
CV	0.193	0.285	0.374	0.193	0.285	0.37	0 .178	0.251	0 .312

Effects of food price inflation on Poverty

This section analyses how simulated food price inflation affects poverty, building on the benchmark figures in Table 1. Higher prices reduce household purchasing power by the amount of the CV. Table 5 shows the impact of hypothetical uniform food inflation scenarios (20%, 30%, and 40%) on poverty lines and indices. A 20% food inflation would raise the rural and urban Headcount (HC) indices from 34% and 22% to 50% and 29.1%, respectively. This would also increase the poverty gap by 5.2% in rural areas and 3.2% in urban areas, and the severity indices by 2% and 1.3% in rural and urban areas, respectively. As food inflation escalates, poverty impacts worsen. For 30% and 40% price increases, the proportion of poor households in the region would reach 46.8% and 50%, respectively. Correspondingly, the poverty gap index would rise by 6.2% and 8.4%, and the poverty severity (PS) index by 2.8% and 4%.

Table5: simulated effects of food price inflation on absolute poverty

Overall				Rural			Urban		
Impact on Head count index(α=0)									
	20%	30%	40%	20%	30%	40%	20%	30%	40%
W1	0.328	0.353	0.361	0.395	0.398	0.405	0.228	0.237	0.246
W2	0.317	0.323	0.342	0.391	0.398	0.398	0.224	0.228	0.233
W3	0.309	0.317	0.324	0.385	0.395	0.398	0.224	0.228	0.233
W4	0.311	0.321	0.328	0.385	0.395	0.398	0.224	0.228	0.228
W5	0.313	0.323	0.3423	0.375	0.391	0.398	0.224	0.228	0.229
W6	0.321	0.350	0.355	0.395	0.398	0.398	0.228	0.242	0.251
Total	0.423	0.467	0.493	0.500	0.587	0.652	0.291	0.322	0.345
Impact on Poverty gap index(α=1)									
W1	0.095	0.100	0.105	0.112	0.117	0.121	0.059	0.062	0.065
W2	0.091	0.094	0.096	0.108	0.112	0.115	0.057	0.059	0.061
W3	0.089	0.091	0.094	0.108	0.111	0.114	0.057	0.059	0.061
W4	0.090	0.093	0.095	0.107	0.111	0.113	0.056	0.058	0.060
W5	0.091	0.094	0.097	0.106	0.110	0.113	0.056	0.058	0.060
W6	0.093	0.098	0.103	0.111	0.116	0.120	0.059	0.063	0.068
Total	0.129	0.152	0.174	0.150	0.178	0.205	0.082	0.095	0.106
Impact on Poverty severity index(α=2)									
W1	0.040	0.043	0.045	0.051	0.053	0.055	0.022	0.024	0.025
W2	0.039	0.040	0.041	0.049	0.051	0.052	0.021	0.022	0.023
W3	0.038	0.039	0.040	0.049	0.051	0.052	0.021	0.022	0.023
W4	0.038	0.039	0.040	0.049	0.050	0.052	0.021	0.022	0.023
W5	0.038	0.040	0.041	0.049	0.050	0.051	0.021	0.022	0.023
W6	0.040	0.042	0.044	0.050	0.053	0.055	0.022	0.024	0.026
Total	0.057	0.068	0.080	0.070	0.078	0.092	0.033	0.039	0.045

Food inflation disproportionately harms rural Ethiopian households, largely because of food's greater weight in their budgets. Across all scenarios, **cereals consistently exert the largest impact** on poverty for both rural and urban populations. Our findings confirm that **food inflation's effects on poverty are more severe for rural households**, aligning with research by Caracciolo et al. (2014), Weber (2015), and Faharuddin et al. (2022). This contrasts with Ticci (2011), who observed a higher *headcount* poverty effect in rural areas but more severe *poverty depth and severity* in urban Ethiopia. Furthermore, unlike the conclusions of Dessus et al. (2008) and Woden et al. (2008), our study suggests that **poverty worsens primarily due to an increase in the number of newly impoverished individuals**, rather than the existing poor experiencing a significant decline in their living standards.

Similarly, we adjusted food expenditures to establish new food poverty lines. Table 6 illustrates the simulated effects of food inflation on food poverty metrics. A 20% increase in food prices would push an additional 13.6% of rural and 8.9% of urban households into food poverty. Consequently, the total share of food-poor households in the region would jump from 34% to 46.6% after the shock. As inflation progresses, so does food poverty; a 30% food inflation scenario would make an extra 20% of rural and 11.2% of urban households food-poor. A 40% inflation would add 21.3% more households to food poverty, nearly doubling the food gap and severity indexes. Likewise, the impact on food poverty is directly tied to the share of food items in household budgets. It worsens as households switch to cheaper, less nutritious foods in response to higher prices. Consistent with Ulimwengu et al. (2009) and Hadley et al. (2011), we conclude that food inflation significantly exacerbates food poverty through reduced dietary diversity and poorer quality diets, affecting rural households more severely than urban ones.

Table6: simulated effects of food inflation on food poverty

Overall				Rural			Urban		
Impact on food poverty Head count index(α=0)									
	20%	30%	40%	20%	30%	40%	20%	30%	40%
W1	0.363	0.389	0.40	0.382	0.395	0.412	0.286	0.295	0.318
W2	0.361	0.363	0.375	0.368	0.381	0.391	0.282	0.286	0.295
W3	0.359	0.362	0.364	0.365	0.378	0.388	0.282	0.286	0.295
W4	0.359	0.362	0.363	0.361	0.378	0.388	0.282	0.286	0.291
W5	0.359	0.364	0.377	0.361	0.375	0.388	0.278	0.286	0.286
W6	0.363	0.381	0.400	0.378	0.395	0.412	0.286	0.318	0.331
Total	0.466	0.524	0.551	0.476	0.540	0.591	0.349	0.372	0.385
Impact on food poverty gap index(α=1)									
W1	0.115	0.121	0.125	0.113	0.118	0.123	0.089	0.093	0.097
W2	0.111	0.114	0.117	0.110	0.113	0.117	0.087	0.090	0.092
W3	0.109	0.112	0.114	0.109	0.112	0.116	0.087	0.090	0.092
W4	0.110	0.112	0.115	0.109	0.113	0.115	0.086	0.089	0.090
W5	0.111	0.114	0.117	0.108	0.111	0.114	0.086	0.088	0.090
W6	0.114	0.118	0.124	0.112	0.117	0.122	0.090	0.095	0.100
Total	0.153	0.177	0.200	0.147	0.173	0.20	0.117	0.132	0.143
Impact on food poverty index(α=2)									
W1	0.053	0.056	0.058	0.057	0.059	0.061	0.041	0.043	0.045
W2	0.050	0.052	0.054	0.055	0.057	0.058	0.040	0.041	0.043
W3	0.050	0.051	0.053	0.055	0.057	0.058	0.040	0.041	0.042
W4	0.050	0.052	0.053	0.055	0.056	0.058	0.039	0.040	0.041
W5	0.051	0.052	0.054	0.054	0.056	0.057	0.039	0.040	0.041
W6	0.052	0.055	0.0574	0.056	0.058	0.060	0.041	0.043	0.046
Total	0.071	0.084	0.097	0.068	0.083	0.093	0.054	0.062	0.069

Logistic Regression Estimates

This section builds on previous discussions by examining household characteristics that contribute to persistent poverty, using a logistic regression model. After addressing potential econometric issues, only three variables proved statistically significant. The model is well-specified, as confirmed by link test results, which show a linear relationship between the response and independent variables. We also confirmed no multicollinearity among explanatory variables. The Hosmer and Lemeshow goodness-of-fit test, with a p-value of 0.8177, indicates that the model adequately fits the data. Furthermore, based on the log likelihood (LR), the model as a whole is statistically significant. The pseudo R-squared suggests the model explains 63% of the change in likelihood.

Table 7 presents the results based on two approaches. The **odds ratio** results show that **household size is positively linked to the likelihood of poverty**. Specifically, for every additional family member, the odds of a household being poor increase by **29%** (statistically significant at 1%). The **marginal effect** further indicates that a household with one more economically dependent member is **5% more likely to fall into poverty**. This highlights that larger households with more dependents face a higher risk of poverty. This finding aligns with studies by Tsehay et al. (2012), Teka et al. (2019), and Anteneh (2020), though it contradicts Teshome and Sharma (2014), who found larger families with economically active members had a lower poverty risk.

Our analysis confirms the common understanding that **poverty is strongly linked to rural areas.** We found that **urban households are significantly less likely to be poor than rural households.** Specifically, the odds of being poor in urban areas are **0.032** (statistically significant at 1%), meaning urban households have **3.2% lower odds of being poor** compared to their rural counterparts. Conversely, **living in a rural area increases the chance of becoming poor by 0.25%,** all else being equal. This supports the idea that regional characteristics, such as isolation and lower resource bases in developing regions like Ethiopia, contribute to higher poverty incidence. This aligns with previous studies by Shibru et al. (2013), Teka et al. (2019), and Anteneh (2020), which highlighted the role of regional factors like distance to markets in poverty.

Our result confirms that **household income is inversely related to the likelihood of being poor,** using food expenditure as a proxy for welfare. The odds ratio for household income is **0.99** (statistically significant at 1%), meaning that for every one Ethiopian Birr (ETB) increase in income, the odds of becoming poor decrease. More practically**, increasing household income by an average of 1,000 ETB reduces the probability of falling into poverty by 2.5%,** all else being equal. This underscores that **income is a critical factor for development policy**, as it directly reflects opportunities and returns from economic activities. This finding aligns with previous research by Tsehay et al. (2012), Shibru et al. (2013), Teshome and Sharma (2014), Teka et al. (2019), and Anteneh (2020), all of whom demonstrated income's contribution to poverty reduction.

Table7: Logistic regression estimates

Dependent variable: poverty status(pos),p=pro(poor=1)		
Variables	Odd-ratio	dy/dx
Residence	0.032 (0.0167) ***	-0.245 (0.027) ***
Family size	544.73 (385.76) ***	0.449 (0.020) ***
Sex(hh)	1.041 (0.426)	0.0028 (0.029)
Age	0.980 (0.0617)	-0.0013 (0.0009)
age square	1.00(0.0007)	0.000013(0.00005)
Literacy	1.020 (0.38)	0.0016 (0.026)
Income	0.99 (0.00008) ***	-0.0000251 (1.57e-06) ***
Constant	0.0014 (0.0023) ***	---
Model specification test		
_hat	0.9912(0.106) ***	
_hatsq	-0.019(0.039)	
Goodness -of-fit tests		
Pseudo R^2 = 0.6283; LR $\chi^2_{(7)}$ = 395.56 Prob > chi2 = 0.0000; Log likelihood = -117. 30604		
Hosmer-Lemeshow $\chi^2_{(8)}$ = 4.28 Prob > chi2 = 0.8306		

Note: figures in brackets are standard errors and *** denotes 1% significance level

Conclusion and Policy Implications

Drawing on the 2016 HCES data, the study investigates both **transient and persistent determinants of poverty**. To achieve its first goal, it quantified the **welfare and poverty impacts of food price inflation**. This was done by estimating the QUAIDS model for food items, then calculating the CV—the extra income households would need to maintain their pre-inflation consumption levels under three hypothetical food price increase scenarios. New poverty lines were then established by adding these CV amounts to the original 2016 food and absolute poverty lines. Finally, the study assessed the impacts by comparing these new poverty measures against baseline figures. For its second objective, the research employed a **logistic regression model** to identify the key household characteristics influencing poverty.

The results show that **household consumption patterns respond predictably to changes in income and prices**. Consistent with theory, **rising food prices negatively impact household well-being**, increasing both vulnerability and poverty. These effects are particularly severe for **rural households** and vary depending on the specific food items and the magnitude of price hikes. **Cereals, drinks, and pulses/oils inflict the highest welfare and poverty impacts.** For instance, a **40% price increase** for these items would result in food expenditure welfare losses of **8.9%, 8.3%, and 5.4% respectively**. This would also increase food poverty by **2.6% per item**, causing the absolute poverty index to rise by **2.8% (cereals), 2.1% (drinks), and 1.7% (pulses/oils)**. Ultimately, **rising food prices worsen poverty and welfare by pushing more households into destitution and exacerbating existing disparities.**

Our findings underscore the **regional nature of poverty in Ethiopia**, with **rural areas disproportionately affected** and more vulnerable. This highlights the urgent need to **reallocate resources towards rural development**, particularly through **heavy investment in infrastructure** like roads, market development, and communication networks to better connect rural and urban centers. Given that larger households with more dependents face higher poverty rates and income inversely affects poverty, **engaging unemployed family members in labor-intensive activities** is a viable policy. Additionally, promoting **girls' education** and **family planning awareness** can help curb fertility rates. Finally, **expanding existing pro-poor programs** is crucial to breaking the cycle of poverty. Modernizing farming practices through

improved agricultural technologies, credit access, and commercialization of smallholder agriculture, combined with **productive safety net programs**, are also essential steps.

Our study acknowledges two limitations: it didn't account for potential, though likely negligible, positive impacts of rising prices on agricultural households, nor did it consider substitution between food items. This could suggest an overestimation of welfare loss and poverty effects. However, in a developing economy like Ethiopia, wages and profits are unlikely to keep pace with rising prices in the short term. Additionally, low-income households, already consuming the cheapest and least diverse foods, have very limited options for substituting food items when prices increase.

Given these considerations, our findings remain valid and suggest several policy recommendations to ease the negative effects of rising food prices. To help the poor, pricing policies should focus on stabilizing commodity prices, especially for items that make up a large portion of household budgets and significantly impact poverty. This must be combined with consumer protection measures like food aid or cash transfers to vulnerable groups, ensuring producer incentives aren't undermined. Ultimately, a sustainable solution for price stability lies in boosting food production and improving productivity by encouraging private investment in food crop sectors. It's also recommended to support farmers with knowledge and capacity building so they can quickly respond to market demands and increase their product sales.

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the author on reasonable request.

Declarations

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Competing interests

The author states there are no conflicts of interest in this research. No personal, financial, or professional connections affected the study's results or conclusions.

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Appendix

TableA1: Marshallian (uncompensated) own and cross price elasticities.

Rural						
	W1	W2	W3	W4	W5	W6
W1	-0.74 (0.06) ***	-0.07 (0.03) **	-0.15 (0.03) ***	-0.07 (0.026) **	0.03 (0 .04)	-0.09 (0.05)
W2	-0.011 (0 .042)	-0.71 (0 .05) ***	-0.08 (0.033) **	0 .028 (0.03)	0.01 (0.05)	0.05 (0.06)
W3	-0.18 (0.05) ***	-0.09 (0.04)**	-0.30 (0.06)***	-0.07 (0.03)**	0.08 (0.05)	0.09 (0.05)
W4	-0.03 (0.04)	0.01 (0.03)	-0.08 (0.06)	-0.78 (0.043) ***	0.09 (0.05)	0.02 (0.06)
W5	-0.33 (0.13)**	-0.33 (0.09)***	-0 .167 (0 .096)*	-0.14 (0.08)*	0.93 (2.33)	-2.84 (0.80)
W6	-0.019 (0 .04)	0.02 (0.03)	-0.07 (0.04)*	-0.009 (0.03)	-0.82 (0 .81)	-0.13 (0.80)***
Urban						
	W1	W2	W3	W4	W5	W6
W1	-0.69 (0.08)***	-0.04 (0.04)***	-0.13 (0.03)***	-0.12 (0.03)***	0.06 (0.07)	0.04 (0.09)
W2	0.36 (0.08)***	-0.23 (0.12)**	-0.02 (0.05)	0.18 (0.05)***	0.09 (1.11)	0.15 (0.11)
W3	-0.49 (0.17)***	0.16 (0.13)	-0.08 (0.14)	0.13 (0.10)	0.22 (0.12)**	-0.06 (0.25)
W4	-0.44 (0.07)***	-0.07 (0.05)	-0.007 (0.04)	-0.77 (0.05)***	-1.13 (0.12)	0.02 (0.11)
W5	0.05 (0.16)	-0.16 (0.14)	0.04 (0.10)	-0.09 (0.10)	-1.05 (3.89)	0.07 (3.85)***
W6	-0.27 (0.12)**	-0.24 (0.08)***	-0.011 (0.05)**	-0.06 (0.06)	-0.07 (2.33)	-1.17 (2.31)

Regional						
Equation	W1	W2	W3	W4	W5	W6
W1	-0.74 (0.04)***	-0.06** (0.02)	-0.13 (0.02)***	-0.10 (0.02) ***	0.13 (0.04) ***	0.071 (0.04) *
W2	-0.03 (0.04)	-0.59 (0.05)***	-0.07 (0.03)**	0.08 (0.03)***	0.014 (0.05)	0.07 (0.055)
W3	-0.18 (0.05)***	-0.05 (0.04s)	-0.84 (0.06)***	-0.04 (0.04)	0.14* (0.075)	0.07 (0.09)
W4	-0.20 (0.04)***	0.04 (0.03)	-0.10 (0.03)***	-0.71 (0.04)***	0.13 (0.06)**	-0.014 (0.06)
W5	-0.24 (0.09) ***	-0.38 (0.08)***	-0.15 (0.07)**	- 0.14 (0.07)**	-0.09 (1.64)	-2.04 (1.62)
W6	0.03 (0.04)	-0.03 (0.03)	-0.06 (0.03)**	-0.03 (0.03)	-0.72 (0.74)	-0.22 (0.74)

***,**,* denote significance at 1, 5 and 10 percent, respectively. Standard errors in brackets.

TableA2 : Hicksian (compensated) own and cross price elasticities.

Rural						
	W1	W2	W3	W4	W5	W6
W1	-0.48 (0.05)***	0.11 (0.03)***	-0.01 (0.03)	0 .10 (0.025)***	0.12 (0.05)**	0.16 (0.05)***
W2	0.16 (0.04)***	-0.59 (0.05)***	0.02 (0.03)	0.14 (0.029)***	-0.07 (0.05)	0 .21 (0.05)***
W3	-0 .02 (0 .05)	0.02 (0.04)	-0.22 (0.06)***	-0.03 (0.04)	0.13 (0.06)**	0.05 (0.07)***
W4	0.16 (0.04)***	0.14 (0.03)***	-0.03 (0.03)	-0.66 (0.09)***	0.16 (0.05)***	0.16 (0.05)***
W5	0.36 (0.13)***	0.13 (0.096)	0.21 (0.098)**	0.30 (0.09)***	1.16 (2.32)	-1.18 (2.30)
W6	0.17 (0.05)***	0.15 (0.03)***	0.03 (0.04)	0.11 (0.035)***	-0.76 (0.80)	0.30 (0.80)
Urban						
	W1	W2	W3	W4	W5	W6
W1	-0.55 (0.08) ***	0.08 (0.03)***	-0.08 (0.03) ***	-0.001 (0.03) ***	0.18 (0.06)***	0.24 (0.09)***
W2	0.19 (0.07)**	-0.33 (0.11)***	-0.05 (0.05)	0.12 (0.05)**	0.013 (0.12)	0.03 (0.12)
W3	-0.41 (0.15)***	-0.12 (0.11)	-0.29 (0.14)**	0.17 (0.05)***	0.26 (0.12)**	0.004 (0.23)
W4	-0.006 (0.06)	0 .13 (0.05)**	0.07 (0 .04)*	-0.84 (0.05)***	0.06 (0 .11)	0.33 (0.11)***
W5	0.41 (0.11)***	0.001 (0.12)	0.11 (0.10)	0.06 (0.11)***	-0.90 (3.39)	0.33 (3.39)
W6	0.32 (0.12)***	-0.03 (0.07)	0.004 (0.06)	0.196 (0.06)***	0.19 (2.32)	-0.70** (0.32)
Regional						

Equation	W1	W2	W3	W4	W5	W6
W1	-0.51 (0.04)***	0.07 (0.02)***	-0.05 (0.03)*	-0.02 (0.02)	0.22 (0.04)***	0.26 (0.04)***
W2	0.12 (0.04)***	-0.51 (0.04)***	-0.02 (0.03)	0.16 (0.03)***	0.06 (0.05)	0.19 (0.05)***
W3	-0.15 (0.05)***	0.03 (0.04)	-0.22*** (0.06)	-0.02 (0.04)	0.16 (0.07)***	0.23 (0.08)***
W4	0.03 (0.04)	0.17 (0.03)***	-0.01 (0.03)	-0.59 (0.04)***	0.22 (0.05)***	0.18 (0.05)***
W5	0 .58 (0.10)***	0.08 (0.07)	0.15 (0.07)**	0.30 (0.07)***	0.22 (1.63)	-1.34 (1.62)
W6	0.31 (0.04)***	0.13 (0.03)***	0.04 (0.03)	0.11 (0.03)***	-0.61 (0.74)	0.11 (0.74)

***, **,* denote significance at 1, 5 and 10 percent, respectively & Standard errors in brackets.