**Asymmetric Impacts of Rising Food Prices on Households’ Welfare in South West Ethiopia**

Yekin Ahmed Ali

Department of Economics, Kotebe Metropolitan University,

E- mail address: [yaaqinil@gmail.com](mailto:yaaqinil@gmail.com)

**P.o.Box**.31248, Addis Ababa, Ethiopia

# Introduction

The effects of food prices will remain a topical issue in the Least Developing Countries (LDCs) so long as food dominates the budget of households (Adekunle et al.2020; Attanasio et al.2013; Kane et al. 2018; Mbegalo 2016; Tefera et al. 2012;Weber 2015). Higher prices signal deficiency in supply due to more forces playing on the demand side. Higher future population entails the challenge of feeding in the light of urbanisation. Economic growth leads to diversification in nutritional diets and higher demand for high value food staff (Colen et al.2018; Mbegalo 2016). The dynamic shifts in consumer preferences coupled with shocks such as drought will exacerbate deficiency in staple foods. As inequality with income growth the rich will afford both high value foods and staples while the poor cannot.

A higher food price implies a lower real income and a lesser consumption bundle, limiting substitution of cheaper staples for preferable ones. Also, the poor should compromise other life essentials (Akbari et al.2013; Mbegalo 2016) to be able to acquire minimum calorie intake. The less diversified diet leads to a deficiency in nutritional intake pervasive to household welfare (Weber2015). For instance, the financial crisis and food price surge of 2008 derived 175 million people worldwide into hunger and undernourishment (Mbegalo2016). The monthly report by Central Statistical Authority (CSA) shows that food prices have been increasing over the recent years by more than 40% a year and the burden of the price upsurge falls heavily on vulnerable poor households who spend nearly 80% of expenditure on foodstuff (Tefera et al2012). The pervasive effects spill over to the macroeconomy as social and political instability (Mbegalo 2016).  
  
Food prices have attracted the attention of academics and practitioners for their asymmetrical effects across different spectrums of livelihoods. Higher food prices are a blessing for net producers, while it hurts net buyers (Adekunle et al.2020; Attanasio et al.2013; Mbegalo 2016; Tefera et al. 2012). Over the long run, however, higher prices have the potential to benefit rural households if it is incentive enough by turning them into net sellers. The negative effects are disproportionately borne by households owing to characteristics such as headships, education, sex, age, residence location. The poor households are the most adversely affected group (Adekunle et al.2020; Attanasio et al.2013; Prifti et al.2017;Tefera et al2012) due to deprivations of resources such as land, employment, and asset.The welfare effect of price changes varies based on the weight of commodities in the budget of the household (Adekunle et al.2020; Kane etal.2018).  
  
The current study shares the same motives with previous studies on Ethiopia and elsewhere (Adekunle et al.2020; Akbari et al.2012; Attanasio et al.2013; Kane et al.2018; Prifti et al.2017;Mbegalo2016; Tefera et al2012; Weber2015;) among others to quantify the welfare cost of higher food prices but, in a particular context of Southwest Ethiopia. Capitalizing on the responses of consumers to changes in the economic environment, the research adds to the current body of knowledge in three ways.

It applied the current state-of-the-art framework known as Quadratic Almost Ideal Demand System (QUAIDS) and used Poi’s (2012) Non-Linear Seemingly Unrelated Regression (nlsur) to estimate food demand systems. The model helps to test the nonlinear curvature in food demand systems and the estimator imposes theoretic restrictions simultaneously controlling for censoring and endogeneity.Second, theoretic consistent elasticities provide insights into the potency of income and price policies to keep households well off in the event of price changes. Third, based on the second-order approximation, the study simulated Compensating Variations (CV) to establish discriminatory effects of higher food prices across different clusters of households.  
  
Following the introduction, section two presents a review of recent literature. The third section presents the methodology applied to estimate elasticities and compute welfare effects. Section four discusses the results. Section five concludes along with policy implications.

## Review of Literature

Demand elasticities are powerful tools for capturing adjustment in food consumption patterns that follow shocks to the budget constraints of households and quantifying the resulting welfare impact. Once estimated, the welfare measure is used to establish nutritional deficiency and food security of households. Elasticity estimates also provide information that guides interventions to mitigate pervasive effects of price increases. Higher-income elasticity than price counterpart provides evidence for the more likely scope of income policy to achieve welfare outcomes (Adekunle *etal.*2020;Caracciolo *etal*2014; Kane *etal.*2018; Mbegalo2016;Prifti *etal.* 2017;Tefera et al.2012).

Reliable estimates are likely to come from a system of demand functions that measure the household behavioural responses while simultaneously capturing heterogeneity in household characteristics. Unbiased and consistent measurements make results transferable (Mbegalo 2016). However, there is an acute dearth of literature providing consistent elasticity estimates, even at the continental level. Colen *et al.*(2018) by a systematic review of empirical studies on food demand in Africa, observed high heterogeneity in income elasticities across countries, which could be partly attributed to  estimation issue. They highlighted the need for more country-specific studies supported with state-of-the-art methodologies to better inform agricultural and food policies. There are variant functional forms of demand models with desirable qualities dictated by demand theory.

One of contemporary the state-of-the-art frameworks is the QUAIDS pioneered by *Banks et al.*(1997). It is an improvement over the Almost Ideal Demand System (AIDS) of Deaton & Muellbauer(1980) after the latter failed to take account of non-linearity between food consumption and income. The other dominant group of theory consistent demand models with rich parameters includes Generalized Leontief (Diewert 1971), Translog (*Christensen et al.* 1975), and Rotterdam (Theil1965; Barten 1964, 1968 1977). However, QUADS has an exceptional quality of functional flexibility for obtaining luxuries (or necessities) goods for different income levels (Mbegalo2016; Weber2015). The framework is the best fit for a cross-sectional study based on low-income countries like the current one.

Many authors had drawn impressive results for different countries based on the QUADS. Prifti*et al.* (2017) measure welfare impact on households in Lesotho by simulating prices of maize by 20, 40, and 60% and determine that it costs incomes amounting to 8.8, 15.5, and 20.3 respectively to keep consumption at the pre-shock level. They conclude that households need 40% more income to stay well off for every one % increment in the price of maize during 2015/16.

 Mbegalo(2016) quantifies that  22%  food price inflation during the 2008 -2012 years in Tanzania costs   11% of incomes of the poor and middle classes and 8%  that of rich households.

In India, 10 %  higher food prices derived nearly 5% rural and 2% urban households into poverty, amounting to 6 and 4%-income loss respectively (Weber2015). Besides, the author showed that both welfare loss and poverty effects double when stimulated for a 20% price increment. Adekunle *et al.*(2020) corroborate this finding that rural households are more vulnerable as there are more productive job opportunities in urban than rural areas. Moreover, Quentin *et al.*(2018) showed that dominant food items in the budget of households determines poverty and welfare effects.  By simulating the prices by 10   and 40%, rural households were worse hit by cereals and roots crops while animal products and vegetables severely affected urban counterparts.

Adekuble*et al*.(2020)  examine the welfare effects of food prices inflation on Nigerian households employing direct and indirect approaches. Second-order effects show that overall price rose by 2.38 % between 2010 and 2016 and reduced   Nigeria’s net buyers’   mean annual expenditure by 2 percentages while it increased net sellers’ real income by 1.58 %. According to first-order estimates, for a 1% increase in the price of cereals, an increase of 1.84% in the household income is required to allow individuals to enjoy real welfare.

Attanasio*et al*. (2013) estimate that the average rural household in Mexico lost about 20% of food expenditure to higher food prices during 2011 alone,  which reduces to 16 and 14% respectively when households are compensated with 50 pesos per week and 5% price subsidy.  In rural Ethiopia, the poor are the worst adversely affected group by food inflation and the impact dies out as one jump to higher income group (Tafera *et al.*2012).

Akbari et al.(2013) measure the welfare effects on Iranian urban households of 47 % food price inflation    between 2009/10-2011/12 as 49.9 % food expenditure to keep households consumption at pre-price shock level.

1. **Materials and Methods** 
   1. **Quadratic Almost Ideal Demand System**

One way to express expenditure function of QUAIDS is[[1]](#footnote-1):

= + (1)

where: is a transcendental price index given by:

= (2)

*is* Cob*- Douglass price aggregator defined as :*

= = exp() (3)

= is a differentiable, homogenous function

= where =0 (4)

U is utility & P is a set of prices and; the subscript denotes the number of food groups in the demand system.

Applying Shephard’s lemma to (1) and substituting for U in the indirect utility function obtain expression for the QUAIDS:

= + + + + (5)

where is the expenditure share for the ith food, ,, and are the parameters to be estimated; is the constant coefficient in the i th share equation, is the slope coefficient associated with the *jth* good in the *i th* share equation, is the price of the *jth* good, and *m* is the total expenditure on the system of foods; and is error term.

Demographic variables enter the system of budget share equations via as intercept terms[[2]](#footnote-2):

= + + + + + (6)

where and are parameters to be estimated and is socio-demographic variables. Theoretic restrictions are given as follows:

Adding up of budget shares requires (=1):

=1;=0= ==0 (7)

Homogeneity of zero degrees in price:

= 0 (8)

And

Slutsky symmetry:= (9)

Two econometric issues must be dealt with before estimation: one is censored demand equations attributed to zero consumption which leads to corner solution.   Zero consumption arises due to factors such as non-preference, non-affordability, purchase infrequency, non-availability, and self-consumption during the recall period of the survey (Boysen2012). If not accounted for regressing the censored QUADS model yields biased coefficients.

Shonkwiler & Yen (1999) propose a two-step econometric technique for handling censoring problem as described below: the first step obtains consistent estimates for ; the probability that a household consumes the food item using probit model .Denote (.) and (.) respectively for the cumulative and density functions of standard normal distribution. This derives expectation for observed budget share as:

= () + () (10)

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

Endogeneity warrants attention because expenditure may be correlated with unobserved variables in budget share equations or jointly determined with the budget shares and results in biased and inconsistent parameter estimates (Blundell & Robin1999;Bopape 2006;Dhar *et al*.2003). To deal with endogeneity issue, censored demand system is augmented by residuals from reduced form expenditure model as below:

= () +() (11)

* 1. Demand Elasticities

By differentiating (14) with respect to lnm and ln, for using afterwards to determine respectively expenditure and price elasticities, we get the following:

==() (12)

= = () (13)

Where, *a price index is* calculated as the arithmetic mean of prices for all *k* food groups. Then, conditional expenditure elasticities are written as,

= + 1 and the conditional Marshallian price elasticities are derived as,

= - , where is Kronecker delta defined as =

Using the Slutsky equation allows us to derive, the conditional Hicksian (compensated) price elasticities as,= +

Hicksian price elasticities measure the response of a particular quantity of a commodity as price changes for a constant level of utility while the Marshallian price elasticities do the same for a constant level of income.

* 1. Welfare Measures

Compensating variation was computed in a bid to quantify welfare effects of price hikes. The compensating variation is money transfer needed to compensate the consumers for the price changes to restore them to pre- shock positions.

Let , and respectively denote vector of prices and money income and utility level before price changes:, and represent respectively vector of prices and money incomes after price changes, and , and respectively denote expenditure functions before and after price changes. The compensation variation at time t is expressed in terms of expenditure function as,

= - (14)

Positive value indicates reduction in consumer welfare while it is vice versa for negative. The second order Taylor expansion[[3]](#footnote-3) of the minimum expenditure function is given as:

= + (15)

where is vector of consumer are prices at time t; is the budget share of the ith commodity; isthe conditional compensated price elasticity of commodity i with respect to the price change of good j; and symbol stands for the variation between before and after shock periods.

* 1. Data Sources and Descriptive statistics

The study used Household Income and Expenditure Survey (HIES) data collected by the CSA of Ethiopia during 2016/17.The data consist of information on various quantities of household consumables including non-food items; consumption expenditures and household demographics. The CSA’s data covered a representative sample of 30,229 households nationally. After cleaning the original data of potential outlier observations,   it draws on consistent data of 519 households for the South West region of which 296 of them are rural.[[4]](#footnote-4) Before, 2017, the region consists of three zones Bench Maji zone consists of 265 households; Kaffa 132 (only rural) and Sheka Zones consist of 132 and 122 households respectively.

The demographic characteristics of sample households in the table1 show stark contrast between rural and urban residences. There were more people per household in rural who devote 54 % of expenditure to food. A household headship was dominated by older males (68%) with second and seventh grades of school attendance in rural and urban respectively.

**Table1: demographic characteristics of households**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Variables | Rural | | | | Urban | | |
| Bench-Maji\* | Kaffa | Sheka | Total | Bench-Maji | Sheka | Total |
| family size | 4 | 5 | 4 | 5 | 3 | 4 | 4 |
| age | 40 | 38 | 41 | 39 | 35 | 39 | 36 |
| Sex ( male=1) | 0.67 | 0.81 | 0.67 | 0.68 | 0.69 | 0 .68 | 0.68 |
| Literacy( literate=1) | 0.30 | 0.35 | 0.49 | 0.66 | 0.73 | 0.80 | 0.6 |
| Years of schooling | 2 | 2 | 3 | 2 | 6 | 8 | 7 |
| Food expenditure share | 0.53 | 0.56 | 0.54 | 0.54 | 0.42 | 0. 51 | 0.44 |

Source: author’s computation from CSA data

The CSA data on consumables were grouped into two distinct components: food and non-food items.  The non-food groups include consumables such as housing, clothing, education, health, transport, and recreation.  There are 18 food subgroups according to CSA classifications, making it difficult to analyse the demand for each commodity group. The decision to construct commodity groupings is left to the discretion of researcher and consequently is made on an ad-hoc basis as there is no theoretic basis (*Adekuble et al*2020). However, for ease of practical and computational reasons, previous studies such as (*Tefera et al.*2012) were consulted and food commodities were classified into such six groups: cereals, pulses and oils, root crops, fruits, and vegetables, animal products and other groups[[5]](#footnote-5). Nevertheless, aggregating food items into groups make it difficult to compute the prices of aggregated bundles. As a result, unit values calculated by dividing the purchase value by quantity were used despite the limitations that they might contain measurement errors, hide quality differences, and reflect non-linear price quantity relations due to prices homogeneity (*Attanasio et al.2013;Tefera et al.*2012; *Weber2015*).  For each food commodity group, the prices indexes were computed as weighted means of commodities in that group, the weights being the mean budget shares of each item.

As shown in table 2 cereals followed by other foods groups dominate the consumption patterns in the region. To urban dwellers, animal products and pulses and oils are preferred to fruits & vegetables to root crops while rural residents consume more quantities of pulses and oils, root crops, and fruits & vegetables than animal products.

**Table:2 food budget shares and proportion of zero expenditures(in brackets) by category**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Items | Rural | | | | Urban | | |
| Bench-Maji\* | Kaffa | Sheka | Total | Bench-Maji | Sheka | Total |
| Cereals | 0. 34  (0.01) | 0. 17  (0.04) | 0. 17  (0.12) | 0. 22  (0.04) | 0. 35  (0.06) | 0. 11  (0.07) | 0. 28  (0.03) |
| Pulses & oils | 0. 11  (0.12) | 0. 19  (0.27) | 0.16  (0.09) | 1.16  (0.08) | 0.14  (0.14) | 0.13  (0.04) | 0.14  (0.12) |
| Root crops | 0.10  (0.32) | 0.16  (0.12) | 0.17  (0.27) | 0.14  (0.21) | 0.03  (0.22) | 0.16  (0.25) | 0.07  (0.28) |
| Fruits & vegetables | 0.18  (0.03) | 0.11  (0.02) | 0.15  (0.05) | 0.14  (0.03) | 0.13  (0.08) | 0.11  (0.03) | 0.13  (0.07) |
| Animal products | 0.11  (0.46) | 0.11  (0.75) | 0.15  (0.27) | 0.11  (0.47) | 0.14  (0.34) | 0.23  (0.26) | 0.16  (0.32) |
| Other foods | 0.16  (0.10) | 0.26  (0.08) | 0.19  (0.02) | 0.20  (0.01) | 0.20  (0.006) | 0.23  (0.00) | 0.20  (0.50) |

**Source**: author’s computation from CSA data

1. Results and Discussion

After making corrections for zero consumption in systems of demand equations and endogeneity in expenditure and household demographics, the QUADS were estimated using Poi’s (2012) Non-Linear Seemingly Unrelated regression (nlsur). The estimator imposes theoretic restrictions such as symmetry, adding up, and homogeneity of QUADS mentioned in the last section. The different structural parameters for expenditure, expenditure square, and prices, demographic and instrumental variables are reported along with their p-values in table A1(appendix). The statistical significance of most of the coefficients indicates that the commodity expenditure shares are responsive to prices and income and the household demographic variables included in the model.

An increase in own prices reduce quantities consumed of all food groups, while that of cross price reduces and increases the quantity of others respectively for substitute and complimentary foods.

The coefficients for squared expenditure provide evidence in support of QUADS specification whereas the positive and negative sign of the expenditure and its square indicate the property of Engle curve; the consumption rises first and then fall as income increases, consistently with that found by Mbegalo (2016) for rural Tanzania. The statistical significances of   linear, square, and cubic terms of the residuals show the relevance of the instruments for controlling endogeneity.

Larger family size is associated with higher consumptions of animal products and other food groups whereas it shifted consumption away from cereals, pulses and oils, and root crops. The positive association between household size and consumption of animal products is consistent with that obtained by *Tefera et al.*(2012).

Sex difference significantly affects the consumption of all except that of animal products and cereals. For a rural community, age increment is associated with reduction in consumption of animal products and other foods and a rise in that of cereals. Furthermore, there is a visible difference in consumption patterns between Bench Maji, Kaffa, and Sheka zones for most of the food groups.

* 1. **Elasticity Estimates**

The marginal elasticities represent quantity responses to changes in prices, incomes, and other determinants and consequently do not help to establish welfare effects of price changes. Representative expenditure and price elasticities should be estimated at means of sample data, for they are more certain than marginal changes.

Table3 shows that all food items across the three groups are normal goods, as indicated by positive and statistically significant coefficients. Animal products and other food are luxury items consistent with many previous studies (Adekuble *et al*2020; Mbegalo2016; Tefera *et al*.2012).  Moreover, the expenditure elasticities of the two commodities differ considerably for urban and rural households. The fact that consumption increases with income is an indication that households had yet not achieved desired quantities of the two food groups. Pulses & oils, fruits & vegetables, and cereals are necessities that  the proportion of income expended on these food groups decreases as income increases whereas that of fruits and vegetables increases at the same rate as an expenditure for urban households. Thus, it is expected that an increase in income will shift consumption patterns away from these goods towards animal products and other foods.

Table3: Expenditure elasticities

|  |  |  |  |
| --- | --- | --- | --- |
| **Items** | **Overall** | **Rural** | **Urban** |
| Cereals | 0.41(0.08)\*\*\* | 0.41(0.09)\*\*\* | 0.51(0.08)\*\*\* |
| Pulses & oils | 0.17(0.09)\* | 0.32(0.11)\*\*\* | -0.007(0.12) |
| Root crops | -0.05(0.16) | -0.02(0.15) | -0.05(0.26) |
| Fruits & vegetables | 0.40(0.12)\*\*\* | 0.57(0.13)\*\*\* | 1.00(0.11)\*\*\* |
| Animal products | 4.67(0.4)\*\*\* | 3.37(0.42)\*\*\* | 3.03(0.27)\*\*\* |
| Other foods | 1.41(0.15)\*\*\* | 2.14(0.16)\*\*\* | 1.31(0.15)\*\*\* |

Tables 4 and 5 present respectively Marshallian and Hicksian own and cross-price elasticities. The former represents changes in the quantity demanded because of changes in prices while capturing both substitution and income effect, whereas, Hicksian elasticity of demand denotes only the substitution effect due to price change keeping the level of utility constant.

Table4: Marshallian (uncompensated) own and cross price elasticities.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Overall | | | | | | | | |
| Equation | Cereals | Pulses and oils | Root crops | Fruits & vegetables | Animal products | | Other foods | |
| Cereals | **-0.81**  **(0.03)\*\*\*** | -0.03  (0.02) | -0.09  (0.02)\*\*\* | -0.07  (0.02)\*\*\* | 0.32  (0.05)\*\*\* | | 0.26  (0.05)\*\*\* | |
| Pulses & oils | 0.014  (0.03) | **-0.52**  **(0.04)\*\*\*** | -0.02  (0.03) | 0.12  (0.03)\*\*\* | -0.07  (0.05) | | 0.12  (0.06) | |
| Root crops | -0.14  (0.05)\*\*\* | 0.007  (0.05) | **-0.30**  **(0.06)\*\*\*** | -0.09  (0.04)\*\*\* | 0.29  (0.08)\*\*\* | | 0.29  (0.10)\*\*\* | |
| Fruits & vegetables | -0.13  (0.03)\*\*\* | 0.09  (0.03)\*\*\* | -0.11  (0.03)\*\*\* | **-0.82**  **(0.03)\*\*\*** | 0.37  (0.06)\*\*\* | | 0.19  (0.06)\*\*\* | |
| Animal products | -0.27  (0.08)\*\*\* | -0.59  (0.09)\*\*\* | -0.19  (0.07)\*\*\* | **- 0.11**  **(0.06)\*** | 0.45  (1.61) | | -3.96  (1.59)\*\* | |
| Other foods | 0.04  (0.03) | -0.08  (0.04)\*\* | -0.02  (0.03) | -0.02  (0.03) | **-1.47**  **( 0.73)\*\*** | | -0.14  (0.84) | |
| Rural | | | | | | | | |
|  | Cereals | Pulses and oils | Root crops | Fruits & vegetables | | Animal products | | Other foods |
| Cereals | **-0.72**  **(0.04)\*\*\*** | -0.007  (0.03) | -0.08  (0.03)\*\*\* | -0.02  (0.02) | | 0.07  (0 .04)\*\*\* | | 0.34  (0.05)\* |
| Pulses & oils | 0.03  (0 .04) | **-0.65**  **(0 .05)\*\*\*** | -0.02  (0 .03) | 0 .08  (0.03)\*\* | | 0.04  (0.05) | | 0.20  (0 .06) |
| Root crops | -0.04  (0.05) | 0.03  (0.05) | **-0.50**  **(0.06)\*\*\*** | -0.07  (0.04)\* | | 0.18  (0.07)\*\*\* | | 0.40  (0.09)\*\*\* |
| Fruits & vegetables | -0.06  (0 .04) | 0.04  (0.04) | -0.13  (0.04)\*\*\* | **-0.88**  **(0.04)\*\*\*** | | -0.1  (0.05)\*\*\* | | 0.32  (0 .07)\*\*\* |
| Animal products | -0.51  (0.09)\*\*\* | -0.41  (0 .11)\*\*\* | -0 .12  (0 .09) | -0.16  (0.07)\*\*\* | | **-4.47**  **(2.32)\*** | | 2.29  (2.36) |
| other foods | -0.07  (0 .04)\* | -0.16  (0.04)\*\*\* | -0.05  (0.04) | -0.03  (0.03) | | 0.91  (0 .82) | | **-2.75**  **(0.83)\*\*\*** |
| Urban | | | | | | | | |
|  | Cereals | Pulses and oils | Root crops | Fruits & vegetables | Animal products | | Other foods | |
| Cereals | **-0.69**  **(0.07)\*\*\*** | 0.02  (0.03) | -0.11  (0.02)\*\*\* | -0.15  (0.03)\*\*\* | 0.25  (0.07)\*\*\* | | 0.17  (0.07) | |
| Pulses & oils | 0.2  (0.07) | **-0.4**  **(0.08)\*\*\*** | -0.004  (0.04) | 0.15  (0.05)\*\*\* | -0.08  (1.11)\*\* | | 0.11  (0.11) | |
| Root crops | -0.4  (0.13)\*\*\* | -0.03  (0.10) | -0.001  (0.12) | -0.02  (0.09) | 0.34  (0.27) | | 0.09  (0.28) | |
| Fruits & vegetables | -0.5  (0.06)\*\*\* | -0.02  (0.05) | -0.07  (0.04)\* | **-0.77**  **(0.05)\*\*\*** | 0.31  (0.11)\*\*\* | | -0.01  (0.11) | |
| Animal products | -0.19  (0.15) | -0.53  (0.12)\*\*\* | -0.01  (0.11) | 0.05  (0.10) | -2.46  (3.15) | | 0.11  (3.03) | |
| Other foods | -0.01  (0.08) | -0.12  (0.07) | -0.05  (0.07) | -0.05  (0.06) | -0.31  (2.16) | | -1.39  (2.14) | |

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

The on diagonals cells are own-price elasticities and the off diagonals cells are cross-price elasticities. It can be observed from the tables that whenever they are statistically significant own-price elasticities are negative. An increment in prices of those goods reduces demands consistent with theory. Furthermore, the rural household's demand for animal products and other foods are price elastic implicating the quantity demands of the two goods fall at higher rates than price increment.

 Cross price elasticities measure the degree of substitutability and complementarily among commodities for negative and positive coefficients respectively. Of 90 estimated uncompensated (Marshallian) and compensated (Hicksian) cross-price elasticities, 45 and 57 respectively are significantly different from zero at conventional significance levels. All coefficients except two are less than one in absolute value, implying a weak response of one commodity group to changes in the price of the other. There is strong substitutability between animal products and other food, as shown by higher cross-price elasticities; for one % increment in the price of other food, demand for animal products falls by 2.89 %.

 On the other hand, the demand for other food falls by 3.96 % in response to a percentage rise in the price of animal products of which the income effect is 1.05 %.  It is found that cereals are consumed along with pulses & oils, animal products, and other food while they are substitutes for root crops and fruits and vegetables. The results conform to consumption pattern of cereals observed for Ethiopia Tefera *et al*. (2012).

 In addition, it is observed that a typical rural household responds to prices more than does an urban counterpart. As theoretically expected, the uncompensated elasticities are more elastic than compensated ones.

Table5 : Hicksian (compensated) own and cross price elasticities.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Overall | | | | | | |
| Equation | Cereals | Pulses and oils | Root crops | Fruits & vegetables | Animal products | Other foods |
| Cereals | **-0.70**  **(0.04)\*\*\*** | 0.04  (0.02)\*\*\* | -0.05  (0.02)\*\*\* | -0.008  (0.02)\*\*\* | 0.37  (0.04)\*\*\* | 0.35  (0.04)\*\*\* |
| Pulses & oils | 0.06  (0.03)\*\*\* | **-0.50**  **(0.04)\*\*\*** | -0.002  (0.03) | 0.14  (0.02)\*\*\* | 0.09  (0.05) | 0.21  (0.05)\*\*\* |
| Root crops | -0.16  (0.05)\*\*\* | 0.001 (0.04) | **-0.30**  **(0.06)\*\*\*** | -0.10  (0.04) | 0.29  (0.08)\*\*\* | 0.28  (0.08)\*\*\* |
| Fruits & vegetables | -0.02  (0.03)\*\*\* | 0.15  (0.03)\*\*\* | -0.07  (0.03)\*\* | **-0.75**  **(0.03)\*\*\*** | 0.41  (0.05)\*\*\* | 0.28  (0.05)\*\*\* |
| Animal products | 0 .99  (0.11)\*\*\* | 0.12  (0.07)\*\*\* | 0.27  (0.07)\*\* | 0.57  (0.07)\*\*\* | 0.93  (1.61) | -2.89  (1.59)\* |
| Other foods | 0.41  (0.05)\*\*\* | 0.13  (0.03)\*\*\* | 0.12  (0.04)\*\*\* | 0.18  (0.03)\*\*\* | -0.13  (0.72) | 0.46  (0.72) |
| Rural | | | | | | |
|  | Cereals | Pulses and oils | Root crops | Fruits & vegetables | Animal products | Other foods |
| Cereals | **-0.62**  **(0.04)\*\*\*** | 0.07  (0.03)\*\*\* | -0.03  (0.02) | 0 .04  (0.02)\*\*\* | 0.10  (0.04) | 0.43  (0.04)\*\*\* |
| Pulses & oils | 0.10  (0.04)\*\*\* | **-0.60**  **(0.05)\*\*\*** | 0.02  (0.03) | 0.12  (0.02)\*\*\* | 0.07  (0.05) | 0 .27  (0.05)\*\*\* |
| Root crops | -0 .05  (0 .04) | 0.03  (0.04) | **-0.49**  **(0.06)\*\*\*** | -0.07  (0.04) | 0.18  (0.06) | 0.40  (0.07)\*\*\* |
| Fruits & vegetables | 0.08  (0.03)\*\*\* | 0.13  (0.03)\*\*\* | -0.06  (0.03) | **-0.79**  **(0.04)\*\*\*** | 0.18  (0.05) | 0.45  (0.05)\* |
| Animal products | 0.31  (0.12) | 0.13  (0.10) | 0.31  (0.10)\*\*\* | 0.36  (0.09)\*\*\* | **-4.20**  **(2.32)\*** | 3.07  (2.34) |
| Other foods | 0.45  (0.04)\*\*\* | 0.19  (0.04)\*\* | 0.23  (0.04)\*\*\* | 0.31  (0.03)\* | 1.08  (0.82) | **-2.26**  **(0.84)\*\*\*** |
| Urban | | | | | | |
|  | Cereals | Pulses and oils | Root crops | Fruits & vegetables | Animal products | Other foods |
| Cereals | **-0.53**  **(0.07)\*\*\*** | 0.09  (0.03)\*\*\* | -0.08  (0.02)\*\* | -0.08  (0.02)\*\* | 0.31  (0.07)\*\*\* | 0.28  (0.06)\*\*\* |
| Pulses & oils | 0.18  (0.07)\*\*\* | **-0.35**  **(0.07)\*\*\*** | -0.004  (0.04) | 0.15  (0.04)\*\*\* | -0.08  (0.10)\* | 0.11  (0.11)\*\* |
| Root crops | -0.44  (0.13)\*\* | 0.03  (0.10) | -0.002  (0.12) | -0.02  (0.09) | 0.34  (0.26) | 0.09  (0.26) |
| Fruits & vegetables | -0.18  (0.06)\*\* | 0 .16  (0 .05)\*\*\* | -0.008  (0 .04) | -0.63  (0.06) | 0.45  (0 .10)\*\*\* | 0.21  (0.10) |
| Animal products | 0.74  (0 .15)\*\*\* | -0.10  (0 .10) | 0.16  (0.10) | 0.45  (0.10)\*\*\* | -2.05  (3.13) | 0.80  (3.06) |
| Other foods | 0.39  (0.08)\*\*\* | 0.06  (0.07) | 0.02  (0.07) | 0.13  (0.06) | 0.49  (1.84) | -1.09  (1.81) |

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

Comparison of expenditure and price elasticities reveals interesting policy prescriptions about the relative effectiveness of income and price policies vis-à-vis rural and urban dwellers. The larger expenditure and price elasticities of rural households implicate relative effectiveness of the policies in rural to offset pervasive impacts of higher food prices. Nevertheless, the results are inconclusive as to relative potency of price over income policies for both areas ruling out the possibility for one size fits all policy prescriptions.

* 1. **Effects of Price Changes on Consumer Welfare**

The compensated elasticities are used to compute the welfare effects of simulated 20 and 40 % increments in food prices. The CV measures the total transfer required to compensate all households for the price changes they experienced as a percentage of their initial total expenditure. The first order (static) approximation measures consumption responses to price changes while ignoring household behavioural responses. In contrast, the second-order (dynamic) approximation removes the substitution effects, as if households are able to change their consumption patterns when prices change. Therefore, given the substantial observed price changes, substitution effects can be non-trivial, and first-order approximations may lead to significant biases and are inappropriate (*Banks et al.*1996) as the case for the current study (Table6).

According to the first-order approximation estimates, the welfare losses are 75 and 95 percentages for respective price simulations. Based on the second-order approximation, however, it suffices to compensate the households with a little higher income than the percentage rise in prices. On average, a 20 % increment in food prices reduces the purchasing power of Southwest households by about 25 %. When food prices were raised by 40 percentages, the loss reaches as large as 45 %.

Table6: Simulated welfare effects of price increases

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| First order effects of proportion of expenditure | | | | | | | | | |
|  | 20% increase | | | | 40% increase | | | | |
|  | Overall | Rural | Urban | | Ove all | | Rural | | Urban |
| 25th percentile | 0.43  (0.03)\*\*\* | 0.38  (0.03)\*\*\* | 0.48  (0.04)\*\*\* | | 0.60  (0.03)\*\*\* | | 0.56  (0.04)\*\*\* | | 0.64  (0.04)\*\*\* |
| 50 th percentile | 0.66  (0.03)\*\*\* | 0.64  (0.04)\*\*\* | 0.67  (0.04)\*\*\* | | 0.83  (0.03)\*\*\* | | 0.84  (0.04)\*\*\* | | 0.83  (0.04)\*\*\* |
| 75th percentile | 0.86  (0.04)\*\*\* | 0.83  (0.06)\*\*\* | 0.88  (0.04)\*\*\* | | 1.04  (0.04)\*\*\* | | 1.01  (0.06)\*\*\* | | 1.05  (0.06)\*\*\* |
| Mean | 0.74 | 0.69 | 0.78 | | 0.92 | | 0.89 | | 0.95 |
| Second order effects of proportion of expenditure | | | | | | | | | |
|  | 20% increase | | | 40% increase | | | | | |
|  | Overall | Rural | Urban | Overall | | Rural | | Urban | |
| 25th percentile | 0.27  (0.03)\*\*\* | 0.21  (0.04)\*\*\* | 0.32  (0.04)\*\*\* | 0.42  (0.04)\*\*\* | | 0.50  (0.04)\*\*\* | | 0.75  (0.05)\*\*\* | |
| 50 th percentile | 0.46  (0.04)\*\*\* | 0.49  (0.03)\*\*\* | 0.53  (0.05)\*\*\* | 0.65  (0.04)\*\*\* | | 0.70  (0.04)\*\*\* | | 0.98  (0.04)\*\*\* | |
| 75th percentile | 0.76  (0.05)\*\*\* | 0.73  (0.08)\*\*\* | 0.78  (0.07)\*\*\* | 1.00  (0.06)\*\*\* | | 0.98  (0.04)\*\*\* | | 1.22  (0.06)\*\*\* | |
| Mean | 0.25 | 0.22 | 0.28 | 0.45 | | 0.42 | | 0.52 | |

\*\*\* denote significance at 1 & figures in brackets are Standard errors.

Results of the study contrast those found by Adekunle *et al.*(2020) ; Kane *et al.*(2018); Mbegalo (2016);*Tafera et al.(*2012). It is observed that food price hikes harm hard urban households than the rural counterparts. The welfare losses for worst-hit urban households, upper quintile are 78 and 1.22 percent receptively for 20 and 40 percent price increment. The least hit rural households losses from the same are 21 and 42 percentages respectively.

1. **Conclusions and Policy Implications**

The study intended to achieve three objectives: (1) to measure food consumption patterns response to determinants in particular context of south west region of Ethiopia; (2) to forecast relative importance to household welfare of income and price policies; and (3) to measure the welfare costs of higher foods prices for rural and urban households. In order to achieve the objectives, first complete demand systems of six food groups were estimated using QUAIDS framework after correcting for estimation problems viz censoring and endogeniety. It was shown that household demand for foods are affected not by price and income alone but reflect difference in test and preferences across households due to size, sex, age, education and location. Non-linear curvature in demand system thus, provides information about the characteristics of food demand in southwest Ethiopia.

This was followed by estimating expenditure, compensated and uncompensated elasticities at means of the sample. It is found that all food staffs are normal goods animal products and other food being luxury items in the expenditure composition of households. This is because the estimated expenditure elasticities were positive and statistically significant for all food groups except root crops as is expected. Similarly, all significant own price elasticies were all negative consistent with economic theory. Also, the results indicate that demand for most food commodities is sensitive to cross prices. The smaller cross price elasticities indicate limited substitutability (complementarity) between commodities. Putting together all these pieces of evidences leads to forecast the potential effects of income and prices policies on welfare of households. Higher income elasticities of urban households imply relative potency of income policies over prices policies to mitigate negative consequences on welfare while the larger elasticities indicate the reverse.

The results for simulated effects of higher prices showed that higher food prices erode the purchasing power of the household and are pervasive to welfare the burden falling largely on urban households. In order to mitigate the negative consequences of diery of households, average households need percentage income compensation as large as percentage change in food prices. But, the lower income households in both groups need at least three fold percentages as large as the average.

Nevertheless, these findings should have been drawn from framework that incorporates production side for rural households and real price data sets.

**Funding Details:** This study was funded by the Author.

Conflict of interest declaration: None

References

Adekunle CP, Akinbode SO, Shittu AM & Momoh S, 2020. Food price changes and farm households’ welfare in Nigeria: direct and indirect approach. *Journal of Applied Economics*, 23(1), 409–425. doi: 10.1080/15140326.2020.1743103.

Akbari A, Ziaei MB & Ghahremanzadeh M, 2013.Welfare Impacts of Soaring Food Prices on Iranian Urban Households: Evidence from survey data. International Journal of Business and Development Studies, 5 (1), 23-38.

Attanasio O, Di-Maro V, Lechene V & Phillips D, 2013. Welfare consequences of food prices increases: Evidence from rural Mexico. *Journal of Development Economics*,104,136–151.doi: 10.1016/j.jdeveco.2013.03.009.

Banks, J. R. Blundell & Lewbel A, 1997. Quadratic engel curve and consumer demand. *Review of Economics and Statistics*, 79(4), 527–539.

Boysen O, 2012. A Food Demand System Estimation for Uganda.*IIIS Discussion Paper, TrinityCollegeDublin*,(396),1–34.Availableat: https://www.tcd.ie/triss/assets/PDFs/iiis/iiisdp396.pdf.

Bopape L & Myers R, 2007. Analysis of household demand for food in South Africa: Model selection, expenditure endogeneity, and the influence of socio-demographic effects. African Econometrics Society Annual Conference, 22.

Caracciolo F, Depalo D & Macias JB, 2014.Food price changes and poverty in zambia: An empirical assessment using household microdata. *Journal of International Development*, 26(4), 492–507. doi: 10.1002/jid.2976.

Colen L, Melo PC, Abdul-Salam Y, Roberts D, Mary S, Gomez s, Paloma Y, 2018. Income elasticities for food, calories and nutrients across Africa: A meta-analysis. *Food Policy*, 77 116–132. doi: 10.1016/j.foodpol.2018.04.002.

Dhar TP & Foltz JD, 2004. Is Soy Milk? The Economics Of The Soy Milk Market. Available at: http://ideas.repec.org/p/ags/aaea04/20337.html.

Mbegalo TY, 2016. The impact of food prices on household welfare and poverty in rural Tanzania. Discussion Papers, No. 216, Georg-August- Universität Göttingen, Courant Research Centre - Poverty, Equity and Growth (CRC-PEG), Göttingen.

Poi BP,(2012. Easy demand-system estimation with quaids. *Stata Journal*, 12(3), 433–446. doi: 10.1177/1536867x1201200306.

Prifti E, Daidone S & Miguelez B,2017. Impact of increases in food prices on consumer welfare in Lesotho. *African Journal of Agricultural and Resource Economics*, 12(1),52–61. doi: 10.22004/ag.econ.258599.

Kane GQ, Tene GLM, Ambagna JJ, Piot-lepetit I & Sikod F, 2018. The Impact of Food Price Volatility on Consumer Welfare in Cameroon. *SSRN Electronic Journal*. doi: 10.2139/ssrn.3176764.

Blundell R & Robin RM, 2016. Estimation in Large and Disaggregated Demand Systems : An Estimator for Conditionally Linear Systems, 14(3),209–232.URL : http://www.jstor.org/stable/223176.

Shonkwiler JS & Yen ST, 1999. Two-step estimation of a censored system of equation. American Journal of Agricultural Economics, 81 (4),972-982.

Tefera N, Demeke M & Rashid S, 2012. Welfare Impacts of Rising Food Prices in Rural Ethiopia : a Quadratic Almost Ideal Demand System Approach. *Proceedings of the International Association of Agricultural Economists Conference*,1–48. Available at: http://ageconsearch.umn.edu/bitstream/126261/2/.

Weber R, 2015. Welfare Impacts of Rising Food Prices : Evidence from India. *International Conference of Agricultural Economists: Agriculture In An Interconnected World*, 1-26.

Appendix

Table A1: Quadratic Almost Ideal Demand Systems estimates

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Overall | Rural | Urban |
| Linear term |  | -0.03(0.03) | -0.08(0.03)\*\* | -0.05(0.02)\*\*\* |
|  | -0.03(0.03) | -0.09(0.03)\*\*\* | 0.07(0.01)\*\*\* |
|  | 0.15(0.03)\*\*\* | 0.003(0.03) | 0.06(0.02)\*\*\* |
|  | -0.09(0.03)\*\*\* | 0.04(0.02)\*\* | 0.06(0.01)\*\*\* |
|  | 0.007(0.05) | 0.15(0.04)\*\*\* | -0.006 (0.04) |
|  | -0.007(0.05) | -0.06(0.04) | 0.02(0.03) |
| Quadratic term |  | 0.03(0.006)\*\*\* | 0.02(0.004)\*\*\* | 0.02(0.004)\*\*\* |
|  |  | 0.01(0.004)\*\*\* | 0.002(0.004)\*\*\* | 0.03(0.003)\*\*\* |
|  |  | 0.04(0.004)\*\*\* | 0.02(0.003)\*\*\* | 0.02(0.004)\*\*\* |
|  |  | 0.0009(0.005) | 0.006(0.004) | -0.006(0.003)\*\* |
|  |  | -0.05(0.01)\*\*\* | -0.009(0.005)\* | 0.02(0.006)\*\*\* |
|  |  | -0.02(0.01)\*\* | -0.03(0.0005)\*\*\* | -0.04(0.007)\*\*\* |
| Prices |  | **-0.04(0.009) \*\*\*** | **-0.07(0.01) \*\*\*** | **-0.08(0.02)\*\*\*** |
|  |  | -0.003(0.007) | 0.007 (0.01) | 0.009(0.01) |
|  |  | -0.017(0.007) \*\* | -0.006 (0.009) | -0.034(0.007)\*\*\* |
|  |  | -0.02(0.007) \*\*\* | -0.009 (0.007) | -0.06 (0.008)\*\*\* |
|  |  | -0.01(0.01) | -0.04(0.01) \*\*\* | -0.001 (0.01) |
|  |  | 0.012 (0.008) | -0.01(0.02) | 0.004 (0.01) |
|  |  | **-0.08(0.009) \*\*\*** | **-0.07(0.01) \*\*\*** | **-0.09 (0.01) \*\*\*** |
|  |  | -0.005 (0.008) | 0.01(0.01) | 0.008(0.004) |
|  |  | 0.02(0.007)\*\*\* | 0.011 (0.008) | -0.0004 (0.004) |
|  |  | -0.07(0.02 \*\*\* | -0.06(0.01) \*\*\* | -0.08 (0.02) \*\*\* |
|  |  | -0.02(0.009)\* | -0.04(0.02) \*\* | -0.032(0.016) \*\* |
|  |  | **-0.09(0.009)\*\*\*** | **-0.08(0.01) \*\*\*** | **-0.07(0.007)\*\*\*** |
|  |  | -0.03 (0.007)\*\*\* | -0.014(0.01) \*\* | -0.01 (0.006)\*\* |
|  |  | -0.03(0.013) \*\* | -0.03(0.016)\* | -0.01(0.01) |
|  |  | -0.01(0.011) | -0.04(0.01)\*\*\* | -0.016(0.014) |
|  |  | -0.04(0.009)\*\*\* | -0.02(0.005)\*\*\* | -0.03(0.007)\*\* |
|  |  | -0.01 (0.014) | -0.009(0.11) | 0.042 (0.014)\*\*\*\* |
|  |  | -0.003 (0.009) | 0.005 (0.11) | 0.0003(0.014) |
|  |  | **-0.4 (0.17) \*\*** | -0.18 (0.19) | -0.05 (0.41) |
|  |  | -0.27(0.16)\* | 0.32(0.19)\* | 0.107 (0.41) |
|  |  | **-0.29 (0.16) \*\*** | -0.23(0.19) | -0.06(0.41) |
| Family size |  | -0.001(0.001) | -0.0006(0.0013) | -0.004(0.002)\*\* |
|  |  | -0.001 (0.0008) | -0.0021(0.001)\*\* | -0.003(0.001)\*\*\* |
|  |  | -0.003 (0.0008)\*\*\* | -0.004(0.001)\*\*\* | -0.0006(0.0008) |
|  |  | -0.0008(0.0008) | 0.0003(0.0008) | -0.0009(0.0008) |
|  |  | 0.0030( 0.0016)\* | 0.002(0.0013)\* | 0.004(0.002)\*\* |
|  |  | 0.0026 (0.0011)\*\* | 0.004(0.002)\*\* | 0.005(0.002)\*\*\* |
| Sex |  | -0.007(0.006) | -0.017(0.006)\*\*\* | -0.011(0.007) |
|  |  | 0.009(0.004)\*\* | -0.002(0.005) | 0.003(0.004) |
|  |  | 0.012(0.004)\*\*\* | 0.003(0.005) | 0.001(0.003) |
|  |  | 0.007(0.004)\*\* | -0.008(0.004)\*\* | 0.0126 (0.004)\*\*\* |
|  |  | -0.013 (0.008) | 0.005(0.006) | -0.005(0.008) |
|  |  | -0.009(0.006)\* | 0.02(0.008)\*\* | -0.001(0.008) |
| Age |  | 0.0002(0.0002) | 0.0004(0.0002)\*\* | 0.0001(0.0002) |
|  |  | -0.0001 (0.000) | 0.00013(0.00014) | -0.00012 (0.0002) |
|  |  | 0.000018 (0.00014) | 0.00018(0.00015) | 0.00018(0.0011) |
|  |  | -0.00004 (0.0001) | 0.00014(0.00012) | 0.00003 (0.0011) |
|  |  | 0.0003(0.0003) | -0.0004(0.0002)\*\* | -0.00004(0.0003) |
|  |  | -0.00031(0.00018) | -0.0004(0.0002) | -0.00012(0.0003) |
| Literacy |  | 0.0032(0.008) | -0.008(0.009) | -0.006(0.011) |
|  |  | 0.008(0.006) | 0.005(0.007) | 0.0014(0.007) |
|  |  | 0.004(0.006) | 0.001(0.008) | 0.006(0.005) |
|  |  | 0.0008(0.005) | 0.010(0.006) | -0.005(0.006) |
|  |  | -0.0125 (0.01) | -0.001(0.008) | 0.004(0.012) |
|  |  | -0.0034(0.006) | -0.007(0.010) | -0.0014(0.011) |
| Years of schooling |  | 0.0011(0.0008) | 0.002(0.0016) | 0.0017(0.001)\* |
|  |  | -0.0009(0.0008) | -0.0006(0.001) | -0.00002(0.0006) |
|  |  | 0.0006(0.0006) | -0.0001(0.0013) | 0.0005(0.0004) |
|  |  | 0.0007(0.0005) | -0.003(0.001)\*\*\* | 0.0009(0.0004)\*\* |
|  |  | -0.0003(0.001) | -0.0009(0.001) | -0.003(0.0018)\* |
|  |  | -0.0017(0.001) | 0.0024(0.002) | -0.00007(0.002) |
| Kaffa dummy |  | 0.058(0.007) \*\*\* | 0.07(0.007)\*\*\* | --- |
|  |  | -0.023 (0.006) \*\*\* | -0.01 (0.004)\*\*\* | --- |
|  |  | -0.047 (0.006) \*\*\* | -0.02(0.005)\*\*\* | --- |
|  |  | 0.012 (0.004) \*\*\* | 0.027 (0.005)\*\*\* | --- |
|  |  | 0.009(0.015) | 0.003(0.012) | --- |
|  |  | -0.009 (0.013) | -0.07(0.015) \*\*\* | --- |
| Sheka dummy |  | 0.06 (0.007) \*\*\* | 0.06(0.008)\*\*\* | 0.06(0.008)\*\*\* |
|  |  | -0.025(0.006) \*\*\* | -0.005(0.005) | -0.014(0.006)\*\*\* |
|  |  | -0.06 (0.006) \*\*\* | -0.025(0.006)\*\*\* | -0.05(0.005)\*\*\* |
|  |  | -0.008(0.005) | 0.012(0.004)\*\*\* | 0.08(0.004)\*\* |
|  |  | 0.05(0.01)\*\*\* | -0.032(0.008)\*\*\* | 0.011(0.013) |
|  |  | -0.011(0.009) | -0.015(0.01) | -0.02(0.012)\* |
| V |  | -0.06 (0.015)\*\*\* | 0.09(0.017)\*\*\* | -0.07(0.023)\*\*\* |
|  |  | -0.049 (0.01)\*\*\* | 0.06 (0.017)\*\*\* | -0.075(0.016)\*\*\* |
|  |  | -0.045 (0.01)\*\*\* | 0.068(0.016)\*\*\* | -0.008(0.011) |
|  |  | -0.014(0.01) | 0.068(0.013)\*\*\* | (0.010)(0.011) |
|  |  | 0.13(0.02)\*\*\* | -0.14(0.023)\*\*\* | 0.010(0.11) |
|  |  | 0.034(0.018)\*\* | -0.15(0.028)\*\*\* | 0.13(0.03)\*\*\* |
| v-square |  | -0.007(0.12) | 0.02(0.016) | 0.01(0.03) |
|  |  | -0.0139(0.009) | 0.02(0.011)\* | -0.0018(0.02) |
|  |  | -0.008(0.009) | 0.017(0.011) | -0.12(0.016)\*\*\* |
|  |  | 0.06(0.009)\*\*\* | -0.013(0.008) | 0.03(0.017)\*\* |
|  |  | -0.04(0.016)\*\*\* | -0.01(0.016) | 0.042(0.012)\*\*\* |
|  |  | 0.005(0.012) | -0.034(0.017)\* | 0.038(0.028) |
| v-cub |  | 0.07(0.016)\*\*\* | -0.003(0.014) | 0.019(0.026) |
|  |  | 0.024(0.011)\*\* | -0.017(0.01) | 0.027(0.032) |
|  |  | 0.025(0.011)\*\* | -0.018(0.011) | -0.104(0.019)\*\*\* |
|  |  | -0.038 (0.01)\*\* \* | -0.063(0.009)\*\*\* | -0.0018(0.014) |
|  |  | -0.057(0.019)\*\* \* | 0.05(0.01) | 0.036(0.016 )\*\* |
|  |  | -0.02(0.016) | 0.05(0.016)\*\*\* | -0.0005(0.03) |
| Constant |  | 0.026(0.066) | -0.017(0.07) | -0.036(0.038) |
|  |  | -0.117(0.05)\*\* | -0.19(0.06)\*\*\* | 0.0006(0.028) |
|  |  | 0.20(0.054)\*\*\* | -0.04(0.08) | 0.119(0.02)\*\*\* |
|  |  | -0.127(0.048)\*\*\* | -0.012(0.06) | 0.075(0.02)\*\*\* |
|  |  | 0.78(0.105)\*\*\* | 0.48(0.12)\*\*\* | 0.52(0.07)\*\*\* |
|  |  | 0.24(0.094)\*\* | 0.78(0.12)\*\*\* | 0.311(0.07)\*\*\* |

1. where= is indirect utility function of *quadratic logarithmic budget share systems when*  = [↑](#footnote-ref-1)
2. Where = + and =0 [↑](#footnote-ref-2)
3. The first term of the right had expression denote the first order Taylor expansion [↑](#footnote-ref-3)
4. Bench-Maji zone was dissolved into Bench-Sheko & Maji zones recently. [↑](#footnote-ref-4)
5. Up on request the author will provide the list of items under respective groups. [↑](#footnote-ref-5)