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Household food demand in Pakistan: A provincial analysis

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ABSTRACT

In developing countries of the world, the pattern of food consumption is usually used as a benchmark for measuring the living standard of people. This paper examines and compares the food expenditure pattern of households across provinces in Pakistan using 2011-12 household integrated economic survey (HIES) data. The study used the linear approximate almost ideal demand system (LA-AIDS) to estimate food demand elasticities. The patterns of food consumption and expenditure for eight food groups: wheat flour, rice, dairy, pulses, meats, fruits and vegetables, cooking oil and other foods are examined. The study observed differences in household consumption patterns across provinces. The estimated results show that all food groups have negative own price elasticities and are consistent with economic theory. All the expenditure elasticities are positive and significant indicating that all food groups are normal. The expenditure elasticities estimated show that dairy and meats are luxury foods in all provinces, while wheat flour, pulses, cooking oil, and other foods are necessities in the diet of the Pakistani households. In all provinces, a household spends most of its food expenditure on dairy products, wheat flour, cooking oil, fruit and vegetables. The estimates suggest that policymakers in Pakistan should ensure and monitor the availability of these essential food items in order to reduce undernourishment and food insecurity in the country.

Keywords

Food Demand;
Elasticities; LA-AIDS; Pakistan

JEL

Classification

D11; D12;
Q10; R22

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1. Introduction

Food is a basic need of life and essential for the existence of every human being. A balance diet helps in maintaining good health. Meeting basic needs such as food remain a major priority of the poor population and they spend a larger portion of their money on it (Begum et al., 2010). Majority of the undernourished and poor people live in the developing world. In a recent estimate, 821 million people worldwide live in chronic hunger, in which

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515.1 million reside in Asian countries (FAO, 2018). People in Pakistan also suffers from severe hunger. Pakistan ranks 106th out of 119 qualifying countries, lagging behind Bangladesh and neighbouring India (GHI, 2018). In Pakistan, about 60 percent of the population is food insecure, with highly prevalent undernourishment. In addition, 44% of children under the age of 5 are stunted, chronically malnourished, and 15% are acutely malnourished (USAID, 2018). Pakistan has made considerable development in getting higher per capita availability of all important food commodities such as meat, cereals, eggs, milk and sugar. The calorie intake of an average Pakistani has increased from 2078 calories in 1949-50 to 2450 calories in 2012-13. However, the problem is that half the country's population is still unable to meet its required caloric intake (Malik et al., 2014; 2015).

In Pakistan, many households consume insufficient quantities of calories, protein and other nutrients. Rather than a balanced diet, households consume more high-energy food products. Furthermore, households have limited dietary diversity, as only dairy products and wheat account for 40% of food expenditure on average. The lowest income quintile households spend most of their food expenditure on wheat, while top income quintile households spend more of their income on meat and dairy products (Karim et al., 2018). In developed countries, people spend more of their money on non-food items and services, whereas, in developing countries, households spend a major portion of their income on food items. People of developed countries such as Canada, Holland and USA spent 13.7, 14.4 and 10.4 percent of their income on food items, respectively; however, in developing countries like India, Philippines, Sudan, more than 50 percent of household money is spent on food items (Begum et al., 2010). The situation in Pakistan is not different, and the households spend 37.05 percent of its income on food (GoP, 2016).

In the last few decades, the analysis of consumer demand has attracted attention both in Pakistan and internationally. In Pakistan, unprecedented poverty, hunger and undernourishment have revived interest in estimating food demand. Although, household consumption patterns in Pakistan have been investigated in a number of studies (Burney and Khan, 1991; Aziz et al., 2011; Begum et al., 2012; Haider and Zaidi, 2017; Irfanullah et al., 2018), still very little is known about the province wise comparison of complete food demand in Pakistan. Quantifying household responses to income and price changes requires careful econometric analysis of the patterns of household consumption. Most of the previous studies estimated food demand for a single province or food demand for the country's rich and poor households. This study compares the consumption patterns of households by estimating the Marshallian, Hicksian, and expenditure elasticities in four Pakistani provinces. The study uses Linear Approximate Almost Ideal Demand System (LA-AIDS) for the estimation of elasticities. The analysis includes eight food commodity groups: (i) wheat flour; (ii) all kinds of rice; (iii) dairy (iv) pulses (v) meats (beef, mutton, fish and chicken); (vi) fruits and vegetables; (vii) ghee and oil; (viii) other foods.

2. Literature review

An important element of any type of research work is the literature review. It guides researchers in finding a gap in the relevant area to be investigated. This section of the paper examines some important studies already conducted on food consumption and household expenditure pattern.

Dynamic Almost Ideal Demand System (AIDS) was used by Fan et al. (1994) to investigate patterns of food demand for China's rural households using household survey data. They found that the estimated expenditure elasticities of all food groups have positive signs indicating that the food items used by household are normal. Furthermore, the estimated expenditure elasticity showed that wheat, grain and rice were necessary food items in household consumption pattern, while meat, tobacco, vegetables and alcohol were luxury items. The result also indicated that the demand for these food items is also increasing with the increase in population and per capita income of the household. In order to avoid food shortages, the study proposed that China should increase its food production.

Jiang and Davis (2007) used the LA-AIDS model with a three-stage budgeting procedure to study food consumption patterns of rural household in Jilin Province of Northern China, using household survey data. In particular, the study was conducted to investigate the demand for livestock products. The data were divided into four groups of food commodities, namely grain, animal products, vegetables and other food products, for estimation purposes. They estimated the expenditure elasticities of the food groups and mainly focused on animal products. The result showed that grain expenditure elasticity was 0.64, indicating that household demand for grain will continue to grow because of the increase in per capita income in that region. Furthermore, the results indicated that the conditional and total expenditure elasticity values of animal products were 1.22 and 0.76 respectively. Haq et al. (2011) analyzed household food demand pattern in Pakistan's Punjab province using data from the 2004-2005 household income and expenditure survey. Food products were categorized into eight groups. They found that households with farming profession consumed more wheat and less of all other products. Furthermore, households with an educated head consumed additional food in rural and urban areas of Punjab, except wheat and vegetables. The estimated expenditure elasticities had a positive sign, indicating that all food groups are normal. The study concluded that demand was inelastic for all food groups, but found that demand for wheat was more inelastic in both regions.

Alexandria, Pauna & Luca (2015) used household budget survey data for estimating food demand in Romania using the almost ideal demand system (AIDS). They estimated food demand elasticities for urban and rural areas of Romania. They found that all the estimated own-price elasticities had expected negative signs. The study concluded that the

estimated expenditure elasticities in rural areas were higher than in urban areas, mainly because of the low cash income of rural people.

Chen et al. (2016) carried out a meta-analysis for the estimation of food and agricultural elasticities in China. The study found that, as per capita increases, the expenditure elasticities of many food products decreases. One of the possible reasons for this may be economic development, which has increased food supply chains, giving people more choices regarding food products that lead to more substitution. The estimated results suggested that China's demands for dairy and meat and, in turn, for animal feed will continue to grow strongly. They also suggested that the demand for these food products be monitored to ensure food security, especially due to the growing population and tight domestic food supplies in China.

Aziz et al. (2017) studied own price and income elasticities of various consumption quintiles for urban and rural households in Pakistan using household survey data. They estimated the parameters of aggregate food commodity groups using the linear approximate almost ideal demand system (LA-AIDS). The study found that households increased vegetable, fruit, milk, and meat consumption with higher incomes. The result also showed that the elasticity of expenditure in urban areas is smaller than in rural areas and that expenditure on most food groups increases at a decreasing rate as household income increases. The estimated expenditure elasticities for all food groups were less than one, with the exception of meat, fruits and milk with elasticities greater than one. The Marshallian own price estimated elasticities for all food groups were found negative and less than one with the exception of meat greater than one indicating elastic demand for meat. The study examined the values of cross price elasticities and found substitution relationships for all the selected food groups.

Haider and Zaidi (2017) studied changes in consumption patterns of household in Pakistan by dividing food expenditures into eleven composite groups. The study used household income expenditure survey (HIES) from 2000-01 to 2013-14 and used quadratic almost ideal demand system (QUAIDS) for empirical estimation. In addition to differences in calories and consumption bundles, the study also estimated household's response to changes in income and prices. Empirical results indicated that the patterns of food consumption vary across regions as well as between provinces. In spite of the increase in food supply availability and per capita income increase, per adult equivalent average calorie intake in the country remains below 2350 Kcal. Furthermore, 30% of children under the age of 5 were found underweight and 45% of children in Pakistan were stunted. They concluded that if the present scenario persists, it can increase the vulnerability of poverty, the burden of diseases throughout the country and low levels of productivity.

Irfanullah et al. (2018) studied household food consumption decision making in Pakistan using the 2011-12 household integrated economic survey and the LA-AIDS model for

estimation. They investigated the effects of price and income changes on food demand in Pakistan. The study found that the Marshallian own price elasticities of milk, fruits, meat and rice are more elastic as compared to other groups. The study concluded that the imposition of taxes on personal income of the household could reduce the consumption of food. The study suggested that prices of essential food groups be maintained at reasonable in order to protect low and middle income groups from food insecurity.

3. Research methods

The almost ideal demand system (AIDS) model introduced by Deaton and Muellbauer (1980) is used for this study. The AIDS model has several advantages over the translog and the rotterdam models such as it satisfies exactly the axioms of choice, simple to estimate, and testing the empirical validity of the restrictions of symmetry and homogeneity is also easy. Its functional form is consistent with known household budget data. Although, both the translog and rotterdam models have some of these properties too but neither of them possesses all the theoretical properties (Deaton & Muellbauer, 1980a).

Deaton and Muellbauer (1980a,b) specified the following demand equation in budget share form for LA-AIDS.

$$\omega_i = \alpha_i + \sum_j y_{ij} \ln p_j + \beta_i \ln \left(\frac{x}{p} \right) \quad (1)$$

where ω_i is the budget share of good i , p_j is the price of good j , x is the expenditure and p is price index approximated by the Stone's price index.

The following theoretical properties of demand are imposed on equation (1).

Adding Up $\sum_i \alpha_i = 1$ $\sum_i \beta_i = 0$ $\sum_i y_i = 0$, Homogeneity: $\sum_j y_{ij} = 0$, and Symmetry: $y_{ij} = y_{ji}$

The parameters of the estimated model are used to derive the elasticities using the following relationships.

$$\text{Marshallian:} \quad \varepsilon_{ij} = \frac{y_{ij} - \beta_i \omega_i}{\omega_i} - \delta_{ij} \quad (2)$$

$$\text{Hicksian elasticity:} \quad e_{ij} = \frac{y_{ij}}{\omega_i} + \omega_j - \delta_{ij} \quad (3)$$

$$\text{Expenditure elasticity:} \quad \eta_i = \frac{\beta_i}{\omega_i} + 1 \quad (4)$$

where

δ_{ij} is kronecker delta which is one for own price and 0 for cross prices. In order to implement this approach, the study estimates the own price, cross-price and expenditure elasticities of separate food commodity on the basis of household consumption / expenditure data.

The data used in this paper are derived from the HIES 2011/2012 and were used for household food expenditure patterns and elasticities estimation. The HIES 2011-12 covers 15807 households that were selected from the urban and rural areas of all provinces of Pakistan. The survey adopted a two-stage stratified random sample design for the selection of a household. In the main stage of the survey, 1158 primary sampling units in rural and urban areas of all Pakistani provinces were selected. Sample 15807 was randomly selected from these primary sampling units in the second stage of the survey. A random systematic sampling system with a random start was selected from each primary sampling unit for 12 or 16 households. The HIES survey gathers detailed information about the value and quantity of a variety of food items consumed. The HIES collects data on patterns of consumption, income of the household by source, characteristics of household and social indicators. This detailed information enables us to study the budget share of different food items to estimate the LA-AIDS system.

4. Results and discussion

4.1 Household monthly food expenditures and food budget shares

The patterns of food consumption in Pakistan have changed over the last two decades. The share of expenditure measures the proportion of income in a specific food group in relation to the total expenditure on food. Descriptive statistics in table 1 explains province wise monthly food budget shares of various food items in Pakistan. It is observed from estimation that dairy products and wheat flour are the major food consumption groups having average budget share more than 40 percent of household expenditure whereas fruits and vegetables, other food, meats, cooking oil and rice having average budget shares of 13.0, 15.8, 11.8, 11.4, and 4.6 respectively. The high expenditures share of wheat flour and dairy products reflects a high consumption level of these food commodities. Table 1 also explains that how consumption and expenditure pattern of the household differ across Provinces. Per household expenditures on the selected food groups are divided into eight groups. The average expenditures per household has been calculated for each food group as well as for each province in the country. The average food expenditures on aggregate food groups is Rs. 9755/month per household in the Pakistan. Baluchistan Province has the highest expenditures on food which is Rs.11892 per household per month. The household monthly average expenditure on wheat flour are much higher for the Baluchistan province amounting to Rs. 2415 reflecting a higher expenditure as compare to other provinces of the country. In the Sindh province the expenditure on rice commodity group is much higher which is Rs. 681/ month per household. The expenditure on dairy products is higher in Punjab province as compare to other provinces, which is Rs. 2744.

Table 1: Household monthly average food expenditures and food budget shares in Pakistan

| Food group | Punjab | Sindh | Khyber Pakhtunkhwa | Baluchistan | Pakistan | F |
|-------------------|----------------|----------------|-----------------------|----------------|----------------|---------|
| Wheat flour | 1298(14.2) | 1356(13.8) | 1804(17.9) | 2415(20.3) | 1519(15.6) | 838.50* |
| Rice | 336(3.7) | 681(6.9) | 385(3.8) | 413(3.5) | 445(4.6) | 382.61* |
| Dairy | 2744(30.1) | 2431(24.8) | 2277(22.6) | 1648(13.8) | 2466(25.3) | 136.73* |
| Pulses | 222(2.4) | 229(2.3) | 284(2.8) | 360(3.0) | 249(2.5) | 307.68* |
| Meats | 1007(11.0) | 1181(12.0) | 1107(11.0) | 1872(15.7) | 1152(11.8) | 148.52* |
| Fruits/vegetables | 1237(13.6) | 1116(11.4) | 1381(13.7) | 1662(13.9) | 1273(13.0) | 216.69* |
| Cooking oil | 1016(11.1) | 1077(11.0) | 1125(11.1) | 1627(13.7) | 1110(11.4) | 488.16* |
| Other food | 1258(13.8) | 1745(17.8) | 1723(17.1) | 1895 (15.9) | 1541(15.8) | 339.73* |
| Total | 9118 | 9816 | 10086 | 11892 | 9755 | 122.96* |
| No of Households | 6903 | 4195 | 3276 | 1424 | 15798 | |

Source: Author's calculation using 2011-12 HIES data. The figures in parentheses are budget share of food item. * show estimates are statistically significant at 1%.

4.2 Monthly average food expenditure by urban and rural household in Pakistan

Descriptive statistics in table 2 explain rural and urban household differences in monthly food expenditure for various food items in Pakistan. It is observed that rural household expenditure on wheat flour is higher than urban households in all the provinces. The expenditure on other food groups in urban areas is higher in all provinces except Khyber Pakhtunkhwa. The expenditure on dairy products in the urban regions of Punjab, Sindh and Baluchistan is higher compared to the rural regions in those provinces. The reason for low expenditure on dairy products in rural areas is the easy availability of dairy products and the price differences between urban and rural areas. Households in urban areas consume more meat than rural regions in all provinces. Households in urban Punjab and Baluchistan spend more on fruit and vegetables as compared to other provinces in Pakistan.

Table 2: Monthly average food expenditure for urban and rural household in Pakistan

| Food group | Punjab | Sindh | Khyber Pakhtunkhwa | Baluchistan | Pakistan |
|-------------------|--------|-------|-----------------------|-------------|----------|
| URBAN | | | | | |
| Wheat flour | 1214 | 1278 | 1660 | 2172 | 1405 |
| Rice | 371 | 642 | 288 | 412 | 436 |
| Dairy | 2896 | 2620 | 2210 | 1688 | 2576 |
| Pulses | 231 | 259 | 281 | 375 | 262 |
| Meats | 1293 | 1589 | 1299 | 1961 | 1440 |
| Fruits/vegetables | 1398 | 1247 | 1458 | 1591 | 1385 |
| Cooking oil | 1069 | 1136 | 1152 | 1567 | 1150 |
| Other food | 1433 | 2039 | 1694 | 1940 | 1700 |
| RURAL | | | | | |

| | | | | | |
|------------------|------|------|------|------|------|
| Wheat flour | 1360 | 1420 | 1895 | 2607 | 1604 |
| Rice | 309 | 713 | 446 | 413 | 451 |
| Dairy | 2632 | 2275 | 2320 | 1616 | 2383 |
| Pulses | 215 | 204 | 286 | 348 | 240 |
| Meats | 794 | 844 | 985 | 1801 | 938 |
| Fruits/vegetable | 1117 | 1008 | 1331 | 1718 | 1190 |
| Cooking oil | 977 | 1029 | 1108 | 1674 | 1081 |
| Other food | 1128 | 1502 | 1742 | 1860 | 1423 |

Source: Author's calculation using 2011-12 HIES data.

4.3 Parameters estimates of the LA-AIDS model

The study used the seemingly unrelated regression (SUR) of Zellner (1963) for the estimation of LA-AIDS equations system. The Delta method (STATA, 2005) were used for deriving the statistical significance of the estimated elasticities. By imposing the restriction of additivity on the expenditure function makes the problem that the variance and covariance matrix become singular due to which one of the equations of the demand system needs to be dropped. In this study the other food equation was selected for omission. The coefficients that are estimated are given in Table 3, 4,5,6,7. The estimated coefficient included in the system are mostly significant at the 95 and 99 percent level of significance. The parameters of the dropped equation (other food) are derived using the condition of adding up. The estimated low values of R^2 are not uncommon when using cross-sectional data.

Table 3: Parameters estimates of the LA-AIDS model for Punjab Province

| Explanatory Variable | Wheat flour | Rice | Dairy | Pulses | Meats | Fruits/Ve g | Oils | Other |
|-----------------------------------|--------------------|--------------------|---------------------|--------------------|----------------------|---------------------|--------------------|--------------------|
| Log of Price of Wheat flour | 0.087 (0.002)* | 0.004 (0.001)* | -0.044 (0.005)* | 0.004 (0.001)* | -0.007 (0.004)*** | -0.009 (0.002)* | 0.015 (0.002)* | -0.051 (0.002)* |
| Log of Price of Rice | -0.009 (0.001)* | 0.011 (0.000)* | -0.006 (0.001)* | 0.000 (0.000) | -0.000 (0.001) | 0.004 (0.000)* | -0.000 (0.000) | 0.001 * |
| Log of Price of Dairy | -0.015 (0.001)* | 0.001 (0.001) | 0.038 (0.003)* | -0.000 (.000) | -0.003 (0.002)*** | -0.007 (0.001)* | -0.004 (0.001)* | -0.007 (0.001)* |
| Log of Price of Pulses | 0.005 (0.001)* | -0.002 (0.000)* | -0.010 (0.002)* | 0.007 (0.000)* | -0.006 (0.002)* | 0.003 (0.001)* | 0.007 (0.001)* | -0.003 (.001)* |
| Log of Price of Meats | -0.006 (0.000)* | -0.002 (0.000)* | -0.006 (0.001)* | -0.001 (0.000)* | 0.019 (0.000)* | -0.001 (0.000)* | -0.003 (0.000)* | 0.001 (0.000)* |
| Log of Price of Fruits/Vegetables | -0.010 (0.001)* | 0.003 (0.001)* | -0.026 (0.003)* | 0.004 (0.000)* | 0.014 (0.002)* | 0.018 (0.001)* | -0.001 (0.001) | -0.001 (0.001) |
| Log of Price of Oils | 0.006 (0.001)* | 0.000 (0.001) | -0.020 (0.003)* | -0.002 (0.000)* | -0.007 (0.002)* | -0.000 (0.001) | 0.026 (0.001)* | -0.003 (0.001)* |
| Log of Price of Other Food | 0.000 (0.003) | 0.001 (0.001) | -0.061 (0.005)* | 0.005 (0.001)* | 0.016 (.004)* | -0.002 (0.002) | 0.011 (0.002)* | 0.029 (0.002)* |
| Household Size | 0.012 (0.000)* | 0.001 (0.000)* | -0.014 (0.000)* | 0.001 (0.000)* | -0.006 (.000)* | -0.001 (0.000)* | 0.005 (0.000)* | 0.001 (0.000)* |
| Household Education | -0.000 (0.000) | 0.000 (0.000)* | -0.001 (0.000)** | 0.000 (0.000)** | 0.000 (0.000)** | -0.000 (0.000) | 0.000 * | 0.000 (0.000) |
| Household age | 0.000 (0.000) | 0.000 (0.000) | 0.000 (0.000)* | 0.000 (0.000)** | 0.000 (0.000) | -0.000 (0.000)** | 0.000 (0.000) | 0.000 (0.000) |
| Constant | 0.453 0.015 | 0.005 (0.007) | -0.061 (0.026)** | 0.019 (0.004)* | -0.317 (0.019)* | 0.228 (0.012)* | 0.240 (0.009)* | 0.431 (0.012)* |
| Number of Observations | 6903 | 6903 | 6903 | 6903 | 6903 | 6903 | 6903 | 6903 |
| R-Squared | 0.431 | 0.170 | 0.257 | 0.188 | 0.333 | 0.067 | 0.402 | 0.155 |

| | | | | | | | | |
|-----|---------|---------|---------|---------|---------|--------|---------|---------|
| Chi | 5239.5* | 1415.5* | 2390.7* | 1599.5* | 3449.9* | 500.2* | 4645.9* | 1267.3* |
|-----|---------|---------|---------|---------|---------|--------|---------|---------|

Source: Author's estimation using 2011-12 HIES data. Values in parentheses are standard errors.

* Significant at 1%, ** significant at 5% and *** significant at 10%.

Table 4: Estimated parameters of LA-AIDS model for Sindh Province

| Explanatory Variable | Wheat flour | Rice | Dairy | Pulses | Meats | Fruits/Veg | Oils | Other |
|-----------------------------------|---------------------|--------------------|--------------------|---------------------|--------------------|---------------------|--------------------|---------------------|
| Log of Price of Wheat flour | 0.054 (0.002)* | 0.021 (0.003)* | -0.014 (0.004)* | 0.000 (0.000) | -0.008 (0.003)* | -0.002 (0.001) | 0.010 (0.001)* | -0.017 (0.002)* |
| Log of Price of Rice | -0.011 (0.001)* | 0.019 (0.001)* | -0.005 (0.002)* | -0.000 (0.000)** | -0.004 (0.001)* | 0.000 (0.001) | 0.001 * | -0.008 (0.001)* |
| Log of Price of Dairy | -0.024 (0.002)* | 0.011 (0.003)* | 0.026 (0.004)* | 0.002 (0.000)* | 0.024 (0.003)* | 0.000 (0.000) | -0.000 (0.001) | -0.018 (0.003)* |
| Log of Price of Pulses | 0.003 (0.002)* | 0.003 (0.002) | -0.019 (0.003)* | 0.009 (0.000)* | -0.002 (0.002) | 0.003 (0.001)* | 0.003 (0.001)* | -0.010 (0.002)* |
| Log of Price of Meats | -0.008 (0.000)* | -0.002 (0.001)* | -0.003 (0.001)* | -0.000 (0.000)* | 0.019 (0.000)* | -0.003 (0.000)* | -0.001 (0.000)* | 0.001 (0.001) |
| Log of Price of Fruits/Vegetables | -0.009 (0.002)* | -0.012 (0.002)* | -0.015 (0.003)* | 0.001 (0.000)** | 0.005 * | 0.020 (0.001)* | -0.004 (0.001)* | 0.024 (0.002)* |
| Log of Price of Oils | 0.002 (0.002)* | 0.007 (0.003)* | -0.038 (0.004)* | -0.001 (0.000)** | -0.007 (0.003)* | 0.004 (0.001)* | 0.029 (0.001)* | -0.007 (0.002)** |
| Log of Price of Other Food | 0.003 (0.004) | 0.039 (0.005)* | -0.028 (0.006)* | 0.010 (0.001)* | 0.026 (0.004)* | 0.005 (0.002)** | 0.012 (0.002) | 0.020 (0.005)* |
| Household Size | 0.006 (0.000)* | 0.004 (0.000)* | -0.007 (0.000)* | 0.000 (0.000)* | -0.004 (0.000)* | 0.000 (0.000)** | 0.002 (0.000)* | -0.002 (0.000)* |
| Household Education | -0.000 (0.000)** | 0.000 (0.000) | 0.000 * | 0.000 (0.000) | 0.000 ** | -0.000 (0.000) | 0.000 (0.000) | -0.000 (0.000)* |
| Household age | -0.000 (0.000) | -0.000 (0.000)* | -0.000 (0.000)* | 0.000 (0.000)* | 0.000 (0.000)* | -0.000 (0.000)** | -0.000 * | 0.000 (0.000)* |
| Constant | 0.320 (0.017)* | 0.221 (0.021)* | 0.079 (0.027)* | 0.001 (0.003) | -0.313 (0.019)* | 0.100 (0.011)* | 0.140 (0.010)* | 0.449 (0.021)* |
| Number of Observations | 4195 | 4195 | 4195 | 4195 | 4195 | 4195 | 4195 | 4195 |
| R-Squared | 0.363 | 0.152 | 0.174 | 0.184 | 0.3783 | 0.119 | 0.227 | 0.143 |
| Chi | 2395.2* | 754.3* | 882.8* | 947.9* | 2552.9* | 568.8* | 1236.4* | 698.9* |

Source: Author's estimation using 2011-12 HIES data. Values in parentheses are standard errors.

* Significant at 1%, ** significant at 5% and *** significant at 10%.

Table 5: Parameters estimates of the LA-AIDS model for Khyber Pakhtunkhwa

| Explanatory Variable | Wheat flour | Rice | Dairy | Pulses | Meats | Fruits/Ve g | Oils | Other Food |
|-----------------------------------|---------------------|---------------------|---------------------|--------------------|--------------------|---------------------|--------------------|---------------------|
| Log of Price of Wheat flour | 0.064 (0.002)* | 0.004 (0.002)** | -0.010 (0.003)* | 0.001 (0.001) | -0.017 (0.003)* | -0.000 (0.002) | 0.007 (0.001)* | -0.049 (0.002)* |
| Log of Price of Rice | -0.008 (0.001)* | 0.009 (0.001)* | -0.003 (0.001)** | 0.001 (0.000)* | 0.002 (0.001) | 0.002 (0.001)* | -0.002 (0.000)* | -0.001 (0.001)** |
| Log of Price of Dairy | -0.005 (0.002)** | 0.004 (0.001)* | 0.021 (0.003)* | 0.003 (0.000)* | -0.000 (0.002)* | -0.009 (0.002)* | 0.001 (0.001) | -0.015 (0.002)* |
| Log of Price of Pulses | 0.004 (0.001)* | -0.003 (0.001)* | -0.003 (0.002)** | 0.008 (0.000)* | -0.000 (0.001) | 0.002 (0.001)** | 0.001 (0.001) | -0.009 (0.001)* |
| Log of Price of Meats | -0.006 (0.000)* | -0.002 (0.000)* | -0.005 (0.001)* | -0.001 (0.000)* | 0.020 (0.001)* | -0.001 (0.000)** | -0.000 (0.000) | -0.003 (0.000)* |
| Log of Price of Fruits/Vegetables | -0.003 (0.002) | -0.003 (0.001)** | 0.002 (0.003) | -0.002 (0.001)* | 0.018 (0.003)* | 0.014 (0.002)* | -0.004 (0.001)* | -0.021 (0.002)* |
| Log of Price of Oils | 0.003 (0.002)** | 0.000 (0.001) | -0.010 (0.002)* | -0.001 * | -0.006 (0.002)* | -0.001 (0.001) | 0.028 (0.001)* | -0.013 (0.002)* |

| | | | | | | | | |
|----------------------------|-------------------|--------------------|--------------------|------------------------|------------------------|--------------------------|------------------------|--------------------|
| Log of Price of Other Food | 0.032 (0.004)* | -0.009 (0.003)* | -0.029 (0.005)* | 0.002 (0.001)* * | 0.009 (.005)** * | 0.008 (0.003)** | 0.006 (0.002)* * | -0.018 (0.004)* |
| Household Size | 0.009 (0.000)* | -0.000 (0.000) | -0.006 (0.000)* | 0.000 (0.000)* | -0.004 (0.000)* | -0.002 (0.000)* | 0.003 (0.000)* | 0.001 (0.000)* |
| Household Education | 0.000 (0.000) | -0.000 (0.000) | -0.000 (0.000) | 0.000 (0.000) | -0.000 (0.000) | 0.000 (0.000) | 0.000 (0.000) | -0.000 (0.000) |
| Household age | 0.000 (0.000) | -0.000 (0.000)* | 0.000 (0.000) | 0.000 (0.000) | 0.000 (0.000) | -0.000 (0.000)** * | 0.000 (0.000)* * | 0.000 (0.000) |
| Constant | 0.232 (0.019)* | 0.009 (0.012) | -0.068 (0.025)* | -0.004 (0.005) | -0.161 (0.024)* | 0.090 (0.015)* | 0.141 (0.010)* | 0.760 (0.018)* |
| Number of Observations | 3276 | 3276 | 3276 | 3276 | 3276 | 3276 | 3276 | 3276 |
| R-Squared | 0.334 | 0.086 | 0.125 | 0.218 | 0.289 | 0.056 | 0.279 | 0.224 |
| Chi | 1644.4* | 310.2* | 467.4* | 911.8* | 1331.1* | 192.9* | 1268.1* | 946.8* |

Source: Author's estimation using 2011-12 HIES data. Values in parentheses are standard errors. * Significant at 1%, ** significant at 5% and *** significant at 10%.

Table 6: Parameters Estimates of the LA-AIDS Model for Baluchistan Province

| Explanatory Variable | Wheat | flour | Rice | Dairy | Pulses | Meats | Fruits/V eg | Oils | Other Food |
|-----------------------------------|---------------------|--------|------------------------|--------------------|------------------------|-------------------------|--------------------|--------------------|---------------------|
| Log of Price of Wheat flour | 0.050 (0.005)* | | -0.017 (0.003)* | 0.002 (0.006) | 0.000 (0.001) | -0.004 (0.005) | -0.005 (0.003) | 0.008 (0.003)** | -0.035 (0.004)* |
| Log of Price of Rice | -0.005 (0.001)* | | 0.007 (0.001)* | -0.001 (0.001) | 0.000 (0.000) | 0.003 (0.001)** | 0.002 (0.001)* | 0.004 (0.001)* | -0.010 (0.001)* |
| Log of Price of Dairy | -0.017 (0.001)* | | 0.003 (0.000)* | 0.034 (0.001)* | 0.001 (0.000) * | 0.002 (0.001)** * | -0.010 (0.001)* | -0.009 (0.001)* | -0.004 (0.001)* |
| Log of Price of Pulses | 0.006 (0.006) | | 0.000 (0.004) | -0.041 (0.007)* | 0.012 (0.001) * | 0.012 (0.007)** * | -0.001 (0.004) | 0.003 (0.004) | 0.008 (0.004)*** |
| Log of Price of Meats | -0.005 (0.002)* | | -0.007 (0.001)* | -0.021 (0.002)* | 0.001 (0.000) * | 0.035 (0.002)* | -0.009 (0.001)* | 0.002 (0.001) | 0.005 (0.001)* |
| Log of Price of Fruits/Vegetables | 0.028 (0.004)* | | -0.015 (0.002)* | -0.028 (0.005)* | 0.003 (0.001) * | 0.007 (0.005) | 0.012 (0.003)* | 0.008 (0.003)* | -0.014 (0.003)* |
| Log of Price of Oils | -0.006 (0.004) | | -0.003 (0.002) | -0.005 (0.005) | -0.000 (0.000) | -0.005 (0.004) | -0.003 (0.003) | 0.025 (0.003)* | -0.003 (0.003) |
| Log of Price of Other Food | -0.016 (0.007)** | | 0.010 (0.004)* * | 0.015 (0.009) | -0.006 (0.001) * | -0.041 (.008)* | 0.033 (0.005)* | -0.003 (0.005) | 0.008 (0.005) |
| Household Size | 0.007 (0.000)* | | 0.001 (0.000)* | -0.006 (0.001)* | 0.001 (0.000) * | -0.003 (0.001)* | -0.001 (0.000)* | 0.001 (0.000)* | -0.001 (0.000)** |
| Household Education | 0.000 (0.000)*** | | -0.001 (0.000)* | -0.001 (0.000)* | 0.000 (0.000) | 0.001 (0.000)** | 0.001 (0.000)* | 0.000 (0.000) | -0.000 (0.000) |
| Household age | 0.000 (0.000)* | | -0.000 (0.000)* | -0.000 (0.000)* | 0.000 (0.000) * | 0.000 (0.000)** | -0.000 (0.000) | 0.000 (0.000)* | 0.000 (0.000) |
| Constant | 0.176 (0.059)* | | 0.226 (0.037)* | 0.0 (0.027)* | 0.131 (0.012) * | -0.078 (0.069) | 0.144 (0.042)* | 0.112 (0.044)** | 0.250 (0.046)* |
| Number of Observations | 1424 | 1424 | 1424 | 1424 | 1424 | 1424 | 1424 | 1424 | 1424 |
| R-Squared | 0.409 | 0.213 | 0.427 | 0.297 | 0.207 | 0.235 | 0.204 | 0.188 | |
| Chi | 986.8* | 385.7* | 1063.0* | 601.9* | 372.9* | 439.5* | 364.9* | 330.4* | |

Source: Author's estimation using 2011-12 HIES data. Values in parentheses are standard errors. * Significant at 1%, ** significant at 5% and *** significant at 10%.

Table 7: Parameters estimates of the LA-AIDS model for Pakistan

| Explanatory Variable | Wheat flour | Rice | Dairy | Pulses | Meats | Fruits/Veg | Oils | Other |
|-----------------------------------|--------------------|-------------------------|--------------------|------------------------|-------------------------|---------------------|------------------------|--------------------|
| Log of Price of Wheat flour | 0.070 (0.001)* | -0.001 (0.001) | -0.041 (0.002)* | 0.002 (0.000) * | -0.007 (0.002) * | -0.004 (0.001)* | 0.010 (0.001) * | -0.029 (0.001)* |
| Log of Price of Rice | -0.008 (0.000)* | 0.010 (0.000)* | -0.002 (0.001)* | 0.000 (0.000) | 0.000 (0.000) | 0.003 (0.000)* | 0.000 (0.000) | -0.004 (0.000)* |
| Log of Price of Dairy | -0.014 (0.001)* | 0.003 (0.000)* | 0.034 (0.001)* | 0.001 (0.000) * | -0.001 (0.001) | -0.009 (0.000)* | -0.008 (0.000) * | -0.004 (0.001)* |
| Log of Price of Pulses | 0.005 (0.001)* | -0.001 (0.001) | -0.009 (0.001)* | 0.008 (0.000) * | -0.002 (0.001) ** | 0.002 (0.001)* | 0.004 (0.000) * | -0.007 (0.001)* |
| Log of Price of Meats | -0.007 (0.000)* | -0.001 (0.000)* | -0.008 (0.000)* | -0.001 (0.000) * | 0.021 (0.000) * | -0.002 (0.000)* | -0.002 (0.000) * | 0.001 (0.000)* |
| Log of Price of Fruits/Vegetables | -0.004 (0.001)* | -0.005 (0.001)* | -0.019 (0.002)* | 0.002 (0.000) * | 0.013 (0.001) * | 0.019 (0.001)* | -0.004 (0.001) * | -0.001 (0.001) |
| Log of Price of Oils | 0.006 (0.001)* | 0.001 (0.001)** * | -0.013 (0.002)* | -0.001 (0.000) * | -0.008 (0.001) * | -0.000 (0.001) | 0.027 (0.000) * | -0.011 (0.001)* |
| Log of Price of Other Food | -0.002 (0.002) | 0.002 (0.001) | -0.031 (0.003)* | 0.003 (0.001) * | 0.011 (0.002) * | -0.002 (0.001) | 0.007 (0.001) * | 0.010 (0.002)* |
| Household Size | 0.010 (0.000)* | 0.002 (0.000)* | -0.012 (0.000)* | 0.000 (0.000) * | -0.004 (0.000) * | -0.001 (0.000)* | 0.003 (0.000) * | 0.001 (0.000)* |
| Household Education | -0.000 (0.000)* | 0.000 (0.000)** | 0.000 (0.000)* | -0.000 (0.000) | 0.000 (0.000) | -0.000 (0.000)* | -0.000 (0.000) | -0.000 (0.000) |
| Household age | 0.000 (0.000)* | -0.000 (0.000)* | -0.000 (0.000)* | 0.000 (0.000) * | 0.000 (0.000) * | -0.000 (0.000)** | 0.000 (0.000) | 0.000 (0.000) |
| Constant | 0.385 (0.009)* | 0.032 (0.007)* | 0.068 (0.017)* | 0.019 (0.002) * | -0.255 (0.012) * | 0.179 (0.007)* | 0.199 (0.005) * | 0.507 (0.009)* |
| Number of Observations | 15806 | 15806 | 15806 | 15806 | 15806 | 15806 | 15806 | 15806 |
| R-Squared | 0.368 | 0.072 | 0.208 | 0.152 | 0.325 | 0.075 | 0.296 | 0.089 |
| Chi | 9200.6* | 1232.1* | 4141.5* | 2827.9 * | 7619.9 * | 1296.8* | 6654.7* | 1558.3* |

Source: Author's estimation using 2011-12 HIES data. Values in parentheses are standard errors. * Significant at 1%, ** significant at 5% and *** significant at 10%.

4.4 Estimated expenditure elasticities for various food groups in Pakistan

Consumers generally adjust their consumption in response to price and income changes (Mudassar, Aziz, & Anwar, 2012). The expenditure elasticities for eight food commodity groups consumed by households across provinces are reported in Table 8. The expenditure elasticities are positive and significant indicating that all food groups are normal. The estimated expenditure elasticities for all the provinces range from 0.526 for wheat flour to 1.501 for meats. The expenditure elasticities estimated shown that dairy and meats are

luxury food items in all provinces, while wheat flour, pulses, cooking oil, and other foods are necessities in the diet of Pakistani household. Our results are similar to what Haq et al. (2008) found. The rice is necessity food item in Punjab and Baluchistan while luxury in Sindh and Khyber Pakhtunkhwa.

Table 8: Expenditure elasticities for various food groups in Pakistan

| Food Group | Punjab | Sindh | Khyber Pakhtunkhwa | Baluchistan | Pakistan |
|-------------------|--------|--------|--------------------|-------------|----------|
| Wheat flour | 0.526* | 0.717* | 0.704* | 0.903* | 0.652* |
| Rice | 0.884* | 1.121* | 1.185* | 0.672* | 0.933* |
| Dairy | 1.478* | 1.365* | 1.302* | 1.406* | 1.411* |
| Pulses | 0.628* | 0.601* | 0.945* | 0.356* | 0.721* |
| Meats | 1.501* | 1.196* | 1.231* | 1.144* | 1.341* |
| Fruits/vegetables | 0.908* | 0.888* | 1.012* | 0.939* | 0.953* |
| Cooking oil | 0.584* | 0.777* | 0.742* | 0.830* | 0.688* |
| Other food | 0.813* | 0.854* | 0.933* | 1.043* | 0.852* |

Source: Author's estimation using 2011-12 HIES data. Values in parentheses are standard errors. * Significant at 1%, ** significant at 5% and *** significant at 10%.

4.5 Estimated Elasticities

Marshallian and Hicksian's own price and cross price elasticities show the response of consumer to changes in prices. Keeping the level of utility constant, the estimated Marshallian elasticities of demand describes changes in the quantity of demand as a result of price changes capturing both substitution and income effects, whereas, the estimated Hicksian elasticity represents only the substitution effect as a result of changes in prices.

All estimated own price elasticities of the Marshallian and Hicksian demand have the expected negative sign and are statistically significant, indicating that the price of a commodity itself have negative effect on its quantity demanded. The own price elasticity of dairy in all provinces is more elastic as compare to other food groups, showing high responsiveness to changes in price. The study of cross price elasticity is helpful in defining the nature of the food commodity for their substitutability and complementarity. The exact nature of the cross price elasticity for eight food groups for all the provinces of Pakistan has also been estimated in this study. If the estimated cross price elasticity for any two food groups are positive, the two commodities are said to be substitute, while both may be called complementary if cross price elasticity have a negative sign. In Punjab province, out of the 56 Marshallian cross price elasticities, 24 elasticities are negative indicating that these goods are complementary, and the remaining 32 elasticities are positive indicating gross substitutes. On the other hand, out of 56 Hicksian cross price elasticities, 6 are negative which are indicating gross complements and the remaining fifty elasticities have positive sign indicating gross substitutes. In Sindh province total estimated Marshallian cross price elasticities are 56 in which 30 elasticities are negative indicating that these goods are complementary consumer goods, and the remaining 26 elasticities have positive sign indicating gross substitute. On the other hand, out of 56 Hicksian cross price elasticities, 7

are negative which are indicating gross complements and the remaining forty nine elasticities have positive sign indicating gross substitutes. In Khyber Pakhtunkhwa province total estimated Marshallian cross price elasticities are 56 in which, 31 elasticities have negative sign indicating that these goods are complementary consumer goods, and the remaining 25 elasticities are positive indicating that these are gross substitute. Further, there are total 56 Hicksian cross price elasticities, four are negative which are indicating gross complements and the remaining fifty two elasticities are positive indicating that these commodities are gross substitutes. In Baluchistan province the total number of estimated Marshallian cross price elasticities are 56 in which, 30 elasticities have negative sign indicating that these goods are complementary consumer goods, and the other 26 elasticities are positive indicating that these are gross substitute. Finally, there are total 56 Hicksian cross price elasticities, nine are negative which are indicating gross complements and the remaining forty seven elasticities are positive indicating that these commodities are gross substitutes.

Table 9: Estimated Marshallian and Hicksian Own-price and Cross-Price Elasticities of Demand for Punjab

| Food group | Wheat flour | Rice | Dairy | Pulses | Meats | Fruits /vegetable | Oils | Others |
|----------------------|---------------|---------------|---------------|---------------|---------------|-------------------|---------------|---------------|
| Uncompensated | | | | | | | | |
| Wheat flour | -0.376 | 0.018 | -0.022 | 0.112 | 0.035 | 0.013 | 0.116 | 0.079 |
| Rice | 0.124 | -0.697 | 0.031 | -0.066 | -0.057 | 0.086 | 0.017 | 0.021 |
| Dairy | -0.293 | -0.156 | -0.999 | -0.172 | -0.158 | -0.230 | -0.206 | -0.351 |
| Pulses | 0.177 | 0.012 | -0.011 | -0.686 | -0.048 | 0.154 | -0.055 | 0.206 |
| Meats | -0.122 | -0.049 | -0.087 | -0.087 | -0.824 | 0.114 | -0.125 | 0.143 |
| Fruits/Vegetables | -0.050 | 0.042 | -0.038 | 0.032 | 0.005 | -0.854 | 0.009 | -0.004 |
| Cooking oil | 0.176 | 0.047 | 0.014 | 0.106 | 0.027 | 0.040 | -0.734 | 0.142 |
| Other Food | -0.339 | 0.033 | -0.028 | -0.000 | 0.035 | 0.017 | 0.000 | -0.764 |
| Compensated | | | | | | | | |
| Wheat flour | -0.291 | -0.021 | 0.185 | 0.062 | 0.048 | 0.077 | 0.162 | 0.144 |
| Rice | 0.281 | -0.665 | 0.310 | -0.044 | 0.027 | 0.222 | 0.135 | 0.158 |
| Dairy | 0.002 | 0.015 | -0.580 | -0.010 | 0.065 | 0.045 | 0.051 | -0.075 |
| Pulses | 0.328 | 0.038 | 0.262 | -0.670 | 0.030 | 0.284 | 0.057 | 0.337 |
| Meats | 0.082 | 0.030 | 0.240 | -0.045 | -0.691 | 0.298 | 0.042 | 0.329 |
| Fruits/Vegetables | 0.097 | 0.065 | 0.232 | 0.045 | 0.081 | -0.727 | 0.119 | 0.124 |
| Cooking oil | 0.286 | 0.033 | 0.246 | 0.081 | 0.065 | 0.129 | -0.663 | 0.232 |
| Other Food | -0.224 | 0.148 | 0.085 | 0.114 | 0.149 | 0.132 | 0.114 | -0.649 |

Source: Author's estimation using 2011-12 HIES data. Values in parentheses are standard errors.

* Significant at 1%, ** significant at 5% and *** significant at 10%.

Table 10: Estimated compensated and uncompensated own-price and cross-price elasticities of demand for Sindh

| Food group | Wheat flour | Rice | Dairy | Pulses | Meats | Fruits /vegetable | Oils | Others |
|----------------------|---------------|--------------|-------|--------|--------|-------------------|-------|--------|
| Uncompensated | | | | | | | | |
| Wheat flour | -0.590 | - | - | 0.134 | -0.012 | -0.021 | 0.124 | 0.060 |
| Rice | -0.329 | 0.723 | - | 0.032 | -0.044 | -0.192 | 0.102 | -0.585 |

| | | | | | | | | |
|--------------------|---------------|--------------|--------------|---------------|---------------|---------------|--------------|---------------|
| Dairy | -0.148 | - | - | -0.168 | -0.099 | -0.148 | - | -0.205 |
| | | 0.109 | 0.976 | | | | 0.247 | |
| Pulses | 0.010 | - | 0.129 | -0.622 | -0.002 | 0.039 | - | 0.418 |
| | | 0.011 | | | | | 0.037 | |
| Meats | -0.102 | 0.016 | 0.203 | -0.037 | -0.844 | 0.026 | - | 0.221 |
| | | | | | | | 0.088 | |
| Fruits/Vegetables | -0.009 | 0.016 | 0.017 | 0.043 | -0.014 | -0.808 | 0.054 | 0.062 |
| Cooking oil | 0.117 | 0.036 | 0.024 | 0.052 | 0.015 | -0.099 | - | 0.043 |
| | | | | | | | 0.718 | |
| Other Food | -0.068 | - | - | -0.034 | 0.021 | 0.160 | - | -0.859 |
| | | 0.016 | 0.075 | | | | 0.014 | |
| Compensated | | | | | | | | |
| Wheat flour | -0.484 | - | 0.074 | 0.116 | 0.053 | 0.053 | 0.197 | 0.198 |
| | | 0.008 | | | | | | |
| Rice | -0.173 | - | 0.070 | 0.065 | 0.071 | -0.066 | 0.225 | -0.397 |
| | | 0.646 | | | | | | |
| Dairy | 0.086 | 0.045 | - | -0.056 | 0.095 | 0.055 | - | 0.061 |
| | | | 0.651 | | | | 0.045 | |
| Pulses | 0.149 | 0.046 | 0.358 | -0.607 | 0.095 | 0.146 | 0.067 | 0.588 |
| Meats | 0.066 | 0.106 | 0.462 | 0.008 | -0.714 | 0.165 | 0.046 | 0.423 |
| Fruits/Vegetables | 0.126 | 0.071 | 0.243 | 0.054 | 0.080 | -0.704 | 0.156 | 0.229 |
| Cooking oil | 0.240 | 0.078 | 0.237 | 0.051 | 0.097 | -0.007 | - | 0.198 |
| | | | | | | | 0.628 | |
| Other Food | 0.085 | 0.136 | 0.078 | 0.119 | 0.175 | 0.313 | 0.138 | -0.705 |

Source: Author's estimation using 2011-12 HIES data. Values in parentheses are standard errors.
 * Significant at 1%, ** significant at 5% and *** significant at 10%.

Table 11: Marshallian and Hicksian Cross and Own-Price Elasticities of Demand for Khyber Pakhtunkhwa

| Food group | Wheat flour | Rice | Dairy | Pulses | Meats | Fruits /vegetable | Oils | Others |
|----------------------|---------------|---------------|---------------|---------------|---------------|-------------------|---------------|---------------|
| Uncompensated | | | | | | | | |
| Wheat flour | -0.599 | 0.013 | 0.029 | 0.074 | 0.023 | 0.039 | 0.071 | 0.231 |
| Rice | 0.091 | -0.774 | 0.102 | -0.084 | -0.069 | -0.096 | -0.003 | -0.250 |
| Dairy | -0.113 | -0.079 | -0.966 | -0.081 | -0.090 | -0.058 | -0.114 | -0.203 |
| Pulses | 0.040 | 0.050 | 0.108 | -0.717 | -0.065 | -0.068 | -0.037 | 0.080 |
| Meats | -0.193 | -0.005 | -0.028 | -0.024 | -0.814 | 0.158 | -0.084 | 0.066 |
| Fruits/Vegetables | -0.005 | 0.016 | -0.066 | 0.016 | -0.009 | -0.898 | -0.006 | 0.053 |
| Cooking oil | 0.094 | 0.011 | 0.035 | 0.037 | 0.025 | -0.007 | -0.723 | 0.081 |
| Other Food | -0.272 | 0.001 | -0.077 | -0.038 | -0.009 | -0.113 | -0.064 | -1.095 |
| Compensated | | | | | | | | |
| Wheat flour | -0.468 | -0.003 | 0.193 | 0.048 | 0.067 | 0.124 | 0.132 | 0.348 |
| Rice | 0.284 | -0.730 | 0.329 | -0.049 | 0.036 | 0.049 | 0.119 | -0.071 |
| Dairy | 0.139 | 0.024 | -0.681 | 0.013 | 0.074 | .147 | 0.067 | 0.035 |
| Pulses | 0.225 | 0.086 | 0.325 | -0.690 | 0.032 | 0.069 | 0.076 | 0.251 |
| Meats | 0.016 | 0.054 | 0.213 | 0.026 | -0.692 | 0.320 | 0.053 | 0.262 |
| Fruits/Vegetables | 0.182 | 0.055 | 0.154 | 0.047 | 0.090 | -0.757 | 0.110 | 0.227 |
| Cooking oil | 0.251 | 0.019 | 0.224 | 0.035 | 0.094 | 0.102 | -0.757 | 0.223 |
| Other Food | -0.111 | 0.163 | 0.084 | 0.122 | 0.151 | 0.047 | 0.096 | -0.934 |

Source: Author's estimation using 2011-12 HIES data. Values in parentheses are standard errors. * Significant at 1%, ** significant at 5% and *** significant at 10%.

Table 12: Estimated cross-price and own-price Marshallian and Hicksian elasticities of demand for Baluchistan

| Food group | Wheat flour | Rice | Dairy | Pulses | Meats | Fruits /vegetable | Oils | Others |
|----------------------|---------------|--------|--------|--------|--------|-------------------|--------|--------|
| Uncompensated | | | | | | | | |
| Wheat flour | -0.727 | -0.006 | -0.064 | 0.049 | -0.007 | 0.160 | -0.009 | -0.062 |

| | | | | | | | | |
|--------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Rice | -0.471 | -0.784 | 0.089 | 0.019 | -0.196 | -0.403 | -0.079 | 0.292 |
| Dairy | -0.039 | -0.065 | -0.799 | -0.361 | -0.215 | -0.265 | -0.096 | 0.056 |
| Pulses | 0.027 | 0.023 | 0.045 | -0.580 | 0.067 | 0.105 | 0.019 | -0.182 |
| Meats | -0.047 | -0.003 | 0.008 | 0.055 | -0.790 | 0.022 | -0.054 | -0.294 |
| Fruits/Vegetables | -0.025 | 0.024 | -0.061 | 0.004 | -0.053 | -0.910 | -0.011 | 0.238 |
| Cooking oil | 0.086 | 0.052 | -0.043 | 0.048 | 0.037 | 0.087 | -0.791 | 0.001 |
| Other Food | -0.228 | -0.070 | -0.034 | 0.041 | 0.026 | -0.097 | -0.027 | -0.952 |
| Compensated | | | | | | | | |
| Wheat flour | -0.547 | 0.010 | 0.052 | 0.063 | 0.124 | 0.285 | 0.111 | 0.078 |
| Rice | -0.283 | -0.759 | 0.213 | 0.039 | -0.057 | -0.270 | 0.048 | 0.440 |
| Dairy | 0.215 | 0.026 | -0.607 | -0.273 | -0.009 | -0.065 | 0.098 | 0.272 |
| Pulses | 0.206 | 0.039 | 0.161 | -0.568 | 0.198 | 0.229 | 0.138 | -0.043 |
| Meats | 0.174 | 0.054 | 0.149 | 0.110 | -0.617 | 0.188 | 0.107 | -0.112 |
| Fruits/Vegetables | 0.166 | 0.051 | 0.066 | 0.028 | 0.089 | -0.774 | 0.119 | 0.389 |
| Cooking oil | 0.262 | 0.065 | 0.069 | 0.056 | 0.165 | 0.208 | -0.675 | 0.137 |
| Other Food | -0.061 | 0.097 | 0.132 | 0.209 | 0.193 | 0.069 | 0.139 | -0.785 |

Source: Author's estimation using 2011-12 HIES data. Values in parentheses are standard errors. * Significant at 1%, ** significant at 5% and *** significant at 10%.

Table 13: Compensated and Uncompensated Cross-Price and Own-price Elasticities of Demand for Pakistan

| Food group | Wheat flour | Rice | Dairy | Pulses | Meats | Fruits /vegetable | Oils | Others |
|----------------------|---------------|---------------|---------------|---------------|---------------|-------------------|---------------|---------------|
| Uncompensated | | | | | | | | |
| Wheat flour | -0.517 | 0.009 | -0.030 | 0.090 | 0.014 | 0.029 | 0.095 | 0.045 |
| Rice | -0.024 | -0.769 | 0.064 | -0.018 | -0.031 | -0.105 | 0.030 | 0.047 |
| Dairy | -0.271 | -0.109 | -0.958 | -0.139 | -0.135 | -0.179 | -0.156 | -0.227 |
| Pulses | 0.100 | 0.013 | 0.032 | -0.680 | -0.041 | 0.089 | -0.040 | 0.128 |
| Meats | -0.106 | -0.031 | -0.043 | -0.059 | -0.827 | 0.096 | -0.120 | 0.083 |
| Fruits/Vegetables | -0.024 | 0.031 | -0.067 | 0.022 | -0.008 | -0.854 | 0.005 | -0.011 |
| Cooking oil | 0.128 | 0.039 | -0.029 | 0.075 | 0.020 | 0.005 | -0.731 | 0.101 |
| Other Food | -0.161 | -0.001 | -0.006 | -0.023 | 0.032 | 0.013 | -0.049 | -0.910 |
| Compensated | | | | | | | | |
| Wheat flour | -0.408 | -0.003 | 0.156 | 0.059 | 0.058 | 0.106 | 0.158 | 0.147 |
| Rice | 0.138 | -0.727 | 0.306 | 0.005 | 0.066 | 0.025 | 0.148 | 0.204 |
| Dairy | -0.004 | 0.035 | -0.612 | -0.012 | 0.067 | 0.055 | 0.065 | 0.032 |
| Pulses | 0.258 | 0.051 | 0.269 | -0.661 | 0.052 | 0.216 | 0.072 | 0.281 |
| Meats | 0.094 | 0.048 | 0.236 | 0.001 | -0.690 | 0.265 | 0.034 | 0.277 |
| Fruits/Vegetables | 0.135 | 0.070 | 0.170 | 0.042 | 0.086 | -0.726 | 0.119 | 0.142 |
| Cooking oil | 0.256 | 0.046 | 0.178 | 0.065 | 0.084 | 0.101 | -0.648 | 0.223 |
| Other Food | -0.025 | 0.134 | 0.129 | 0.113 | 0.168 | 0.150 | 0.086 | -0.774 |

Source: Author's estimation using 2011-12 HIES data. Values in parentheses are standard errors. * Significant at 1%, ** significant at 5% and *** significant at 10%.

5. Conclusion

The paper examined complete food demand for households in Pakistan using LA-AIDS model. Pakistan is a developing country, and, like other developing countries, the people of

the country consumes a major portion of their income on food. The LA-AIDS model was estimated for eight food groups. The food items were categorized into eight food groups, including wheat flour, rice, dairy, pulses, meats, fruits and vegetables, cooking oil, and other food. Results suggested that Baluchistan, which is the poorest province, has the highest monthly food expenditure per household. The own price elasticities of all food groups are found to be negative and consistent with economic theory. All the expenditure elasticities are positive and significant, indicating that all food groups are normal. In addition, the expenditure elasticities estimated show that dairy and meats are luxury food items in all provinces, while wheat flour, pulses, cooking oil, and other foods are necessities in the diet of Pakistani household. In all provinces, a household spends most of its food expenditure on dairy products, wheat flour, cooking oil, fruit and vegetables.

The estimated food demand in this paper can be very useful in the formulation of the country's food and agricultural policies. In Pakistan, households spend a major proportion of their food expenditures on dairy products, wheat flour, cooking oil and vegetables, so the government is suggested to ensure and monitor the availability of these essential food items in order to reduce undernourishment and food insecurity in the country. Furthermore, Baluchistan, the poorest province, has the highest monthly household food expenditure, so the government is suggested to provide targeted food subsidies and initiate various projects that would increase people's purchasing power to protect them against further poverty.

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