Demand for Imported Staple Food Commodities in the Kingdom of Saudi Arabia

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Abstract: *This research empirically estimated the demand for imported staple food commodities in the Kingdom of Saudi Arabia using dated data of 38 years (1980 to 2017) sourced from Food and Agriculture Organization and United Nations Conference on Trade and Development databases. The collected data covered the consumer price index; import quantities and expenditures of fifteen staple food commodities. The collected data were analysed using descriptive statistics and linear expenditure system almost ideal demand system (LES/AIDS) model. The empirical evidence showed the diversification on food spending to be very low as one commodity (barley) had a dominant influence on the consumers' budget expenditure. Furthermore, it was observed that the dietary diversity of consumers is low. Income effect had strong influence than the substitution effect in determining the demand for the selected imported commodities. It also showed that as consumers' income increase and consumers' diversify their diets, the consumption of non-staple foods rather than the staple foods would increase. Therefore, the study recommends that people should be encouraged to engage in optimal dietary diversification in order to enhance their diet nutritional quality and health status. However, since almost all of the commodities are important given that they fulfilled the needs of the people, especially the poor who face tight budgetary constraints. Thus, it becomes imperative for the policymakers to enhance their home-grown economy so as enhance the economy, foreign exchange reserve and protect the health status of the country population.*

Keywords: Food commodity, imported food, LES/AIDS model, Saudi Arabia

1. Introduction

The Gulf Cooperation Council (GCC) countries, with an approximate population of 40 million are among the world's richest countries in respect to oil and gas reserves, and per capita wealth (Adam *et al*., 2019). However, about 90% of their food requirements are imported as the domestic production is inadequate to meet their current demand. Therefore, the food imports in the GCC region stud at $25.8 billion in 2010 (FAO *et al*. 2019). High dependence on imports makes the GCC food supply very vulnerable and highly dependent on the world food market (Vasileska and Rechkoska, 2012; FAO, 2019).

In the last four decades, countries of the Arab Gulf region experienced a rapid and drastic change in their socio-economic situation, patterns of food consumption, lifestyle and health status. This was mainly attributed to the sharp increase in income due to oil revenue accumulations. Nevertheless, under-nutrition and micro-nutrient deficiencies still exist among vulnerable groups; diet-related chronic diseases have become the main health problems while communicable diseases have diminished (FAO, 2017; Adam *et al*., 2019).

Adam *et al*. (2019) opined that qualitative and quantitative changes in food diets represent the main characteristics of the dietary changes and diversification in transitional nutrition. Thus, the growth, consumption patterns and outlook of the food sector is of substantial importance for these countries. Many factors interact in different and complex ways to influence and shape dietary consumption patterns; and diet composition and content. These factors include income, prices, individual preferences and beliefs, culture, traditions and geographical location, environmental, social and economic factors. Major shifts in dietary patterns are occurring, such as a shift in consumption of basic staple foods towards more diversified diets.

Therefore, Kingdom of Saudi Arabia being an epicentre of tourism and rapid population growth in the GCC region was chosen as a pilot country to examine the demand pattern of imported staple food commodities so as to chart a realistic narrative that will enhance homegrown economy and the health status of its populace in particular and the region in general. Thus, it is in view of the foregoing that the present study aimed at determining the demand elasticity for imported foods in The Kingdom of Saudi Arabia. The specific objectives were to examine the Average budget and Marginal budget shares of the consumers; and, to determine the expenditure and price elasticities of the selected food items

2. Research Methodology

The study used time-series data that spanned from 1980 to 2017; which covered Consumer price index(CPI), import quantities and expenditures of fifteen staple food commodities *viz.* barley, wheat, rice, maize, millet, dry beans, potatoes, root and tubers, coffee, tea, vegetables, spices, beef, mutton and chicken meat. The data were sourced from the database of FAO and UNCTAD and the collected data were analysed using descriptive statistics (first objective) and LES/AIDS model (second objective).

Empirical model

The budget share form of the LA/AIDS model is indicated below following Anwarul-Huq *et al.* (2004), Awal *et al.* (2008) and Babar *et al.* (2011).

$$\omega_i = \alpha_i + \sum_j \gamma_{ij}\, lnP_j + \beta_i ln\left[\frac{X}{P^*}\right] + \varepsilon_i \quad [1]$$

$$lnP^* = \sum_j w_j lnP_j \quad [2]$$

$$\omega_i = \alpha_i + \sum_{j=1}^{n=15} \gamma_{ij} lnP_j + \beta_i ln\left[\frac{X}{P^*}\right] + \varepsilon_i \quad [3]$$

The restrictions on the parameters of the AIDS in equation (1) are:

$$\sum_i \alpha_i = 1. \sum_i \beta_i = 0. \sum_j \gamma_{ij} = 0, (Addding - up\ condition, Engel\ Aggregation \quad [4]$$

$$\sum_j \gamma_{ij} = 0\ (homogeneity\ condition) \quad [5]$$

$$\gamma_{ij} = \gamma_{ji} (Symmetry\ condition) \quad [6]$$

Where,

ω_i = budget share of the i^th^ commodity (i.e. $\omega_i = P_i Q_i / X$);
P_j = is the price of the j^th^commodity;
X = total household expenditure on all the food items considered for the study;
P^* = stone price index;
ε_i = stochastic term and it is assumed to be zero and has constant variance;
α_i = intercept;
γ_{ij} = price coefficient; and,
β_i = expenditure coefficient

According to Blanciforti and Green (1983) and Awal *et al.* (2008) the model that uses Stone's geometric price index is referred than the "Linear Approximate Almost Ideal Demand System (LA/AIDS)". The demand elasticities are calculated as the functions of the estimated parameters and they have standard implications.

The expenditure elasticity ($\in_i$) which measures the sensitivity of demand in response to changes in consumption expenditure is specified as follow:

$$\in_i = 1 + \left(\frac{\beta_i}{\omega_i}\right) \quad [7]$$

$$\in_i = \frac{MBS}{ABS} \quad [8]$$

Where,

MBS = marginal budget share
ABS = average budget share

Price elasticity is estimated in two ways *viz.* uncompensated (Marshallian) elasticity that contains both price and income effects, and the compensated (Hicksian) elasticity which contains only price effect.

The uncompensated own-price elasticity ($\in_{ii}$) and the cross-price elasticity ($\in_{ij}$) measure how a change in the price of one product affects the demand of itself and that of the other products, respectively, with the total expenditure and other prices being held constant, that is, *ceteris paribus*. The Marshallian own and cross-price elasticities are calculated using the model indicated below (Babar *et al.*, 2011).

$$\in_{ii} = \left(\frac{\gamma_{ii}}{\omega_i}\right) - (\beta_i + 1) \quad [9]$$

$$\in_{ij} = \left(\frac{\gamma_{ij}}{\omega_i}\right) - (\beta_i \omega_i / \omega_j) \quad [10]$$

The Hicksian own and cross-price elasticities ($\in_{ii}^*\ and\ \in_{ij}^*$), which measure the price effects on the demand assuming the real expenditure ($X/_{P^*}$) is constant is given below following Babar *et al.*, (2011).

$$\in_{ii}^* = \left(\frac{\gamma_{ii}}{\omega_i}\right) + (\omega_i - 1) \quad [11]$$

$$\in_{ij}^* = \left(\frac{\gamma_{ij}}{\omega_i}\right) + \omega_j \quad [12]$$

Besides, the compensated price elasticity can be estimated by using $\in_i$, $\in_{ii}$ and $\in_{ij}$, and the permutation as indicated below.

$$\in^*_{ij} = \in_{ij} + \in_i * \omega_i \quad [13]$$

Babar *et al*. (2011) reported that the sign of the estimated $\in^*_{ij}$ indicates the substitutability or complementarily between the destinations under consideration. A commodity pair is denoted as a complement or substitute if their compensated cross-price elasticity is negative or positive, respectively.

Based on the value of expenditure elasticity, a food item is classified as a necessity/necessary commodity ($0 < \in_i < 1$), a luxury commodity ($\in_i > 1$) or a Giffen / inferior commodity ($\in_i < 0$) (Babar *et al*. 2011). In absolute term, the demand for a particular commodity is price elastic (inelastic) if the elasticity value of its own-price is larger than unity (less than unity).

The Hicksian elasticity indicates the change in demand for a commodity due to a price variation. The real expenditure change caused by the aforementioned price variation is compensated by an expenditure variation so that satisfaction/utility is kept constant.

When the objective is to use a tax instrument to limit consumption of a certain item by raising its price to consumers, the value of the price elasticity of demand is the key (Clements and Si, 2015) which was calculated following the formula below.

$$RPI = \frac{Requited\ reduction\ in\ consumption}{Price\ elasticity} \quad [14]$$

Where,
RPI = Required price increase

3. Results and Discussion

3.1. Average and marginal budget shares of the food items

Table 1 showed imported barley to have the highest budget share (0.328), followed by imported rice (0.202) and then imported chicken meat (0.201) (Table 1). Thus, the average budget share of these three household food commodities had an overwhelming dominance in the average annual expenditure budget of consumers of imported commodities in the study area. This showed that on the average consumers of imported commodities in the study area expended \$0.328, \$0.202, \$0.201 and \$0.269 on barley, rice, chicken meat and the rest of the considered food items respectively from a \$1.00 budget on imported food items. On the average, with the exception of the three food commodities *viz*. barley, rice and chicken, all the remaining imported food items each accounted for less than 10% from the average annual budget expenditure of consumers of imported food commodities, thus indicating a very little diversity in their diet. Thus, the diversity of barley, rice and chicken in the diet of the consumers in the studied area is high. This did not come as a surprise as the major food items consumed in the studied area are these three items.

On the average, the quantity consumed per year was highest for barley (4.9 million MT), followed by maize (1.23 million MT), then rice (0.78 million MT), wheat (0.59 million MT), chicken meat (0.372 million MT) and the least been the dry beans (4741.03MT) (Table 2). Therefore, it can be suggested that these food items had more patronage with respect to consumption in the study area, possibly attributable to the low price of these food items when compared to their relative substitutes. The coefficient of variations in price for vegetables, barley, coffee, potatoes, root and tubers and mutton were high; dry beans, maize, rice, spices, tea, wheat, beef and chicken meat were moderate; while it was low for millet. This indicates that the first and the second categories of the food items are sold based on grades, thus the reason for the high and moderate variations in their prices (Table 3 and 4). However, millet having low variation in its price indicates that the imported commodity is not graded, thus the low price variation may be attributed to spatial and temporal marketing costs.

Table 1: Summary statistics of the budget share

Items	Mean	SD	Minimum	Maximum	CV
ω_{Barley}	0.327605	0.099883	0.076819	0.529767	0.30489
$\omega_{DryBeans}$	0.001255	0.000385	0.000174	0.002177	0.30673
ω_{Coffee}	0.00103	0.000762	2.01E-05	0.002429	0.73995
ω_{Maize}	0.083133	0.027056	0.019045	0.153566	0.32546
ω_{Millet}	0.000679	0.000399	0.000138	0.001609	0.58714
$\omega_{Potatoes}$	0.010361	0.008971	0.002383	0.038199	0.86589
ω_{Rice}	0.202216	0.047743	0.12945	0.317712	0.23610
$\omega_{Roots\&Tubers}$	0.000403	0.000279	0.000106	0.001704	0.69334
ω_{Spices}	0.010207	0.004139	0.003628	0.019648	0.40549
ω_{Tea}	0.044805	0.019863	0.012004	0.09232	0.44331
$\omega_{Vegetables}$	0.002	0.001544	0.000368	0.006037	0.77207
ω_{Wheat}	0.037014	0.03784	7.98E-06	0.129633	1.0223
ω_{Beef}	0.031759	0.029376	0.001473	0.10089	0.92496
$\omega_{Chickenmeat}$	0.20125	0.055069	0.082444	0.379701	0.27363
ω_{Mutton}	0.046284	0.013125	0.024795	0.074463	0.28358

ω = budget share; SD = standard deviation; CV= coefficient of variation

Source: Authors' own computation, 2020

Table 2: Summary statistics of the volume/quantity of import (metric ton)

Item	Mean	SD	Minimum	Maximum	CV
Barley	4858060	2429596	478810	10546312	0.50012
Dry Beans	4741.026	2975.481	1420	12541	0.62760
Coffee	1325.447	1587.314	9	5028	1.1976
Maize	1233816	830609.1	99590	3732787	0.67320
Millet	5710.361	3535.816	609	15263	0.61919
Potatoes	66663.5	33436.72	13980	135225	0.50157
Rice	780329	381636.2	250143	1591875	0.48907
Root & Tubers	2753.526	2754.039	153	11269	1.0002
Spices	12235.97	9183.778	2600	36596	0.75056
Tea	20071.13	8367.374	7711	37454	0.41689
Vegetables	8676.684	11295.13	600	51808	1.3018
Wheat	590047.6	943802.7	47	3237739	1.5995
Beef	24173.08	16123.56	1300	55090	0.66700
Chicken meat	372282	229361.7	140670	885386	0.61610
Mutton	40643.71	13091.61	15640	62504	0.32211

SD = standard deviation; CV= coefficient of variation

Source: Authors' own computation, 2020

Table 3: Summary statistics of commodity prices

Items	Mean	SD	Minimum	Maximum	CV
P_{Barley}	186.5777	78.32663	68.95066	389.9718	0.41981
$P_{DryBeans}$	708.9445	236.8246	423.8317	1368.845	0.33405
P_{Coffee}	3195.471	1480.827	1484.146	8112	0.46341
P_{Maize}	190.3024	67.7005	105.8637	370.7296	0.35575
P_{Millet}	283.2722	55.05606	185.0571	457.9321	0.19436
$P_{Potatoes}$	325.6181	144.4897	172.2278	725.8683	0.44374
P_{Rice}	677.956	225.0707	475.177	1244.162	0.33198
$P_{Roots\&Tubers}$	601.1391	287.3596	222.2222	1250	0.47803
P_{Spices}	2314.497	802.0513	1390.879	4381.5	0.34653
P_{Tea}	5109.302	1161.581	3397.967	7563.966	0.22735
$P_{Vegetables}$	1108.999	1023.671	189.7847	6038.06	0.92306
P_{Wheat}	311.2782	79.80295	124.1135	587.6289	0.25637
P_{Beef}	2649.263	824.6798	1692.308	4566.913	0.31129
$P_{Chickenmeat}$	1438.393	413.9402	993.1615	2382.056	0.28778
P_{Mutton}	2831.693	1226.683	1650	5612.594	0.43320

P = Price; SD = standard deviation; CV= coefficient of variation

Source: Authors' own computation, 2020

Table 4: Summary statistics average annual expenditure ($)

Items	Mean	SD	Minimum	Maximum	CV
Barley	984046.4	807048	67376	3249587	0.82013
Dry Beans	3746.868	3527.074	837	13928	0.94134
Coffee	3899.421	5339.664	30	17230	1.3693
Maize	256057.6	216867.5	16704	692611	0.84695
Millet	1683.876	1211.133	158	4920	0.71925
Potatoes	19721.37	8711.995	5030	37066	0.44175
Rice	592581.6	474844.6	147094	1769426	0.80132
Root & Tubers	1516.5	1953.348	147	9976	1.2881
Spices	32959.82	36156.71	5700	128534	1.0970
Tea	107652.8	65120.8	30755	254004	0.60492
Vegetables	8167.026	11794.35	451	39490	1.4441
Wheat	165767.9	269553.3	13	1023886	1.6261
Beef	61680.08	40860.09	2200	148254	0.66245
Chicken meat	613473.1	553171.6	150604	1978438	0.90170
Mutton	121838.6	75295.27	31072	283536	0.61799
Expenditure	2974793	2370725	821761.5	8785074	0.79694

$ = Dollar

Source: Authors' own computation, 2020

Furthermore, barley, rice and chicken meat had the highest marginal budget shares with an estimate of 48.34%, 18.80% and 14.91% respectively (Table 5). Therefore, it can be inferred that there is low diversification in food spending with one single commodity dominating the consumers' food diet.

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Table 5: Marginal budget share (marginal propensity to consume) of the selected foods

Commodity	ABS	MBS
ω_{Barley}	0.327605	0.48341
$\omega_{DryBeans}$	0.001255	0.000728
ω_{Coffee}	0.00103	0.000475
ω_{Maize}	0.083133	0.113263
ω_{Millet}	0.000679	3.07E-05
$\omega_{Potatoes}$	0.010361	-0.00155
ω_{Rice}	0.202216	0.188036
$\omega_{Roots\&Tubers}$	0.000403	0.000335
ω_{Spices}	0.010207	0.006945
ω_{Tea}	0.044805	0.002881
$\omega_{Vegetables}$	0.002	0.001578
ω_{Wheat}	0.037014	0.027195
ω_{Beef}	0.031759	-0.00988
$\omega_{Chickenmeat}$	0.20125	0.149045
ω_{Mutton}	0.046284	0.037515
Total	1	1

ABS = Average Budget Share
MBS = Marginal Budget Share
Source: Authors' own computation, 2020

3.2. Parameter estimates of demand function

The results of the parameter estimates for the demand function proved that the functional form (semi-logarithm) best fit the specified linear approximate almost ideal demand system (LA/AIDS) model as indicated by the most pertinent diagnostic statistics viz. Langrage Multiplier test statistic for serial correlation; Arch effect test statistics for auto-covariance and Koenker test statistics for heteroscedasticity which were within the acceptable margin of less than 10% degree of freedom(Table 6). Also, it was observed that the OLS estimated model is devoid of spurious correlation and regression as evidenced from their respective coefficient of multiple determinations (R2) which were within the plausible region and less than the D-W statistics respectively. The estimated results were found to be consistent as they did not violate the homogeneity and symmetry restrictions implied by consumption theory. Thus, these indicate that the parameter estimates are efficient, consistent and reliable for future predictions with certainty and accuracy.

A cursory review of the results showed the R2 for the estimated demand functions ranges from 0.589 to 0.926, with imported vegetables having the lower limit while imported beef had the upper limit. The R^2 estimates showed the percentage contribution of the price and income to the household demand for a particular commodity. For instance, the R^2 values of 0.589 and 0.926 for vegetables and beef respectively, imply that 58.9% and 92.6% variations in consumers' demand for imported vegetables and beef respectively were determined by own-price, substitute prices and income that were captured in the model while the disturbing economic reality accounts for the remaining percentages. With the exception of coffee, root and tubers, and vegetables, the intercept coefficient of all the remaining commodity demand functions was different from zero at 10% degree of freedom (Table 6). Commodities viz. barley and wheat had negative significant intercept coefficients while the remaining selected food items had positive significant intercept coefficients. The significance of the intercept implies an exogenous growth in the demand for a commodity independent of the movements in prices and income. Thus, it can be inferred that the exogenous growth in the share of the commodities with positive intercepts have increased while that of barley and wheat have declined as evident by the negative sign. The observed decline in the demand for barley and wheat may be attributed to changes in tastes (Table 6).

The results showed that the budget share of barley increased and decreased with an increase in the prices of millet, wheat and chicken; and, potatoes respectively. Also, the budget share of dry beans increased with an increase in its own-price and price of chicken meat while it decreased with an increase in the prices of maize, roots & tubers, tea, vegetables and wheat. The budget share of coffee decreased with an increase in its own-price and prices of roots and tubers, tea and vegetables; while it increased with an increase in the price of mutton. The budget share of maize increased and decreased with an increase in its own-price, prices of dry beans, tea and beef; and, prices of millet, potatoes, wheat and chicken meat, respectively. The demand for millet increased with an increase in its own-price, prices of potatoes and chevron, while it decreased with an increase in the prices of maize and tea. The demand for potatoes increased and decreased with an increase in its own-price, prices of cocoa, spices and wheat; and, millet, tea, vegetables and mutton, respectively.

The budget share of rice increased with an increase in its own-price and price of tea, while it decreased with an increase in the prices of barley, coffee, spices and wheat. The consumption share of roots and tubers increased and decreased with an increase in the prices of potatoes and mutton; and, chicken meat respectively. The budget share of spices increased with an increase in its own-price and the price of wheat; and decreased with an increase in the prices of roots and tubers, tea and vegetables. The budget share of tea decreased with an increase in the prices of coffee, roots and tubers and chicken meat; while it increased with an increase in the prices of barley, millet, potatoes and mutton. The budget share of vegetables was found only to increase with an increase in the prices of potatoes and mutton. The budget share of wheat decreased and increased with an increase in the prices of chicken meat; and, coffee, maize, potatoes, rice, roots and tubers, vegetables and mutton, respectively.

The budget share of beef decreased with an increase in its own-price and the prices of maize, rice and tea; while it increased with an increase in the prices of millet, potatoes, spices and vegetables. The budget share of chicken meat increased with an increase in the price of potatoes and decreased with an increase in the price of tea. The budget share of mutton increased with an increase in the prices of dry beans and tea; and, decreased with an increase in the prices of millet, spices, vegetables and beef.

Table 6: Parameter estimates of the LA/AIDS

Item	Barley	Dry Bean	Coffee	Maize	Millet	Potatoes	Rice	Root& Tuber
Intercept	-1.4825	0.008049	0.004745	0.150580	0.003445	0.07889	0.69629	0.00121
	3.25***	4.80***	1.44^{NS}	1.65*	2.84***	3.05***	4.75***	1.01^{NS}
P_{Barley}	0.034242	5.88E-05	-0.00015	-0.01604	0.000312	0.007059	-0.05774	0.000244
	0.42^{NS}	0.19^{NS}	0.25^{NS}	0.97^{NS}	1.43^{NS}	1.52^{NS}	2.19**	1.13^{NS}
$P_{DryBeans}$	-0.04718	0.001451	-0.00033	0.038913	-0.00034	0.004903	0.000424	4.27E-05
	0.57^{NS}	4.80***	0.56^{NS}	2.36**	1.56^{NS}	1.05^{NS}	0.02^{NS}	0.20^{NS}
P_{Coffee}	-0.04532	7.15E-05	-0.00068	0.007904	1.84E-05	0.009904	-0.02947	7.22E-05
	1.02^{NS}	0.44^{NS}	2.12**	0.88^{NS}	0.16^{NS}	3.92***	2.06**	0.62^{NS}
P_{Maize}	-0.11493	-0.00077	-0.00026	0.067582	-0.0007	0.004867	-0.03883	-0.00029
	1.04^{NS}	1.89*	0.33^{NS}	3.06***	2.38**	0.78^{NS}	1.10^{NS}	0.99^{NS}
P_{Millet}	0.192687	3.68E-05	0.000733	-0.08316	0.000925	-0.01074	-0.05015	5.13E-06
	2.02**	0.10^{NS}	1.06^{NS}	4.35***	3.65***	1.99**	1.63*	0.02^{NS}
$P_{Potatoes}$	-0.12727	0.00021	0.000412	-0.02769	0.000532	0.00624	-0.01729	0.000452
	1.99**	0.89^{NS}	0.89^{NS}	2.16**	3.13***	1.72*	0.84^{NS}	2.69***
P_{Rice}	-0.22287	0.000305	-0.0005	-0.022	-4.7E-05	0.004506	0.261195	2.88E-05
	1.53^{NS}	0.57^{NS}	0.47	0.75^{NS}	0.12^{NS}	0.55^{NS}	5.59***	0.08^{NS}
$P_{Roots\&Tubers}$	0.01181	-0.00042	-0.0005	-0.00361	-5.6E-05	0.003151	0.002895	-3E-05
	0.34^{NS}	3.25***	1.96**	0.51^{NS}	0.59^{NS}	1.58^{NS}	0.26^{NS}	0.33^{NS}
P_{Spices}	-0.00349	0.000178	0.000193	-0.00691	0.000201	0.008953	-0.09417	-8.3E-05
	0.04^{NS}	0.51^{NS}	0.28^{NS}	0.36^{NS}	0.80^{NS}	1.66*	3.09***	0.33^{NS}
P_{Tea}	0.051931	-0.0012	-0.00267	0.055286	-0.00101	-0.01282	0.092091	-7.8E-05
	0.53^{NS}	3.37***	3.79***	2.84***	3.93***	2.33**	2.95***	0.31^{NS}
$P_{Vegetables}$	-0.01463	-0.00029	-0.00052	0.00602	9.59E-06	-0.00255	0.000471	0.000027
	0.54^{NS}	2.92***	2.66***	1.11^{NS}	0.13^{NS}	1.66*	0.05^{NS}	0.38^{NS}
P_{Wheat}	0.097943	-0.00053	0.000211	-0.01705	0.000149	0.004942	-0.0596	-0.00014
	2.15**	3.15***	0.64^{NS}	1.87*	1.23^{NS}	1.91**	4.07***	1.14^{NS}
P_{Beef}	0.109392	-0.00012	0.000758	0.049257	0.000139	-0.00671	-0.03691	-3.5E-06
	1.01^{NS}	0.31^{NS}	0.97^{NS}	2.27**	0.48^{NS}	1.09^{NS}	1.06^{NS}	0.01^{NS}
$P_{Chickenmeat}$	0.296361	-0.00015	0.001045	-0.08838	-6.9E-05	-0.00157	-0.07867	-0.00116
	1.69*	0.23^{NS}	0.82^{NS}	2.52**	0.15^{NS}	0.16^{NS}	1.40^{NS}	2.52**
P_{Mutton}	-0.15017	0.000772	0.002573	-0.02611	0.000557	-0.00999	0.019517	0.000864
	1.59^{NS}	2.23**	3.77***	1.38^{NS}	2.23**	1.87*	0.64^{NS}	3.49***
Expenditure	0.155805	-0.00053	-0.00055	0.03013	-0.00065	-0.01191	-0.01418	-6.8E-05
	4.30***	3.96***	2.12**	4.16***	6.74***	5.81***	1.22^{NS}	0.71^{NS}

***, **, * = significant at 1%, 5% and 10%, respectively; NS = non-significant; Source: Authors' own computation, 2020

Table 6: Continued…

Item	Spices	Tea	Vegetable	Wheat	Beef	Chicken meat	Mutton
Intercept	0 .02972	0.367059	-0.001872	-0.327625	0.371889	0.865466	0.234753
	1.79*	6.52***	0.26 NS	3.13***	6.44***	3.15***	4.55***
P_{Barley}	-0.00197	0.019208	-0.0014	-0.006	0.053963	-0.0415	0.009704
	0.66 NS	1.89*	1.08 NS	0.32 NS	5.18***	0.84 NS	1.04 NS
$P_{DryBeans}$	0.002665	0.008845	-0.0018	-0.02371	0.016899	-0.01804	0.017267
	0.89 NS	0.87 NS	1.40 NS	1.26 NS	1.62*	0.36 NS	1.86*
P_{Coffee}	-0.00071	-0.01446	-0.00016	0.031585	-0.00823	0.043288	0.006196
	0.44 NS	2.63***	0.22 NS	3.08***	1.46 NS	1.61 NS	1.23 NS
P_{Maize}	-0.00182	-0.02171	0.001798	0.083487	-0.02659	0.054712	-0.00654
	0.45 NS	1.59 NS	1.04 NS	3.29***	1.90**	0.82 NS	0.52 NS
P_{Millet}	0.002509	0.039756	-0.00042	-0.00615	0.030466	-0.09382	-0.02267
	0.72 NS	3.37***	0.28 NS	0.28 NS	2.52**	1.63*	2.10**
$P_{Potatoes}$	0.002979	0.04369	0.002168	0.031332	0.021099	0.065399	-0.00227
	1.28 NS	5.53***	2.16**	2.13**	2.60**	1.70*	0.31 NS
P_{Rice}	-0.00818	-0.01497	0.000305	0.081148	-0.06075	-0.01929	0.001118
	1.54 NS	0.83 NS	0.13 NS	2.43**	3.30***	0.22 NS	0.07 NS
$P_{Roots\&Tubers}$	-0.00339	-0.00874	0.000105	0.019345	-0.00183	-0.02099	0.002263
	2.64***	2.01**	0.19 NS	2.39**	0.41 NS	0.99 NS	0.57 NS
P_{Spices}	0.008775	0.001095	0.000767	0.01253	0.064409	0.02778	-0.02022
	2.54**	0.09 NS	0.51 NS	0.57 NS	5.36***	0.49 NS	1.88*
P_{Tea}	-0.01553	-0.0131	-0.00226	-0.01792	-0.05183	-0.10367	0.022785
	4.39***	1.09 NS	1.48 NS	0.80 NS	4.22***	1.77*	2.07**
$P_{Vegetables}$	-0.00191	-0.00502	0.000339	0.017416	0.0079	-0.00193	-0.00533
	1.93**	1.50 NS	0.80 NS	2.80***	2.30**	0.12 NS	1.74*
P_{Wheat}	0.002936	-0.00536	0.000442	0.012864	0.000227	-0.03044	-0.00659
	1.77*	0.95 NS	0.62 NS	1.23 NS	0.04 NS	1.11 NS	1.28 NS
P_{Beef}	0.003943	0.007457	0.000284	-0.03115	-0.03252	-0.04344	-0.02037
	1.00 NS	0.56 NS	0.17 NS	1.25 NS	2.37**	0.67 NS	1.66*
$P_{Chickenmeat}$	-0.00351	-0.04205	-0.00232	-0.16388	0.015722	0.083615	-0.01499
	0.55 NS	1.94**	0.84 NS	4.07***	0.71 NS	0.79 NS	0.76 NS
P_{Mutton}	0.014275	0.021394	0.003623	0.056917	-0.00694	0.056908	0.0158
	4.16***	1.84*	2.45**	2.63**	0.58 NS	1.00 NS	1.48 NS
Expenditure	-0.00326	-0.04192	-0.00042	-0.00982	-0.04164	-0.05221	-0.00877
	2.47**	9.39***	0.74 NS	1.18 NS	9.09***	2.40**	2.14**

***, **, * = significant at 1%, 5% and 10%, respectively; NS = non-significant; Source: Authors' own computation, 2020

Table 6: Continued …

Items	Barley	Dry Bean	Coffin	Maize	Millet	Potatoes	Rice	Root& Tuber
R2	0.6020	0.6386	0.6424	0.7827	0.8239	0.8419	0.8204	0.6493
F-stat	1.98***	2.31***	2.35***	4.72***	6.14***	6.98***	5.99***	2.42***
D-W stat	1.80(0.02)**	1.95(0.05)**	1.67(0.007)***	2.24(0.26) NS	2.84(0.91) NS	1.59(0.003)***	2.27(0.28) NS	2.15(0.17) NS
Autcr. Test	0.198(0.95)NS	0.37(0.82) NS	0.49(0.49) NS	0.50(0.48) NS	0.97(0.49) NS	1.62(0.21) NS	0.63(0.43) NS	1.81(0.17) NS
Hetero (LM)	35.1(0.32) NS	36.8(0.25) NS	34.2(0.35) NS	32.9(0.41) NS	32.2(0.45) NS	34.7(0.33) NS	29.2(0.60) NS	37.7(0.22) NS
Arch test(LM)	6.12(0.29) NS	3.99(0.40) NS	15.3(0.35) NS	0.007(0.93) NS	4.19(0.52) NS	4.26(0.37) NS	0.14(0.69) NS	19.1(0.16) NS
Norm. test (χ^2)	0.49(0.78) NS	1.68(0.43) NS	0.60(0.73) NS	3.57(0.16) NS	4.12(0.12) NS	0.87(0.64) NS	2.58(0.27) NS	20.5(3.5e-5)***
RESET test	2.06(0.16) NS	1.41(0.26) NS	1.03(0.37) NS	1.03(0.32) NS	0.95(0.40) NS	5.16(0.16) NS	1.59(0.22) NS	10.2(0.96) NS
CUSUM test	3.91(0.85) NS	1.34(0.19) NS	0.98(0.33) NS	1.13(0.26) NS	1.10(0.28) NS	0.95(0.35) NS	2.03(0.54) NS	1.17(0.25) NS
Chow test	6.14(0.57) NS	2.87(0.15) NS	3.17(0.13) NS	2.46(0.19) NS	1.08(0.52) NS	2.38(0.20) NS	2.46(0.19) NS	0.34(0.94) NS

Items	Spices	Tea	Vegetable	Wheat	Beef	Chicken meat	Mutton
R2	0.6927	0.8470	0.5899	0.8532	0.9264	0.5181	0.7048
F-stat	2.95***	7.26***	1.88***	7.66***	16.5***	1.45***	3.13***
D-W stat	1.53(0.002)***	2.01(0.08)*	2.15(0.17) NS	1.91(0.04)**	2.07(0.11) NS	1.77(0.01)***	1.75(0.01)***
Autcr. Test	0.59(0.70) NS	0.004(0.94) NS	0.15(0.69) NS	0.01(0.89) NS	0.08(0.77) NS	0.27(0.61) NS	0.53(0.47) NS
Hetero (LM)	31.4(0.49) NS	29.6(0.58) NS	34.9(0.32) NS	32.1(0.45) NS	36.0(0.28) NS	33.0(0.41) NS	32.8(0.42) NS
Arch test(LM)	0.02(0.87) NS	1.02(0.31) NS	7.31(0.19) NS	2.31(0.12) NS	0.12(0.72) NS	0.50(0.47) NS	0.76(0.38) NS
Norm. test (χ^2)	0.87(0.64) NS	7.06(0.02)**	13).3(0.001) NS	0.19(0.91) NS	0.47(0.79) NS	1.07(0.58) NS	0.08(0.95) NS
RESET test	2.29(0.12) NS	8.22(0.26) NS	0.43(0.51) NS	1.06(0.31) NS	0.56(0.46) NS	4.77(0.41) NS	0.89(0.42) NS
CUSUM test	1.60(0.12) NS	0.80(0.43) NS	0.29(0.77) NS	1.18(0.24) NS	-1.12(0.27) NS	3.80(0.11) NS	0.31(0.75) NS
Chow test	5.68(0.52) NS	1.58(0.35) NS	7.70(0.03)**	1.27(0.45) NS	19.7(0.005)***	3.95(0.09)*	7.74(0.03)**

***, **, * = significant at 1%, 5% and 10%, respectively; NS = non-significant

Source: Authors' own computation, 2020

3.3. Expenditure and own-price elasticities

Displayed in Table 7 are the expenditure and both uncompensated and compensated own-price elasticities for the considered food items. A good can be identified as a necessity, luxury or Giffen (inferior) based on the signs and size of the degree of fluctuation of the elasticity value for a particular commodity to a change in income. Generally, the expenditure elasticities for the selected imported food items in the country were high and this can be explained by the economic situation in the country. This revealed that most of the households especially the poor face tight budgetary constraints and all of the selected commodities are considered to be very important because they fulfil their fundamental needs.

The estimated expenditure elasticities of barley, maize, millet, rice and wheat were 1.48, 1.36, 0.05, 0.93 and 0.74 respectively, indicating that a 10%increase in consumers' income would increase the demand for the aforementioned commodities in respective order by 14.8%, 13.6%, 0.5%, 9.3% and 7.4% (Table 7). The expenditure elasticity estimates for coffee, tea, vegetables and roots and tubers were 0.461, 0.064, 0.789 and 0.832 respectively, implying that a 10% increase in consumers' income would increase the demand for the above-mentioned commodities in respective order by 46.1%, 0.64%, 5.89% and 8.32%. Besides, the expenditure elasticity estimates of chicken meat and mutton were 0.741 and 0.811 respectively, imply that an increase in consumers' income by 10% would increase the demand for the former and latter commodities by 7.41% and 8.11% respectively.

However, the empirical evidence showed the expenditure elasticity estimates of potatoes and beef to be -0.150 and -0.31 respectively, indicating that if consumers' income increased by 10% the demand for the former and latter goods would decrease by 1.50% and 3.1%. Therefore, for most of the food items, any policy aimed at raising the per capita income in the country, diversity towards high-quality diet is likely to be enhanced.

A cursory review of the results showed a positive expenditure elasticity estimates for all the food items with the exception of potatoes and beef, thus implying that potatoes and beef are non-normal goods while the remaining are normal goods. The empirical evidence showed potatoes and beef to be income inelastic and negatively signed, that is, less than zero, indicating they are inferior or Giffen commodities. Furthermore, barley and maize were found to be income elastic, that is, greater than unity, implying they are luxury commodities, while all the remaining food items have positive income inelastic, that is, less than unity but greater than zero, indicating that these food items are necessities. However, it is worth to mention that the expenditure elasticity values of millet and tea were close to zero, indicating that these commodities are near or close to inferior commodity, that is, not as such sensitive to change in expenditure.

The expenditure elasticity values for potatoes and beef and all the remaining food items revealed that if the consumers' income increased the demand for the former would be decreased while that of the later commodities would increase. Thus, it is expected that these commodities will witness an increase or decrease (potatoes and beef) in demand when the increase in the income is in tandem with the overall economic growth in the study area. However, in relative terms, if the real per capita income plummets, necessary commodities would have less income allocated to them. Given a fixed supply for normal goods, the upward shift of demand curves will imply that the equilibrium market prices will increase. For those commodities whose own-prices are less than unity (inelastic), it is anticipated that the increase in their respective prices due to the shift in their respective demand curves would lead to a decrease in the demand by less than the proportionate change in price. Also, for those food items whose own-elasticity values are elastic i.e. greater than unity, it is anticipated that the rise in their respective prices due to the shift in their respective demand curves would lead to a decrease in the demand by more than the proportionate change in price. Thus, results show that as consumers' income rise and consumers' diversify their diets, their consumption of non-staple foods rather than staple foods tends to increase.

An interesting observation was that coffee and tea tend to have less expenditure elasticity. The consumption of this commodity class (coffee and tea) is relatively less affected by income changes and can be inferred that it is a staple food in the country, thus occupying a special place in the consumers' diet.

Table 7: Expenditure (Income), Uncompensated and Compensated own-price elasticities

Items	Expenditure	Uncompensated	Compensated	Income effect	PP(%PR)
Barley	1.475588	-1.05128	-0.56787	4.834096	23.780443
Dry Beans	0.579977	-0.156865	-0.157593	0.00728	159.373
Coffee	0.46133	-1.66402	-1.66355	0.004752	15.023843
Maize	1.362437	-0.21719	-0.10392	1.132628	115.10864
Millet	0.045291	-0.363108	-0.363138	0.000307	68.85011
Potatoes	-0.14978	-0.38582	-0.38737	0.0155183	64.796833
Rice	0.929875	-0.305846	-0.493881	1.880356	81.74056
Root &Tubers	0.831554	-1.07521	-1.07488	0.003347	23.251244
Spices	0.680451	-0.13697	-0.13002	0.069451	182.52435
Tea	0.064302	-1.25035	-1.24747	0.02881	19.994371
Vegetables	0.78921	-0.83014	-0.82856	0.015785	30.115525
Wheat	0.734709	-0.64264	-0.61545	0.271948	38.902041
Beef	-0.31121	-1.98219	-1.99208	0.0988379	12.612299
Chicken meat	0.740596	-0.53232	-0.38327	1.490448	46.964561
Mutton	0.810533	-0.64986	-0.61235	0.375147	38.469824

PP = Protectionist Policy; PR = Price Rise

Source: Authors' own computation, 2020

3.4. Response of demand to price changes

According to economic theory, own-price elasticity is expected to be negatively signed, implying that the demand curve is negatively sloped. The Marshallian (uncompensated) elasticity of demand refers to change in the demand for a commodity due to the change in price without any compensation for the change in price or income (Table 7). While the Hicksian (compensated) elasticity of demand for a commodity refers to that portion of a total change in demand which is compensated by a change in price. Once the change in total demand is compensated by a changing in price, the remaining left is an income effect. In other words, compensation is meant to sustain consumers at the same level of utility as before the change in price. Thus, the price effect plus income effect equals a total effect.

The empirical evidence showed both the uncompensated and compensated own-price elasticities for all the selected food items to be in conformity with the prior expectation (negative sign), indicating an inverse relationship between the price of a normal commodity and its demand (Table 7). Between the uncompensated and compensated own-price elasticities, a substantial difference was observed, thus indicating a substantial income effect. In addition, most of the uncompensated own-price elasticities in absolute term were higher than their respective corresponding compensated own-price elasticities, implying that price effect wax more influence than the income effect.

The uncompensated own-price elasticity estimates for barley, coffee, root and tubers, tea and beef were greater than unity while that of the remaining selected food items were less than unity. This implies that the demand for the former goods react elastically to change in their respective own-prices while the demand for the latter goods reacts inelastic to change in their respective own-prices. Thus, for barley, coffee, root and tubers, tea and beef, change in their respective own-price affects their demand to a greater extent when compared to other commodities. It was observed that the uncompensated own-price elasticity estimates for all the selected food items were lower than their respective corresponding income elasticities, indicating that the responsiveness of demand to own-price changes is smaller than to the variations in the total expenditure.

The Marshallian own-price elasticity is composed of price or substitution effect and income effect. The uncompensated own-price elasticity estimate of barley indicates that if the price of barley plummets by 10% the demand for barley would increase by 10.51%. Of this total increase in demand, compensated own-price elasticity posited that 5.68% was purely due to price effect. The income effect of the price fall accounts for 4.823% (10.51-5.68) increase in barley demand due to the increase in the real per capita income if the nominal or money income remains unchanged. If the per capita income increased by 10% and subsequently accompanied by a decline in the price of barley by 10%, the demand for barley would increase by 25.27% (10.51+14.76). The rise in the per capita income represents a shift in the demand curve of barley which normally would lead to an increase in the price of barley; this is not desirable for an importing economy which depends on an external market for supply. However, a decrease in the supply (importation) of barley by 25% would increase the price of barley by 23.78%, thus resulting in a decrease in the demand for barley. Any international trade protectionist measures taken to protect Saudi's economy from external economic incursion will aid in stimulating growth and development of domestic industries, thus increasing the GDP of the country. However, for the estimation of the resulting equilibrium level of barley consumption, information on the supply elasticity of barley would be required.

The results showed the income effect of change in price to be moderate for barley while it was small for the remaining selected food items. These were so because the barley had a moderate share in the household income while the remaining selected food items each had a small share in the annual consumers' expenditure budgets. Thus, change in barley price had a moderate effect on the real income which owed to its moderate share in the consumers' annual budget while for the remaining food items, income effect due to change in their respective prices are small and it owes to their small share in the annual consumers' budget. It was observed that the compensated own-price elasticity values were lower than the uncompensated own-price elasticity estimates, thus indicating the predominant effect of income effect over the substitution effect. Also, it implies that the price responsiveness of all the selected food items was income-dependent, such that if income is held constant i.e. ceteris paribus (that is, income is not constant in the decision making process), consumers would tend to be less responsive to food prices.

3.5. Cross-price elasticity

The matrices of cross-price elasticity estimates for the uncompensated and compensated are shown in Table 8 and 9. The uncompensated cross-price elasticity shows the 'gross' cross-price effect that includes both the price and income effects while the compensated cross-price elasticity represents the pure price effect, that is, only the substitution effect or the net effect of a price change on demand. The cross-price elasticity characterized a pair of goods as complements or substitutes depending on the signs of the elasticity estimate. If the elasticity estimate is positive, the commodity pair is referred to as 'substitute'; if negative, the commodity pair is referred to as 'complement'. For the uncompensated cross-price elasticity, out of the 105 estimates, 52 commodity pairs were found to be complementary commodities as evidenced by their respective elasticity values which were negatively signed while the remaining 53 commodity pairs were substituted commodities, as indicated by their respective cross-price elasticity, were positively signed. Besides, for the compensated cross-price elasticity, it was observed that 55 commodity pairs were 'net' substitutes while fifty commodity pairs were 'net' complements as indicated by their respective positively and negatively signed elasticities respectively. For the food items which were found to be substituted, it implies that an increase in the price of one commodity would lead to an increase in the demand of its pair, ceteris paribus. While in the case of a commodity pair which complement, it implies than an increase in the price of one commodity would lead to a decrease in the demand of its pair, ceter is paribus. For substitute commodities, it means two commodities can substitute each other if there is a change in the price of one of the commodity; while for the complementary commodities, it means that the consumption of one implies the consumption of the counterpart, thus an increase in the price of one will lead to a decrease in the demand for its complementary counterpart.

The negative sign of the uncompensated cross-price elasticity of demand for barley due to change in the price of vegetables indicates that the two goods are complements. The estimated elasticity of the commodity pair being 0.046 implies that if the price of vegetables increase by 10% the demand for barley would decrease by 0.46%, ceteris paribus, The compensated cross-price elasticity of vegetables to barley, that is, the net effect of vegetables price change on demand for the barley; indicates that if the price of vegetables increase by 10%, the consumption of barley would decrease by 0.43%, ceteris paribus.

The positive sign of the uncompensated cross-price elasticity of wheat to barley implies that the two commodities are substitutes. The elasticity estimate being 0.281 means that if the price of wheat increase by 10% the demand for barley would increase by

2.81%,ceteris paribus, that is, consumers' would shift to the alternative (barley in this case). For the compensated cross-price elasticity, the net effect of wheat price change on the demand for barley implies that if the price of wheat surged by 10% the demand for barley would increase by 3.36%, ceteris paribus.

Therefore, it can be inferred that the decrease and increase in the demand for barley by 0.46% and 2.81%, is due to the increases in the prices of vegetables and wheat respectively, and an increase in the real per capita income. In addition, the decrease and increase in the demand for barley by 0.43% and 3.36% are due to pure price effect arising from the increase in only the prices of vegetables and wheat respectively. Thus, the relationship between vegetable and barley are net complements while that of wheat and barley are not substitutes.

It was observed that the signs of the uncompensated and compensated cross-price elasticity estimates for some particular commodities were contrary. The negativity of the uncompensated cross-price elasticity of demand for beans (-0.032) due to the fall in the price of chicken meat, that is, the total effect of a change in the price of chicken on the demand for beans indicated that the two commodities were 'gross' complements. However, the compensated cross-price elasticity estimate was positive (0.085), indicating that the two commodities are 'net' substitute. The uncompensated cross-price elasticity is more ambiguous as reported by Awal et al. (2008). They postulated that in change, a strong income effect plays a role. Furthermore, they suggested that compensated cross-price elasticity is the most appropriate when information on substitution possibilities are needed.

Generally, it can be inferred that there is low diversity in the Saudi Arabians' dietary composition. It is important that a number of different food sources should be consumed, thus consumers should be encouraged to consume a wide variety of foods to improve their nutritional quality and health condition. Aziz et al. (2011) reported that dietary diversity is one of the most pertinent ways to ensure a balanced diet for people across all the age categories.

Table 8: Uncompensated cross-price elasticity for the selected food items

Items	D_{Barley}	$D_{Drybean}$	D_{Coffee}	D_{Maize}	D_{Millet}	D_{Potato}	D_{Rice}	$D_{R\&T}$	D_{Spices}	D_{Tea}	D_{Veg}	D_{Weat}	D_{Beef}	D_{ChM}	D_{Mutton}
P_{Barley}	**-1.0513**	0.1845	0.0316	-0.3117	0.7727	1.0580	-0.2626	0.6619	-0.0881	0.7352	-0.6290	-0.0751	2.1287	-0.1212	0.2717
$P_{Dry\ Bean}$	-0.1446	**-0.1569**	-0.3229	0.4676	-0.5004	0.4747	0.0022	0.1063	0.2615	0.1986	-0.9010	-0.6402	0.5337	-0.0893	0.3733
P_{Coffee}	-0.1388	0.0574	**-1.6640**	0.0947	0.0281	0.9571	-0.1457	0.1796	-0.0697	-0.3218	-0.0781	0.8536	-0.2579	0.2154	0.1341
P_{Maize}	-0.3904	-0.5752	-0.208	**-0.2172**	-0.9469	0.5654	-0.1862	-0.6988	-0.1520	-0.4068	0.9162	2.2776	-0.7283	0.2934	-0.1256
P_{Millet}	0.5879	0.0296	0.7119	-1.0005	**-0.3631**	-1.0363	-0.2479	0.0129	0.2459	0.8879	-0.2112	-0.166	0.9602	-0.4660	-0.4897
P_{Potato}	-0.3934	0.1716	0.4059	-0.3369	0.7942	**-0.3858**	-0.0848	1.1242	0.2952	0.9848	1.0862	0.8492	0.6779	0.3277	-0.0470
P_{Rice}	-0.7765	0.3283	-0.3740	-0.3379	0.1232	0.6674	**-0.3059**	0.1056	-0.7369	-0.1449	0.1952	2.2459	-1.6476	-0.0434	0.0625
P_{Roots} & $_{Tubers}$	0.0359	-0.3355	-0.4852	-0.0435	-0.0817	0.3046	0.0144	**-1.0752**	-0.3319	-0.1947	0.0527	0.5227	-0.0572	-0.1042	0.0489
P_{Spices}	-0.0155	0.1463	0.1924	-0.0869	0.3060	0.8758	-0.4649	-0.2038	**-0.1369**	0.0339	0.3855	0.3412	2.0414	0.1407	-0.4350
P_{Tea}	0.1372	-0.9399	-2.5636	0.6488	-1.4504	-1.1858	0.4586	-0.1872	-1.5074	**-1.2504**	-1.1222	-0.4723	-1.5732	-0.5035	0.5008
$P_{Vegetables}$	-0.0456	-0.2308	-0.5046	0.0717	0.0160	-0.2436	0.0025	0.0674	-0.1861	-0.1102	**-0.8301**	0.4711	0.2514	-0.0091	-0.1147
P_{Wheat}	0.2814	-0.4049	0.2251	-0.2185	0.2545	0.5195	-0.2922	-0.3331	0.2995	-0.0850	0.2287	**-0.6426**	0.0557	-0.1416	-0.1354
P_{Beef}	0.3188	-0.0839	0.7531	0.5810	0.2349	-0.6111	-0.1803	-0.0035	0.3965	0.1962	0.1485	-0.8332	**-1.9822**	-0.2076	-0.4341
$P_{Chicken\ meat}$	0.8089	-0.0319	1.1232	-1.1361	0.0901	0.0799	-0.3749	-2.8416	-0.2798	-0.7502	-1.1159	-4.3741	0.7589	**-0.5323**	-0.2858
P_{Mutton}	-0.4804	0.6345	2.5229	-0.3308	0.8653	-0.9105	0.0998	2.1534	1.4134	0.5208	1.8213	1.5499	-0.1579	0.2948	**-0.6499**

Own-price elasticities are written in bold letters; R & T = Roots & Tubers; veg = vegetables; ChM = Chicken meat

Source: Authors' own computation, 2020

Table 9: Compensated cross-price elasticity for the selected food items

Items	D_{Barley}	$D_{Drybean}$	D_{Coffee}	D_{Maize}	D_{Millet}	D_{Potato}	D_{Rice}	$D_{R\&T}$	D_{Spices}	D_{Tea}	D_{Veg}	D_{Weat}	D_{Beef}	D_{ChM}	D_{Mutton}
P_{Barley}	**-0.5679**	0.3745	0.1827	0.1347	0.7875	1.0089	0.0421	0.9343	0.1348	0.7563	-0.3705	0.1656	2.0267	0.1214	0.5373
$P_{DryBeans}$	-0.1428	**0.1576**	-0.3223	0.4693	-0.5003	0.4745	0.0034	0.1073	0.2624	0.1987	-0.9001	-0.6393	0.5333	-0.0884	0.3743
P_{Coffee}	-0.1373	0.0579	**-1.6636**	0.0961	0.0281	0.9569	-0.1447	0.1804	-0.0689	-0.3218	-0.0773	0.8543	-0.2582	0.2161	0.1349
P_{Maize}	-0.2677	-0.5269	-0.1697	**-0.1039**	-0.9432	0.5529	-0.1089	-0.6297	-0.0955	-0.4015	0.9818	2.3387	-0.7542	0.3549	-0.0582
P_{Millet}	0.5889	0.0299	0.7122	-0.9996	**-0.3631**	-1.0364	-0.2473	0.0134	0.2465	0.8879	-0.2107	-0.1655	0.9599	-0.4655	-0.4891
P_{Potato}	-0.3781	0.1776	0.4107	-0.3227	0.7946	**-0.3874**	-0.0751	1.1328	0.3022	0.9855	1.0944	0.8569	0.6747	0.3353	-0.0387
P_{Rice}	-0.4781	0.4455	-0.2807	-0.0624	0.1324	0.6371	**-0.4939**	0.2738	-0.5993	-0.1319	0.3548	2.3946	-1.7106	0.1064	0.2264
$P_{Roots\&Tubers}$	0.0365	-0.3353	-0.4849	-0.0429	-0.0816	0.3046	0.0147	**-1.0749**	-0.3317	-0.1947	0.053	0.5230	-0.0573	-0.1039	0.0493
P_{Spices}	-0.0005	0.1523	0.1971	-0.0729	0.3065	0.8743	-0.4555	-0.1953	**-0.1300**	0.0347	0.3935	0.3487	2.0382	0.1482	-0.4268
P_{Tea}	0.2033	-0.9139	-2.5429	0.7098	-1.4483	-1.1925	0.5002	-0.1499	-1.4769	**-1.2475**	-1.0868	-0.4394	-1.5872	-0.4703	0.5371
$P_{Vegetables}$	-0.0427	-0.2297	-0.5037	0.0744	0.0161	-0.2439	0.0043	0.0691	-0.1848	-0.1101	**-0.8286**	0.4725	0.2507	-0.0076	-0.1131
P_{Wheat}	0.3359	-0.3834	0.2421	-0.1681	0.2562	0.5139	-0.2577	-0.3024	0.3247	-0.0827	0.2579	**-0.6155**	0.0442	-0.1142	-0.1054
P_{Beef}	0.3657	-0.0655	0.7678	0.6243	0.2364	-0.6158	-0.1508	0.0229	0.4181	0.1982	0.1736	-0.8098	**-1.9921**	-0.1841	-0.4084
$P_{Chickenmeat}$	1.1059	0.0849	1.2161	-0.8619	0.0992	0.0498	-0.1878	-2.6743	-0.1429	-0.7372	-0.9571	-4.2262	0.6963	**-0.3833**	-0.1227
P_{Mutton}	-0.4121	0.6613	2.5442	-0.2677	0.8674	-0.9175	0.1428	2.1919	1.4449	0.5238	1.8579	1.5839	-0.1723	0.3291	**-0.6124**

Own-price elasticities are written in bold letters; R & T = Roots & Tubers; veg = vegetables; ChM = Chicken meat

Source: Authors' own computation, 2020

4. Conclusions

Based on the findings of the study, it can be inferred that there is low diversification in food expenditure with barley having an overwhelming influence on the consumers' food budget. In addition, rice and chicken with appreciable portions trailed behind barley in the consumers' budget share. Of the fifteen considered food items, one commodity was found to be a luxury and the other one inferior; while the remaining eleven commodities were necessities. Thus, it indicates that as consumers' expenditures increase and consumers' diversify their diets, the consumption of non-staple foods rather than the staple foods tend to increase. For approximately two-third of the selected commodities, the responsiveness of their demand to own-price changes is less than the responsiveness to total expenditure (income). Furthermore, income effect dominates in determining the demand for imported commodities as evidenced from the uncompensated own-price elasticity estimates been greater than the compensated own-price elasticity estimates. The cross-price elasticity estimates showed the substitution effects of prices to be very weak. Therefore, the research advised people to consume a wide variety of foods to improve their diet nutritional quality and health status. However, since almost all of the commodities are important given that they fulfilled the needs of the people, especially the poor who face tight budgetary constraints. Thus, it becomes imperative for the policymakers to enhance their homegrown economy to enhance the economy, foreign exchange reserve and protect the health status of the country populace.

Conflict of Interest

The authors declare that there is no conflict of interest.

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