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Potential impact of food inflation on households' welfare: Evidence from Pakistan

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The global food price crises of 2007–2008 and the recent resurgence of food inflation have gained attention of the researchers about the causes and consequences of this volatility in food prices around the globe. This paper aims to examine the potential impact of food inflation on households' welfare in Pakistan. For this purpose, the authors used a flexible Linear Approximate Almost Ideal demand System (LA/AIDS) to estimate the food demand pattern using the recently available Household Integrated Economic Survey of Pakistan for the year 2018–2019. Food products were categorized into thirteen food groups including milk, meat, fruits, vegetables, sugar, beverages, cereals, wheat, rice, oil & fats, tea, condiments and baked products. The estimated model was used to simulate different price increase scenarios in each of the currently own price. We found out that the estimated loss in the consumption was consistently high for milk, sugar, cereals, rice, wheat, meat and oil & fats. The issue of limited diversity in the dietary pattern and persistently food inflation will result in alarming food security in the country. The Effect of an increase in the general price level on food consumption could only be reduced by enhancing households' purchasing power in the current scenario. The outcome of this research study will help policymakers in the agriculture sector to develop reliable and sound policy designs that will help control the implications of food inflation on household welfare loss.

Keywords: food inflation, food policy, elasticities, food security, Pakistan.

Introduction

Food being the basic need of life is the center of focus for all the researchers around the globe for the last four decade (Lyu et al., 2015; Ameye, Bachewe and Minten, 2021; Lei, Xian and Jun-fei, 2021). The world has progressed from traditional agriculture to industrial development for the provision of different goods and services for every walk of life. With all these development the burgeoning population, scarcity of natural resources like shortage of water and land fragmentation and urbanization has put tremendous pressure to meet food demand (Dawe et al., 2015). In middle and high income countries, where people on the average spend less on food, i. e. below 30 percent of their income while, the share of income reaches to more than 62 percent in the underdeveloped countries (Gao, 2012; Ameye, Bachewe and Minten, 2021).

There is much debate over the effect of changes in food prices and its devastating effects on consumption of low-income countries which may result in issues related to cheaper, low-quality staple food as compared to high-income countries (Drewnowski, 2010; Han and Powell, 2011; Aggarwal, Monsivais and Drewnowski, 2012; Xu et al., 2014; Powell et al., 2013; Headey and Alderman, 2019). The debate over higher food prices and its implication between the buyers and sellers of agricultural commodities in developing countries which are home to majority of the poor are different (Cornelsen et al., 2014). From the seller's point of view an increase in price could potentially increase the net income and may result in higher standard of living. While, on the other hand, higher food prices adversely affect the purchasing power of the buyers and may result in poverty (Haq, Nazli and Meilke, 2008; Digvijay, 2022; Ginn and Pourroy, 2022)[1].

Pakistan being a developing country is no exception, and is currently facing the highest-ever price increase in its present affecting the purchasing power of its consumers adversely (Ullah and Abbas, 2018). Pakistan experienced a stable inflation with high economic growth from 2001 to 2006. However, due to rise in the fuel and key food items prices pushed the annual inflation rate to 11.3 percent (Gorter, Drabik and Just, 2013; Tyner, 2013; Kilain and Zhou, 2022)[2]. Food inflation in Pakistan averaged 6.78 percent from 2011 to 2022, reaching an all the time high of 23.70 percent in January 2020[3]. Since 2012, increase in major food items prices such as rice, wheat flour, eggs, meat, sugar, fruits and vegetables rose sharply since 2013 (Figure).

In Pakistan the expenditures share of food commodities are high as compared to the non-food items both in rural and urban regions. The share of food items is 36.05 percent in 2018–2019 percent which is lower than 37.05 percent in 2015–2016. This declining share of food items is due to increase in the expenditures share of electricity, water, housing and others. For overall Pakistan out of the total food expenditures 20 food items contribute 86.79 percent (Appendix, 1). The share of these food items is low in urban regions (85.63 percent) as compared to rural regions (87.65) percent. A close analysis reveals that wheat, vegetables, sugar, vegetable ghee and milk constitutes 50.57 percent share out of

[1] См. также: World Bank. (2008) 'Addressing the food crisis: The need for rapid and coordinated action', *Background paper for the Group of Eight Meeting of Finance Ministers*, Osaka, June 13–14. Washington: The World Bank.

[2] Government of Pakistan. (2022) *Household Integrated Economic Survey*. Islamabad: Pakistan Bureau of Statistics.

[3] Government of Pakistan. (2022) *Household Integrated Economic Survey*. Islamabad: Pakistan Bureau of Statistics.

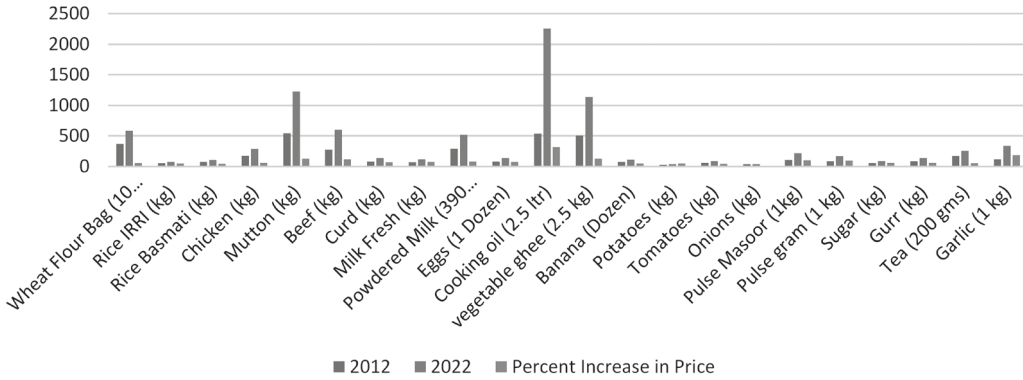

Figure. Average Prices of Major food Items in Pakistan

Source: Pakistan Bureau of Statistics. (2022) *Government of Pakistan*. Available at: https://www.pbs.gov.pk/ (accessed: 10.11.2023).

86.79 percent, clearly indicating that these are the major food items[4]. Consumption in an economy is closely connected to its progress and development in a way that it measures the welfare of the consumers making expenditures on consumptions (Tule, Alisu and Chiemeke, 2019; Demeke and Tenwa, 2021). Furthermore, it will also help in establishing business setup and its extension because the entire investment is dependent on the consumption pattern of the country.

1. Review of Literature

Analysis of the food consumption pattern has gained more attention of authors and nations since it reflects consumers' behavior. The impact of food inflation on Ethiopian urban household was investigated by Y. Alem and M. Soderbom (Alem and Soderbom, 2012). The results revealed that household with low level of assets holding and casual workers were the most affected households by the food inflation and a significant amount of their expenditures need to be reallocated to food. In Philippines the impact of food inflation on poverty was studied by T. Fuji (Fuji, 2013) across different areas and between agriculture and non-agriculture household's. Their result revealed that majority of the poor households' are severely and adversely affected by the food inflation and they may not be able to escape poverty. X. Irz, J. Niemi and Liu X. (Irz, Niemi and Liu, 2013) investigated the dynamics of food price by establishing a long run equilibrium relationship between energy, agriculture commodities, wages and food prices by using a vector error correction model. Their results highlighted a significant and positive relationship between inputs used in the production of agriculture commodities and food prices.

Food prices and inflation dynamics in Ethiopia studied by D. Durevall, J. L. Loening and Y. A. Birru (Durevall, Loening and Birru, 2013) highlighted that movement in the global commodities prices, measured in domestic currency, determined the long run

[4] Government of Pakistan. (2019) *Household Integrated Economic Survey*. Islamabad: Pakistan Bureau of Statistics.

evolution of the domestic prices. They suggested that world food prices and domestic agriculture production should be considered when analyzing inflation in developing economies. A similar study was also conducted by R. V. Hill and C. Porter (Hill and Porter, 2017) in Ethiopia to investigate vulnerability to droughts and food prices shocks. They find out that majority of the Ethiopian households are unable to adjust their consumption expenditures against sudden food prices shock and lack of rainfall. For example M. K. Tule, A. A. Alisu and C. C. Chiemeke (Tule, Alisu and Chiemeke, 2019) examined the predictability of the agriculture commodity prices in Nigeria's inflation forecast by considering twelve major commodities. They highlighted that agriculture commodities individually can predict headline and food inflation (Ginn and Pourroy, 2020; 2022) investigated the contribution of the food subsidy policy to monetary policy in India by using Bayesian DSGE model. The results of the study showed that CPI and therefore interest rate volatility would be 21 percent higher in the absence of food subsidies, because of the shocks at the global food prices. Furthermore, in order to offset the supply subsidy welfare cost, it requires the inclusion of the demand subsidy program in order to benefit the urban households.

M. N. Sarwar, H. Hussain and M. B. Maqbool (Sarwar, Hussain and Maqbool, 2020) examine the pass through effect of the global crude oil prices on food as well as non-food prices in Pakistan by using nonlinear ARDL approach. Their result show connectedness between the oil price shocks and food and nonfood price increase. Interlinkages between food and non-food sources of inflationary pressure in Ethiopia was investigated by H. Demeke and Tenaw (Demeke and Tenwa, 2021) by using non-linear Auto-Regressive Distributed lag (ARDL) model. Their findings exhibited that money supply growth, world food prices, price increase expectations, food supply and real income are the main reason for food inflation both in the short and long run. A. Alam, I. Dutta, E. Haque and R. Nogales (Alam et al., 2022) analyzed the impact of Rohingya refugees on the Bangladesh's food price by using difference-in-difference approach. They find out that because of this sudden influx the overall food prices increased by 8 percent. Similarly S. A. Raza, K. Guesmi, F. Belaid and N. Shah (Raza et al., 2022) examined the volatility connectedness of global oil price with food price since January 1993 to September 2020 by using wavelet technique. They find out a bidirectional association between the food prices and incidences with the global oil prices.

This paper will add to the existing literature in the following ways. Firstly, we model an economy in which the non-tradable food share in the consumption expenditure is large and estimated the completed demand system for thirteen food groups. Secondly, we simulate different price scenario for the existing prices of the commodities to estimate the potential impact of the food inflation on the consumers' welfare. A very limited literature on the food price increase and its potential impact on the households in Pakistan is available. So the monetary authorities can look for the price volatility shock in food sector and help policy makers in the agriculture sector to develop reliable and sound policy designs that will help control the implications of food inflation on household welfare loss. The remaining sections of the paper are structured as follows. First in data and methodology section we discussed the data and source of data, method used for model estimation. This is followed by empirical results where the estimation of compensated, uncompensated and expenditures elasticities for different food groups are briefly discussed and the last portion of this paper is composed of conclusion and recommendations.

2. Data and Methodology

2.1. Data and Data Sources

To estimate the food demand elasticities we used Linear Approximate almost Ideal Demand system for thirteen food groups by using the recent available Household Integrated Economics Survey (HIES) of Pakistan for the year 2018–2019 issued by Pakistan Bureau of Statistics for analysis. The PSLM covers all the provinces of Pakistan except military protected and restricted areas. The total Sample size for this research study is 16,891 households, out of which 113,397 is rural and 55,534 is urban households.

2.2. Theoretical Model and Estimation

We estimated compensated and uncompensated own and cross price and expenditures elasticities by using the estimated coefficients from the Linear Approximate Almost Ideal Demand System (LA/AIDS) model. The LA/AIDS provide the first order approximation to the expenditures functions and satisfies the axioms of consumer choices and allows for investigating interdependence among products (Byrne, Capps and Shaha, 1996). Although majority of the studies have used LA/AIDS model for the estimation of demand system. Like study conducted by G. Mustafa, W. Huo, A. Pervaiz, M. R. Ullah and M. Zulfiqar (Mustafa et al., 2022) have used the LA/AIDS model for only four food categories i. e meat, vegetables, fruits and pulses which is a major limitation of their study. While in our study we categorized the food into thirteen food groups including milk, meat, fruits, vegetables, sugar, beverages, cereals, wheat, rice, oil & fats, tea, condiments and baked products thus providing an in depth picture of the consumers response to the price. Likewise (Ullah and Jan, 2016; Hayat, Hussain and Yousaf, 2016; Anindita, Sa'diyah and Khoiriyah, 2022; Tarrega et al., 2020; Shaheryar et al., 2022) estimated elasticities by using LA/AIDS model. In the current study we have not only estimated the compensated, uncompensated and expenditures elasticities for these thirteen food groups but also our major focus is on the estimation of potential impact of higher food prices on consumers and we actually quantify that how much additional income is required to compensate the consumers.

2.3. Specification and Estimation of the LA/AIDS

A. Deaton and L. Muellbauer (Deaton and Muellbauer, 1980a; 1980b) derived the LA/AIDS from a flexible expenditure function with Price Independent Generalized Logarithmic preference that is extremely useful for estimating a demand system with many desirable properties. The AIDS model automatically satisfies the aggregation restriction and with simple parametric restrictions, homogeneity and symmetry can be imposed. The LA/AIDS system in its budget share form is given as:

$$w_i = \alpha_i + \sum_j \gamma_{ij} lnp_j + \beta_i \ln\left(x / p\right) + \mu_i, \quad (1)$$

where α_i, β_i and γ_{ij} are the parameters that need to be estimated; w_i is the budget share of good *i*; p_j is the price of good *j* and *x* is the total expenditure; *P* is the aggregate price index approximated by Laspeyres Price Index that is defined by $\ln\left(P^L\right) = \sum_i \overline{w_i} \ln\left(P_i\right)$; n

is the number of goods; ln is the natural logarithm, where $\gamma_{ij} = \frac{1}{2}\left(\gamma^{*}_{ij} + \gamma^{*}_{ji}\right) = \gamma_{ji}$ for two goods *i* and *j*. Separability is imposed at the food level, implying that consumers modify their optimal food consumption bundle when relative prices of individual foods change, given an optimal allocation of expenditure on food. Due to separability, the marginal rate of substitution (MRS) between any food items is independent of the changes in the non-food items. Hence, the individual food price change influence non-food consumption expenditures only through their influence on the allocation of total expenditures to food and non-food. The advantage of separability lies in the fact that at each stage of budgeting, information appropriate to the stage is required.

To account for the household characteristics, equation (1) is augmented with household specific socioeconomic, demographic, and regional characteristics, using the following relationship proposed by Pollack and Wales (1981).

$$\mathrm{D}^{\mathrm{i}}\left(\eta\right) = \sum_{\mathrm{r}=1}^{\mathrm{N}} \delta_{\mathrm{ir}} \eta_{\mathrm{r}}, \tag{2}$$

where η_{r} is a matrix of socioeconomic variables, and δ_{ir} is the vector of parameters. The socioeconomic variables include household size measured as the number of household members; a binary variable for marital status of the household; and regional dummies representing the urban and rural region. Binary variables are equal to 1 when the phenomenon exists and 0 otherwise (for example, marital status equals (1) when the household is married, otherwise it is 0). In this study, socioeconomic, demographic, and regional characteristics included in Equation (1) as follows:

$$w_i = \alpha_i^{***} + \sum_k \delta_{ik} \eta_k + \sum_j \gamma_{ij} \ln\left(p_j\right) + \beta_i (\ln\left(x\right) - \sum_j \overline{w}_j \ln\left(p_j\right)) + \mu_i^{***}, \tag{3}$$

where $\alpha_i^{***} = \alpha_i^{**} - \sum_k \delta_{ik} \eta_k$. The demographic and dummy variables used in the complete demand system are the same as the ones used in single equation models.

Equation (3) is estimated for overall Pakistan. The budget shares and the price included in equation (3) are for thirteen food groups: milk, meat, fruits, vegetables, beverages, sugar, cereals, wheat, rice, oil & fats, tea, condiments and baked products. The theoretical restrictions, i. e. adding up, homogeneity and symmetry imposed during the estimation process is as follow:

$$\sum_i \alpha^{***} = 1, \text{ and } \sum_i \delta_{ik} = 0, \quad k = 1, \ldots\ldots\ldots, m. \tag{4}$$

To estimate the system of equation in per capita terms the seemingly unrelated regression estimation method of A. Zellner (Zellner, 1963) is employed. Using the delta method the statistical significance of the estimated elasticities is employed. If a surveyed household does not consume a commodity, then the price for that commodity is missing; to keep these (missing) observations in the analysis, missing prices are replaced by average prices (Cox and Wohlgenant, 1986). Imposing the property of additivity of the expenditure function makes the variance and covariance matrix singular; thus, one of the equations needs to be omitted to estimate the LA-AIDS. The expenditure equation for

"other food" is omitted, and the coefficients for the omitted equation are derived using the theoretical conditions imposed on the estimation process. However, the coefficients estimated using LA/AIDS are invariant to the omitted equation.

2.4. Demand Elasticities for the LA/AIDS Model

The elasticity derivations for the LA/AIDS models are widely investigated and well documented. Following (Buse, 1994; Green and Alston, 1990), taking the derivative of equation (3) with respect to ln(x), the expenditure elasticity e_i can be obtained as follows:

$$e_i = 1 + \left(\frac{1}{w_i}\right)\left(\frac{\partial w_i}{\partial \ln(x)}\right) = 1 + \left(\frac{\beta_i}{w_i}\right). \quad (5)$$

Taking the derivative with respect to ln (p_j), uncompensated own ($j = i$) and cross ($j \neq i$) price elasticities, $e_{ij}^{\text{LA/AIDS}}$, become as follows:

$$e_{ij}^{\text{LA/AIDS}} = -\ \delta_{ij}\left(\frac{i}{w_i}\right)\left(\frac{\partial w_i}{\partial p_j}\right) = -\ \delta_{ij} + \left(\frac{\gamma_{ij}}{\overline{w}_i}\right) - \left(\frac{\beta_i}{\overline{w}_i}\right)\overline{w}_j \quad \forall_i,\ j = 1,\ldots\ldots,\ n, \quad (6)$$

where δ_{ij} is the Kronecker delta that is unity if $i = j$, and zero otherwise. The Hicksian compensated price elasticities can be derived for the LA/AIDS model. The compensated price elasticities, $s_{ij}^{\text{LA/AIDS}}$, become as follows:

$$s_{ij}^{\text{LA/AIDS}} = e_{ij} + e_i w_j = -\ \delta_{ij} + \left(\frac{\gamma_{ij}}{\overline{w}_j}\right) + \overline{w}_j \quad \forall_i,\ j = 1,\ldots\ldots,\ n. \quad (7)$$

3. Results and Discussion

This section of the study presents and discusses the detailed results obtained from the estimation of the LA/AIDS model for the selected food groups. All the coefficients obtained from the demand model satisfies the homogeneity, adding up, negativity and symmetry restrictions and agree with priori theoretical expectations as shown in Appendix 1. Overall from the table it is evident that maximum number of parameters from the LA/AIDS model are significant at 99 significance level.

3.1. Uncompensated, Compensated Own price and Expenditures Elasticities

According to demand theory the quantity demanded of a commodity has an inverse relation with its own price. Consumer's response to a price change is represented by own price elasticities and to examine its effect both the uncompensated and compensated own price elasticities were estimated. The uncompensated own price elasticities of demand represents both the income and substitution effects while, on the other hand the compensated own price demand elasticities reflects the substitution effect only holding the level of utility constant. Both the uncompensated and uncompensated demand elasticities are given in Table 1. All the estimated elasticities shows that consumers were quite responsive to a price change

as per prior expectation. All off the elasticities given in the table are having a negative sign. The uncompensated own price elasticities ranges from –1.115 for milk to –0.209 for fruits. Milk (–1.115), sugar (–1.094), cereals (–1.089) and tea (–1.035) having elasticities greater than unity suggests that all these food groups were highly responsive to its own price. While, for all other food groups the estimated elasticities were less than unity. The compensated own price elasticities of demand ranges from –1.608 for cereals to –0.199 for wheat. Wheat and rice being the basic components of our daily diet is having both the uncompensated and compensated demand elasticities less than unity suggests that consumers were less responsive to its price. Unlike our results (Moloko, Dzanja and Chilongo, 2018) reported meat, beans and salt were elastic item in their research area. While, meat having the most elastic (–25.29) shows an outlier in their study. Similarly G. Mustafa, W. Huo, A. Pervaiz, M. R. Ullah and M. Zulfiqar (Mustafa et al., 2022) reported pulses and vegetables as inelastic food item while meat and fruits were found luxury items in their study.

To attain a specific level of utility households spends their income on the purchase of certain goods. The estimated expenditures elasticities thus provides a useful insight to into the consumption level of the consumers. Based on the expenditures elasticities food groups can be categorized into necessities (having value less than one) and luxuries (having values greater than one). Table 1 shows that the expenditures elasticities for all the food groups are positive ranging from 1.342 for milk to 0.512 for meat. Milk (1.342), fruits (1.012), and sugar (1.172) having elasticities greater than one suggests that these food groups were considered as luxuries by the households. Like our findings Yams, meat, fish, dairy products and fruits were

Table 1. **Uncompensated, Compensated Own Price and Expenditures Elasticities, 2018–2019**

Variables	Uncompensated Own Price Elasticities	Compensated Own price Elasticities	Expenditure Elasticities
Milk	–1.115***	–0.737***	1.342***
Meat	–0.316***	–0.259***	0.512***
Fruits	–0.209***	–0.153***	1.012***
Vegetables	–0.564***	–0.471***	0.950***
Sugar	–1.094***	–1.027***	1.172***
Beverages	–0.629***	–0.608***	0.807***
Cereals	–1.089***	–1.060***	0.935***
Wheat	–0.299**	–0.199***	0.732***
Rice	–0.943***	–0.933***	0.723***
Oil & fats	–0.304***	–0.242***	0.737***
Tea	–1.035***	–1.006***	0.874***
Condiments	–0.258***	–0.233***	0.836***
Baked Product	–0.906***	–0.795***	0.825***

Note: *** indicates significant at 99 %; ** significant 95 %; * significant at 90 %.

Source: Author's own estimation from HIES, 2018–2019.

found luxury food item by N. Lokugem, S. Zivkovic, K. Lange and B. Chidmi (Lokugem et al., 2019), while cereals vegetables and pulses are income elastic food items. Meat, vegetables, beverages, cereals, wheat, rice, oil & fats, tea, condiments and baked products having expenditures elasticities of 0.512, 0.950, 0.807, 0.935, 0.723, 0.737, 0.874, 0.836 and 0.825 respectively can be regarded as necessities. Our results are in contrast with A. M. Ibrahim, R. Elzaki, M. Y. Sisman and A. M. Mahish (Ibrahim, 2018; Elzaki, Sisman and Mahish, 2021) who reported income elastic demand for meat group. Similarly the studies conducted by A. V. Zamora, R. García-Mata, M. A. Martínez-Damian and R. C. García-Sanchez (Zamora et al., 2021) reported fruit as a luxury food item, whereas N. Hayat, A. Hussain and H. Yousaf, R. Anindita, A. A. Sa'diyah and N. Khoiriyah (Hayat, Hussain and Yousaf, 2016; Anindita, Sa'diyah and Khoiriyah, 2022) found meat as a luxury food and their results are consistent with our findings.

3.2. Uncompensated cross price elasticities

Table 2 shows uncompensated cross price elasticities for all the food groups' indication a substitutive or complementary significant relations. When income of the households changes they decide to save a portion of their income and spent the rest on the purchase of certain items. Positive cross price elasticities show that food groups are substitutes while negative cross price elasticities indicated that both the food group are gross complements. The results indicate that milk is having complementary relation with all the food groups except oil & fats (0.079). The uncompensated cross price elasticities for meat show that wheat (–0.223), oils & fats (–0.072) and tea (–0.013) is having significant complementary relation. G. Forero-Cantor, J. Ribal, N. Sanjuán (Forero-Cantor, Ribal and Sanjuán, 2020) reported chicken as a substitute for dairy products and eggs. Fruits is having a significant complementary relation with wheat (–0.142), oil & fats (–0.072) and baked products (–0.022). Cereals (0.012) are the only food group having substitutive relation with the vegetables. All the food groups shows a complementary except cereals (0.025) with sugar. Wheat (–0.099), oils & fats (–0.156) and baked products (–0.032) is having a complementary relation with beverages. The cross price elasticities of wheat (–0.069), oil & fats (–0.049) and baked products (–0.009) shows a complementary relation with the cereals food group. Wheat is having complementary relation with all food groups expect rice (0.001). While, rice is having substitutive relation with all food group except oil & fats (–0.078). Condiments (0.019) is the only food group having substitutive relation with the oil & fats. The cross price elasticity of baked product (0.049) shows a substitutive relation with the tea. While baked products (–0.031) shows a complementary relation with the condiments. The elasticities of substitution reported by E. Lopez and E. Pagoulatos (Lopez and Pagoulatos, 2003) ranged from 0.09 for wines, brandy and spirit to 5.93 for soya bean oil mills.

3.3. Compensated Cross Price Elasticities

All the compensated cross price elasticities of demand are shown in Table 3. The positive compensated elasticities of demand for oil & fats (0.079) shows a substitutive relation with milk. While, for the reaming food groups all the foods groups are having a complementary relation with the milk. Fruits (0.011), vegetables (0.030), sugar (0.060), beverages (0.086), cereals (0.084), rice (0.155), condiments (0.079) and baked products (0.053) are having substitutive relation with the meat. Only wheat (–0.143), oil & fats (–0.072) and baked products (–0.022) are having complementary relation with fruits. In case of vegetables

Table 2. **Estimated Un-Compensated (Marshallian) Own Price and Cross Price Elasticities**

Variables	Milk	Meat	Fruits	Vegetables	Sugar	Beverages	Cereals	Wheat	Rice	Oils & fats	Tea	Condiments	Baked product
Milk	**–1.115***** (0.0058)												
Meat	–0.210*** (0.0075)	**0.316***** (0.0124)											
Fruits	–0.099*** (0.0069)	0.011*** (0.0109)	**-0.209***** (0.0113)										
Vegetables	–0.114*** (0.0089)	0.030*** (0.0146)	0.016*** (0.0153)	**–0.564***** (0.0087)									
Sugar	–0.095*** (0.0033)	0.060*** (0.0050)	0.023*** (0.0052)	–0.030*** (0.0029)	**–1.094***** (0.0047)								
Beverages	–0.070*** (0.0059)	0.086*** (0.0092)	0.151*** (0.0095)	–0.015*** (0.0055)	–0.022*** (0.0087)	**–0.629***** (0.0096)							
Cereals	–0.110*** (0.0027)	0.084*** (0.0039)	0.011*** (0.0040)	0.012*** (0.0023)	0.025*** (0.0037)	0.005*** (0.0041)	**–1.089***** (0.0038)						
Wheat	–0.113*** (0.0199)	–0.223*** (0.0330)	–0.143*** (0.0347)	–0.285*** (0.0198)	–0.099*** (0.0318)	–0.069*** (0.0353)	0.412*** (0.0331)	**–0.299***** (0.0212)					
Rice	–0.098*** (0.0087)	0.155*** (0.0139)	0.042*** (0.0145)	–0.059*** (0.0083)	–0.034*** (0.0133)	0.003*** (0.0147)	–0.082*** (0.0138)	0.001*** (0.0090)	**–0.943***** (0.0186)				
Oils & fats	0.079*** (0.0111)	–0.076*** (0.0179)	–0.072*** (0.0187)	–0.251*** (0.0107)	–0.107*** (0.0171)	–0.156*** (0.0189)	0.014*** (0.0178)	–0.261*** (0.0115)	–0.078*** (0.0241)	**–0.304***** (0.0100)			
Tea	–0.007*** (0.0070)	–0.013*** (0.0113)	0.053*** (0.0119)	–0.053*** (0.0068)	–0.070*** (0.0109)	0.010*** (0.0120)	–0.011 (0.0113)	–0.060*** (0.0073)	0.255*** (0.0172)	–0.018*** (0.0063)	**–1.035***** (0.0092)		
Condiments	–0.091*** (0.0081)	0.079*** (0.0129)	0.066*** (0.0134)	–0.101*** (0.0077)	–0.123*** (0.0123)	0.001*** (0.0136)	–0.049*** (0.0127)	–0.121*** (0.0083)	0.004*** (0.0154)	0.019*** (0.0071)	–0.010*** (0.0104)	**–0.258***** 0(.0095)	
Baked products	–0.105*** (0.0050)	0.053*** (0.0078)	–0.022*** (0.0081)	–0.029*** (0.0046)	0.055*** (0.0074)	–0.032*** (0.0082)	–0.009 (0.0077)	0.027*** (0.0050)	0.057*** (0.0105)	–0.042*** (0.0043)	0.049*** (0.0062)	–0.031*** (0.0057)	**–0.906***** (0.005)

Note: *** indicates significant at 99%; ** significant 95%; * significant at 90%. Figures in the parenthesis represents the standard errors.

Source: Author's own estimation from HIES, 2018–2019.

Table 3. **Estimated Compensated (Hessian) Own Price and Cross Price Elasticities**

Variables	Milk	Meat	Fruits	Veg	Sugar	Beverages	Cereals	Wheat	Rice	Oil & fats	Tea	Condi-ments	Baked product
Milk	**–0.737***** (0.0058)												
Meat	–0.004 (0.0075)	**–0.259***** (0.0124)											
Fruits	0.053*** (0.0064)	0.117*** (0.0107)	**–0.153***** (0.0112)										
Veg	0.080*** (0.0088)	0.074*** (0.0146)	0.115*** (0.0154)	**–0.471***** (0.0087)									
Sugar	0.084*** (0.0030)	0.064*** (0.0049)	0.082*** (0.0052)	0.022*** (0.0029)	**–1.027***** (0.0048)								
Beverages	0.028*** (0.0054)	0.059*** (0.0090)	0.178*** (0.0094)	0.006 (0.0054)	–0.058*** (0.0086)	**–0.608***** (0.0096)							
Cereals	0.018*** (0.0023)	0.062*** (0.0039)	0.043*** (0.0041)	0.039*** (0.0023)	0.067*** (0.0037)	0.032 (0.0041)	**–1.060***** (0.0039)						
Wheat	0.119*** (0.0199)	–0.141*** (0.0330)	–0.007 (0.0347)	–0.155*** (0.0198)	0.046 (0.0318)	0.061*** (0.0353)	0.014*** (0.0025)	**–0.199***** (0.0212)					
Rice	0.045*** (0.0082)	0.149*** (0.0137)	0.089*** (0.0144)	–0.017 (0.0082)	0.023* (0.0132)	0.044** (0.0146)	0.032*** (0.0053)	0.011 (0.0088)	**–0.933***** (0.0186)				
Oil & fats	0.260*** (0.0106)	–0.045* (0.0177)	0.013 (0.0186)	–0.171*** (0.0106)	–0.013 (0.0170)	–0.076*** (0.0189)	0.317*** (0.0177)	–0.213*** (0.0113)	–0.030 (0.0241)	**–0.242***** (0.0092)			
Tea	0.136*** (0.0068)	–0.033** (0.0113)	0.087*** (0.0118)	–0.025*** (0.0067)	–0.026 (0.0108)	0.038** (0.0120)	0.020* (0.0113)	–0.063*** (0.0072)	0.001 (0.0153)	–0.007 (0.0063)	**–1.006***** (0.0092)		
Condi-ments	0.035*** (0.0076)	0.056*** (0.0126)	0.097*** (0.0133)	–0.076*** (0.0076)	–0.083*** (0.0122)	0.026 (0.0135)	–0.021* (0.0127)	–0.127*** (0.0081)	0.249 (0.0172)	0.027*** (0.0071)	0.017 (0.0103)	**–0.233***** (0.0062)	
Baked product	0.006*** (0.0046)	0.014* (0.0076)	–0.007 (0.0080)	–0.020*** (0.0046)	0.080*** (0.0073)	–0.022** (0.0082)	0.003 (0.0077)	0.005 (0.0049)	0.052*** (0.0104)	0.034*** (0.0043)	0.060*** (0.0094)	–0.021*** (0.0057)	**–0.795***** (0.0103)

N o t e: *** indicates significant at 99%; ** significant 95%; * significant at 90%. Figures in the parenthesis represents the standard errors.

S o u r c e: Author's own estimation from HIES, 2018–2019.

the compensated cross price elasticities for cereals (0.011) only shows a substitutive relation with vegetables. While for sugar only baked products (0.055) is having a substitutive relation. Food groups like Wheat (–0.069), oils & fats (–0.156) and baked products (–0.032) are having complementary relation with beverages. Oils & fats (0.014) is the only food group having a substitutive relation with cereals group. Oils & fats (–0.261), tea (–0.060) and condiments (–0.121) are food group having a complementary relation with wheat. For rice only oils & fats (–0.078) is the only food group having a complementary relation with each other. Tea (–0.018) and baked products (–0.042) both groups shows a complementary relation with oils & fats. Condiments (–0.010) shows a complementary, while baked products (0.049) shows a substitutive relation with tea. Both baked products (–0.031) and condiments is having a complementary relation as shown by their negative compensated cross price elasticity.

3.4. Simulation Results

To fully gain insight into what can be learned from these elasticities simulation results were applied to the uncompensated demand elasticities. The estimated elasticities show the response of a quantity demanded to a price change indicating allocation of budget share to these food groups. Inelastic demand for a food group shows a positive relationship between price and market share and will result in an increased revenue. Ultimately the impact of increased price on the share of each food group is the summation of direct impact on the demand for that food group and the substitution effect on the other food group. Any increase in the price of the food groups need compensation in terms of increased income of the household's to stay

Table 4. **Per Month Expected Price Increase for Food Groups in Pakistan**

Food Groups	Own Price Elasticities	Required Expenditures		
		5 Percent	10 Percent	15 Percent
Milk	–1.115	287.33	602.02	944.07
Meat	–0.316	21.70	45.46	71.29
Fruits	–0.209	7.08	14.84	23.28
Vegetables	–0.564	8.99	18.83	29.53
Sugar	–1.094	80.68	169.04	265.09
Beverages	–0.629	4.54	9.51	14.92
Cereals	–1.089	101.58	212.83	333.76
Wheat	–0.299	27.67	57.97	90.90
Rice	–0.943	32.82	68.76	107.82
Oil & fats	–0.304	18.04	37.80	59.28
Tea	–1.035	4.01	8.41	13.18
Condiments	–0.258	5.45	11.42	17.92
Baked Product	–0.906	8.84	18.52	29.04

Source: Author's own estimation from HIES, 2018–2019.

on the same indifference curve. If any one category having large expenditures share among the food group, then increase in the price reduces the purchasing power by a substantial amount.

Table 4 shows the simulation results, which illustrates the required per month expenditures/income when the respected food group's price increased. An increase of 5 to 15 percent in milk price required an amount of Rs. 287.33 to Rs. 944.07. The required expenditures are Rs. 21.70, 45.46 and 71.29 for meat when the prices increase to 5, 10 and 15 percent. The required expenditures for cereals, i. e. Rs. 101.58, Rs. 212.83 and Rs. 333.76 at simulated increase of 5, 10 and 15 percent. Among the food groups the highest required expenditures were observed for milk Rs. 944.07, followed by Rs. 333.76 for cereals, Rs. 265 for sugar and Rs. 107 for rice food group. These result exhibit that the estimated loss in the consumption were consistently high for milk, sugar, cereals, rice, wheat, meat and oil & fats. Increase in the prices of these food groups could result in huge welfare loss.

Conclusion and Recommendations

Food being the basic need of life and its demand has gigantic effect on the social, political and economic stability in the country. For this reason, it is imperative to gain knowledge of food demand and its elasticities that will result increase access to food in Pakistan. Change in the income level and prices of food results in shifts of consumers' expenditure and welfare loss can be predicted using demand elasticities. Therefore, this research estimated the Almost Ideal Demand System for thirteen food groups to provide future base food policies designing with the objective of food security. The estimated model was used to simulate different prices increase scenarios and to estimate the associated loss in consumers' welfare and how much additional income would be required to offset this loss in welfare to compensate the households. Using the uncompensated own price elasticities and assuming the price increase of 5, 10 and 15 percent in each of the commodity own price.

We find out that the estimated loss in the consumption were consistently high for milk, sugar, cereals, rice, wheat, meat and oil & fats. Increase in the prices of these food groups could result in huge welfare loss. In the current scenario where food inflation in Pakistan is more than 15 percent.

In order to compensate the consumers' would require thousands of rupees to consume the same old food basket. The issue of limited diversity in the dietary pattern and persistently food inflation will definitely result in an alarming food security in the country. Effect of increase in the general price level on food consumption could only be reduced by enhancing households' purchasing power in the current scenario. The outcome of this research study will help policy makers in the agriculture sector to develop reliable and sound policy designs that will help control the implications of food inflation on household welfare loss.

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Потенциальное влияние продовольственной инфляции на благосостояние домашних хозяйств: пример Исламской Республики Пакистан

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Мировой продовольственный кризис 2007–2008 гг. и рост продовольственной инфляции привлекли внимание исследователей к причинам и последствиям волатильности цен на продовольствие во всем мире. Цель написания данной работы заключается в изучении потенциального влияния продовольственной инфляции на благосостояние домашних хозяйств в Пакистане. Для достижения поставленной цели авторами была использована гибкая система почти идеального спроса (LA/AIDS) для оценки структуры спроса на продукты питания с применением доступных данных интегрированного экономического исследования домашних хозяйств Пакистана за 2018–2019 гг. Продовольственные товары были разделены на 13 групп, включая молоко, мясо, фрукты, овощи, сахар, напитки, крупы, пшеницу, рис, масла и жиры, чай, приправы и хлебобулочные изделия. Расчетная модель использовалась для имитации различных сценариев повышения цен на каждую из групп товаров. Выяснилось, что расчетные потери в потреблении были стабильно высокими для молока, сахара, круп, риса, пшеницы, мяса, масла и жиров. Проблема ограниченного разнообразия в структуре питания и сохраняющаяся продовольственная инфляция, безусловно, приведут к ухудшению продовольственной безопасности страны. Снизить влияние роста общего уровня цен на потребление продуктов питания в современных условиях можно только путем повышения покупательной способности домашних хозяйств. Результаты данного исследования помогут экспертам в сельскохозяйственном секторе разработать надежные схемы, которые позволят контролировать последствия продовольственной инфляции, приводящие к снижению благосостояния домашних хозяйств.

Ключевые слова: продовольственная инфляция, продовольственная политика, эластичность, продовольственная безопасность, Пакистан.

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Appendix 1. **Parameter Estimates of the LA/AIDS Model for Overall Pakistan, 2018–2019**

Explanatory Variables	Milk	Meat	Fruit	Veg.	Sugar	Beverages	Cereals	Wheat	Rice	Oils & fats	Tea	Condiments	Baked products
lmilkp	–0.0052*** (0.0016)	–0.0059*** (0.0010)	0.0029*** (0.0006)	0.0034*** (0.0006)	–0.0018** (0.0005)	0.0002 (0.0003)	0.0033*** (0.0003)	–0.0029*** (0.0008)	0.0008 (0.0006)	–0.0032*** (0.0005)	0.0014*** (0.0003)	–0.0005** (0.0002)	0.0013*** (0.0002)
lmeatp	–0.0319*** (0.0021)	0.1324*** (0.0013)	–0.0017** (0.0007)	–0.0220*** (0.0007)	–0.0016 (0.0007)	–0.0027*** (0.0003)	–0.0034*** (0.0004)	–0.0284*** (0.0011)	–0.0161*** (0.0008)	–0.0172*** (0.0006)	–0.0042*** (0.0003)	–0.0053*** (0.0003)	–0.0020*** (0.0002)
lfruitp	–0.0007 (0.0018)	0.0068*** (0.0011)	0.0438*** (0.0006)	–0.0123*** (0.0006)	–0.0049*** (0.0006)	0.0001 (0.0003)	–0.0007 (0.0003)	–0.0227*** (0.0009)	0.0063*** (0.0007)	–0.0096*** (0.0005)	–0.0025*** (0.0003)	–0.0016*** (0.0002)	0.0020*** (0.0002)
lvegp	–0.0051** (0.0024)	–0.0026 (0.0016)	0.0009 (0.0008)	0.0423*** (0.0009)	0.0046*** (0.0008)	0.0065*** (0.0004)	–0.0009 (0.0005)	–0.0239*** (0.0013)	–0.0136*** (0.0009)	–0.0073*** (0.0007)	–0.0038*** (0.0004)	0.0005 (0.0003)	–0.0015*** (0.0003)
lSugarp	0.0073*** (0.0008)	0.0007 (0.0005)	0.0013*** (0.0003)	–0.0035*** (0.0003)	–0.0049*** (0.0003)	0.0008*** (0.0001)	0.0003 (0.0002)	–0.0021*** (0.0004)	0.0002 (0.0003)	–0.0004 (0.0002)	–0.0003** (0.0001)	–0.0010*** (0.0001)	–0.0005*** (0.0001)
lbvrgsp	0.0004 (0.0015)	0.0036*** (0.0009)	0.0084*** (0.0005)	–0.0020*** (0.0005)	0.0018*** (0.0005)	0.0096*** (0.0003)	–0.0003 (0.0003)	–0.0082*** (0.0008)	–0.0018*** (0.0006)	–0.0052*** (0.0004)	–0.0033*** (0.0002)	–0.0026*** (0.0002)	0.0001 (0.0002)
lcerealsp	–0.0040*** (0.0006)	0.0033*** (0.0004)	0.0006** (0.0002)	0.0007*** (0.0002)	0.0020*** (0.0002)	0.0000 (0.0001)	–0.0029*** (0.0001)	–0.0024*** (0.0003)	0.0000 (0.0002)	0.0002 (0.0002)	–0.0008*** (0.0001)	0.0012*** (0.0001)	0.0001 (0.0001)
lwheatp	–0.0047 (0.006)	–0.0304*** (0.0036)	–0.0079*** (0.0019)	–0.0285** (0.0019)	–0.0052** (0.0018)	–0.0019** (0.0009)	0.0130*** (0.0011)	0.0902*** (0.0029)	–0.0109*** (0.0021)	–0.0155*** (0.0016)	0.0069*** (0.0009)	–0.0132*** (0.0008)	–0.0018** (0.0007)
lricep	–0.0004 (0.0023)	0.0112*** (0.0015)	0.0024** (0.0008)	–0.0063** (0.0008)	–0.0014** (0.0008)	–0.0001 (00004)	–0.0027*** (0.0004)	–0.0048*** (0.0012)	0.0010 (0.0009)	0.0038*** (0.0006)	0.0000 (0.0004)	0.0070*** (0.0003)	0.0003 (0.0003)
loilsfatsp	0.0495*** (0.0030)	–0.0142*** (0.0019)	–0.0039*** (0.0010)	–0.0251*** (0.0010)	–0.0056*** (0.0010)	–0.0042*** (0.0005)	0.0074*** (0.0006)	–0.0403*** (0.0015)	–0.0053*** (0.0011)	0.0569*** (0.0008)	–0.0004 (0.0005)	–0.0067*** (0.0004)	–0.0011** (0.0003)
lteap	0.0291*** (0.0019)	–0.0073*** (0.0012)	0.0030*** (0.0007)	–0.0057*** (0.0007)	–0.0034*** (0.0006)	0.0001 (0.0004)	–0.0004 (0.0004)	–0.0131*** (0.0010)	–0.0015 (0.0007)	–0.0034*** (0.0005)	–0.0013*** (0.0003)	0.0008*** (0.0003)	–0.0005** (0.0002)
lcondmintsp	0.0014 (0.0021)	0.0028** (0.0013)	0.0037*** (0.0007)	–0.0104*** (0.0007)	–0.0065*** (0.0007)	–0.0001*** (0.0002)	–0.0016*** (0.0004)	–0.0213*** (0.0011)	0.0102*** (0.0008)	–0.0002 (0.0006)	–0.0005 (0.0003)	0.0224*** (0.0001)	0.0002 (0.0003)

lbckd-prdctp	–0.0024* (0.0013)	–0.0001 (0.0008)	–0.0012*** (0.0004)	–0.0034*** (0.0005)	0.0037*** (0.0004)	–0.0010*** (0.0003)	–0.0004*** (0.0002)	–0.0013 (0.0007)	0.0010 (0.0005)	0.0017*** (0.0004)	0.0015*** (0.0002)	–0.0011*** (0.0002)	0.0028*** (0.0002)
ltfoodV	0.0963*** (0.0019)	–0.0535*** (0.0012)	0.0007 (0.0007)	–0.0049*** (0.0007)	0.0099*** (0.0006)	–0.0051 (0.0001)	–0.0020 (0.0001)	–0.0363*** (0.0010)	–0.0129*** (0.0003)	–0.0222*** (0.0005)	–0.0042*** (0.0003)	–0.0050*** (0.0003)	–0.0026*** (0.0002)
lage_class	–0.0030*** (0.0007)	0.0014** (0.0004)	–0.0006*** (0.0008)	0.0001 (0.0002)	–0.0014*** (0.0002)	–0.0002*** (0.0001)	0.0004*** (0.0001)	0.0024*** (0.0004)	0.0005** (0.0003)	0.0006*** (0.0002)	0.0005*** (0.0001)	0.0002*** (0.0001)	–0.0002 (0.0001)
lhh_size	–0.0670*** (0.0017)	0.0176*** (0.0011)	–0.0122*** (0.0006)	–0.0013* (0.0006)	–0.0016** (0.0006)	–0.0065*** (0.0003)	0.0041** (0.0003)	0.0504*** (0.0009)	0.0117*** (0.0007)	0.0203*** (0.0005)	0.0041*** (0.0003)	0.0014 (0.0002)	–0.0026** (0.0002)
marital_status	0.0009 (0.0016)	0.0026 (0.0010)	0.0009 (0.0006)	–0.0011** (0.0006)	0.0003 (0.0005)	0.0004 (0.0003)	–0.0007 (0.0003)	–0.0007*** (0.0008)	–0.0011 (0.0006)	–0.0011 (0.0004)	0.0003 (0.0003)	–0.0003*** (0.0002)	0.0003 (0.0002)
_cons	–0.3078	–0.2834	–0.1669	0.5174	0.1340	0.0389	–0.0006	0.7281	0.2300	0.1336	0.0952	0.0614	0.0360
No. of Observation	24809	24809	24809	24809	24809	24809	24809	24809	24809	24809	24809	24809	24809
R Squared	0.2512	0.3732	0.2593	0.2113	0.1144	0.1909	0.0881	0.3684	0.1655	0.2371	0.1925	0.3007	0.1286
chi^2	8324.77	14769.8	8683.93	6645	3204.58	5852.49	2397.74	14471.14	4920.25	7709.74	5912.35	10667.34	3662.53

Note: *** indicates significant at 99%, ** significant 95% and * significant at 90%. Figures in the parenthesis represents the standard errors.