HOUSEHOLD'S DEMAND FOR ANIMAL FOOD: AN EMPIRICAL INVESTIGATION FROM PAKISTAN

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Abstract

The objective of study is to investigate household demand system for animal food in Pakistan. To accomplish this purpose Household Integrated Economic Survey data from 2018 to 2019 is taken for three different basket of animal food (i.e. meat, milk and fish). Household behavior is also analyzed by estimating on price, cross price and income elasticities of there different commodities groups. Empirical outcome of Almost Ideal Demand System (AIDS) indicates that income elasticities are positive for meat, milk and negative for fish. It implies household increase the demand for milk and meat as their income uplift. In case of own price elasticity milk is necessary and meat is luxury group. While, in case of cross price elasticity all of the three commodities groups are substitute to each other.
Keywords: Almost demand System, animal food demand, microdata, Pakistan.

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INTRODUCTION

Analysis of the food demand has been major concern of the economists because households' consumption is the important element of gross domestic product in any economy. Pattern of the households' consumption varies across the household on the basis of preferences, traditional culture, income and commodities prices. Household maximize their consumption pattern by demanding the different product at an optimal level. However, the demand analysis of food defines the ability and willingness of an individual to consume different food items. It's also relates with the nourishment and food security (Hayat et al., 2016). While food security also depends on the components of individuals income and the availability of food at the reasonable price level (Hariyati & Raharto, 2012). Therefore, at the households' level food security links with the availability as well as its affordability of the basic needs of foods items. And unavailability of foods security associates with the poverty (Akram, 2020). On the other hand, animal foods hold nutrients which cannot be produce automatically in human body. Undernourishment creates the health problems which reduce the productive capacity of individual and resultantly, at aggregate level GDP affected. Therefore community should produce animal foods (Akaichi & Revoredo-Giha, 2014; Legendre et al., 2008; Hayat et al., 2016).

Demand for animal foods is rising globally and changing the structure of food consumption due to rapid increase in population, urbanization, and changing lifestyles with boosts in income. Specially, in developing economies, share of value added products and animal's foods raises (WHO, 2003; Gerosa and Skoet, 2012). According to the United Nations Food and Agricultural Organization (FAO), during 1990 to 2009, aggregate meat consumption increased globally by almost 25 percent to almost 60 percent per capita. And it is expected that meat consumption will rise continuously by 1.7 percent per year through 2022. Similarly, in 2020 world milk consumption was approximately 190 million tons. According to the report per capita consumption of milk and dairy products is higher in developed countries, but the gap with many developing countries is reducing. In developing countries demand for milk products are escalating with increase in population growth, incomes, urbanization and changes in intakes. Such consumption tendency is prominent in East and Southeast Asia.

In the case of Pakistan main source of foods are agricultural sector as well as livestock sector. Agriculture sector comprises with crops food like food grains, pulses, vegetables, fruit and oil seeds. Conversely, livestock consists of animal food like milk, meat, egg and fish. But with the passage of time structure of food intakes has been changing in Pakistan. Empirically it observed that share of wheat in total calories declined while share of animal food and other sources rose. Nevertheless in Pakistan, both wheat and dairy products have approximately 30 percent share of the household budget and almost 16.47 percent of such share went to dairy products (Friedmen et al. 2011).

Keeping in mind, the above opinion related to the importance of animal food. The present study examines the household behavior about the food demand. In this regard, household size and three different animal food groups (i.e. milk, meat and fish) data is taken from the HIES. Further, the Almost Ideal Demand System (AIDS) model used to empirically analyze the demand behavior of household. The study divide in two four section, introduction base on I, while II, III, and IV based on literature, data, methodology and results and conclusion respectively.

STATEMENT OF PROBLEM

Food demand for any commodity delineates the preferences and consumption behavior of the individual. Globally demand structure for food changes, not only due to increasing population growth, but also increase in the per capita consumption in the return of growing investment in food products. In such changing consumption pattern, Livestock products have vital role for the healthy growth of human being. Such as, these products provide quality protein and quality protein for both nutrient weak people and healthy people in proper amounts. Therefore, it is important to analyze the combination of animal food for healthy intakes.

RESEARCH OBJECTIVES

The objectives of current study are following as:

• To analyze the household behavior and preferences about different animals' foods by sharing their budget among these given food items.

• To investigate the influences of prices as well as income on household demand by examining on price, cross price and income elasticities respectively.

• To identify the magnitude of elasticities for policy recommendation.

HYPOTHESES OF STUDY

• Household preferences raise for animal food

• Animal food prices have impact on the behavior of household to the purchase the food.

• Households' incomes affect the attitude of households towards the purchase of such food.

LITERATURE REVIEW

The debate related to the individuals' consumption behavior started during 80s in Northern Europe. In this regard Stigler (1954) conducted the significant study on the base of survey data and highlighted that with the low income individuals spent more of their incomes on food and reduce such share as their income increases. So to analyze household's utility behavior economist started to find out the demand function of particular commodity. In addition Alfred Marshall defined that demand for particular commodity base on income, its own price and prices of other commodities, where Individual's nominal income and prices of other commodities keep constant to find out the maximum utility of particular good. Later on John Hicks defined that demand for particular commodity is the function of prices and quantity purchase. According to him individual minimizes his expenditure by keeping the utility constant. Empirically several studies analyze the nature of individual's demand by estimating income, own price and cross price elasticities with different demand models.

Farooq, *et al*., (1999) empirically examine the farm households' consumption behavior in response of changes in prices, incomes and age composition of household in the case of Pakistan at district level. In this regard authors use the Almost Ideal Demand System (AIDS) model and observe that demand for dairy products and meat are income elastic. This implies that these are luxury products. They also observe that if other thing remains same, increase in family size reduces the demand for dairy products and meat. While increase in households income raises demand for these products. Similarly another study Ghafoor, *et al.,* (2012) in comparison of vegetal products and animal food products (milk, eggs and meat) reveals income elaticities of animal food demand are positive.

Haq, *et al.,* (2009), study evaluates expenditure elasticities, compensated (Hicksian) and uncompensated (Marshallian) own and cross price elasticities for the NWFP province of Pakistan by taking HIES data from 2004 to 2005[1]. Linear Approximate Almost Ideal Demand model (LA-AIDS) for eight commodities concludes that all the commodities are normal however; demand for milk and meat is inelastic and elastic respectively. Another study of Haq, *et al., (*2011), follows the same pattern for rural and urban sector of the Punjab province of Pakistan, Concludes that price elasticities for all eight commodities counting milk and meat are less than one and income elasticities for both milk and meat are greater than one. Further In comparison of rural sector they recommend that urban sector is not sensitive to price change as the rural sector.

Rahman, *et al*., (2019) by using aggregated and disaggregated food models, estimates the individual preferences for animal food. Empirical results from LA-AIDS on the bases of United States data (from 1999 to 2016) indicate that own price elasticities hold the theory i.e. demand raises as prices fall. While cross prices elasticities show that animal food commodities are

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[1] The HIES collects data on household characteristics, consumption patterns, household income by source, and social indicators.

substitute for each other. At last weak separability test recommend that non meat commodities are removable form meat commodities.

In another study, Khoiriyah, *et al*., (2020) by using QUAIDS model observe that house hold size has a significant role to analyze the animal food consumption in Indonesia. They highlighted that all food items are elastic except egg. A beef demand is more effective by the changes in income and price. However growing meat and chicken consumption determine the beef prices. By estimating the same demand system Akram (2020) analyzes the consumer behavior regarding the eighteen food groups. From the empirical analysis study find outs that in case of Pakistan, demographic and transaction factors affect demand for specific product. Like No of dependence of household, age and education of family head and residence ownership have significant influence on demand. Ownership of residence significantly raises the demand for luxurious foods (i.e. hoteling, mutton, beef and chicken). Whereas increase in age and education of household raise the demand for nutritious food (i.e. vegetables, milk, eggs, yogurt, meet and dry fruits).

Hina and Abba (2021) investigate the food demand at the provincial level of Pakistan by taking Household Integrated Income and Consumption Survey (HICS) 2015-2016. Further to analyze the future demand of some products, consumption behavior of households and elasticity's of demand are examine at both national and provincial level respectively. By using AIDS model study observes that, in the individual's pattern of demand changes in income, prices and some social economic factors (i.e. household size, literacy of head and occupation) have a significant role. Empirical result also shows that there is no inferior commodities in the given food bundle because income elasticities are positive in all over the Pakistan. Whereas vegetables, Clarified butter, Sugar and pulses are necessary commodities. On other side, grain, meat and milk are luxuries. Household's further estimated demand from 2016 to 2040 also indicates that with the passage of time per capita demand of all given food stuffs in Khyber Pakhtun khwa (KPK) will beat Punjab.

From the above literature, it apparent that mostly study used different commodities groups to examine the consumption patter of households. Specifically, analysis on animal food demand is missing. So, present study fills this gap by analyzing the animal food (i.e. chicken, beef, mutton fish and milk product) demand for households. Further income, on price and cross price elasticities will measure to find the household's consumption and preference regarding specific product.

DATA AND MODEL SPECIFICATION

DATA

The present study takes micro data of Household Integrated Economic Survey (HIES) 2018-2019 conducted by Pakistan Bureau of Statistics. The data is counted on monthly bases and major animal food items are classified into three groups: 1) Meat (Beef, mutton and chicken); 2) Milk (milk fresh, milk tetra pack and lassi made with yogurt) and 3) Fish (frozen, Prawns and Shrimps). The Study considers all the household of survey and drives prices of all food items and income share of household.

METHODOLOGY

The theory related to demand for goods and services base on notions of commodities sets, utility function and order of preferences of consumers. Practically to analyze the demand system three main approaches were used. In the first approach, equations connected to utility maximization problem are solved through Linear Expenditure System (Stone, 1954) and Indirect Addilog Model (Paris and Houthakker, 1955). In the second approach demand system based on Ad-hoc Naive Model (Deaton 1986) conditions, where identified theoretical restrictions are imposed (like in Generalized Addilog Demand System by Theil 1969). In the third approach demand system is conducted by estimating the arbitrarily particular functional form through Rotterdam model (Theil, 1965), Translog model (Christensen et al., 1975), Almost Ideal Demand System

(Deaton & Muellbauer, 1980). The present study uses Almost Ideal Demand System (AIDS). In addition, this system is used as a trademark to obtain optimal consumes quantity for each group of commodities by using commodity category spending and group prices alone.

The demand system is built on an expenditure function that is specified below, where I, U, P represent total expenditure, utility and the price respectively.

$$\ln[I(P, U)] = (1 - U)\ln[\alpha(P)] + U\ln[\beta(P)] \tag{1}$$

Where

$$\ln[\alpha(P)] = \alpha_0 + \sum_k \alpha_k \ln(P_k) + \tfrac{1}{2}\sum_k \sum_j \psi_{kj}\ln(P_k)\ln(P_j) \tag{2}$$

$$\ln[\beta(P)] = \ln[\alpha(P)] + \beta_0 \prod_k P_k^{\beta_k} \tag{3}$$

Put equation 2 and 3 in 1, yield

$$\text{Ln}[\alpha(P)] = \alpha_0 + \sum_k \alpha_k \ln(P_k) + \tfrac{1}{2}\sum_k \sum_j \psi_{kj}\ln(P_k)\ln(P_j) + U\beta_0 \prod_k P_k^{\beta_k} \tag{4}$$

Demand function for food commodity is obtained in two parts. By taking derivative of the above expenditure function with respect to log(   ) and compensated demand function is obtained by applying Shepherd's lemma in the first part. In the second   is to substitute in the resulting equation the indirect utility function, which can be obtained by inverting the above expenditure function. The result would be yield in form of expenditure share where P is the price index

$$S_i = \alpha_i + \sum_{j=1}^{3} \Psi_{ij}\ln(P_j) + \beta_i \ln\left(\frac{X}{P}\right) + \mu_{it} \tag{5}$$

Where

S_i is share of budget for ith commodity group, it describes the ratio of expenditure of particular group to total expenditure i.e. S_i= pi qi/∑pi qi where qi is the quantity of i th commodity. X is Per capita expenditure on all food and obtains as ∑pi qi /h, where h is the household size. P is price index calculated by Stone as $\ln P = \sum S_i \ln P_j$. Pj represent prices unit or aggregate. i, denote for commodity and j for groups. a_i, Ψ_{ij} and β_i are parameters to be estimated where; a_i represents intercept, Ψ_{ij} is assign to measure the effects of price changes in jth commodities groups, β_i represents the influence of real income relative to a change in expenditure shares of   ith commodities.

Ston's Price index with per capita expenditures is constructed as:

$$\ln(X / P) = \ln X - \ln P \tag{6}$$

To achieve the requirements of utility maximization, some restrictions are imposed on the coefficients of equation 5, which consist of theoretical features of demand system. Restriction are Specified as, adding up condition indicates that sum of expenditure shares on all commodities will be equal to one ($\sum S_i = 1$), restriction of homogeneity specifies that changes in all prices and income do not affect the quantity demand, symmetry condition suggests that Slutsky matrix of the compensated price effect is negative it implies that transitivity exists among the individual choices. The AIDS model automatically satisfies these restrictions, adding up is verified if $\sum_i \alpha_i = 1$, $\sum_i \psi_i = 0$ and $\sum_i \beta_i = 0$.

While homogeneity and symmetry are verified if $\sum \Psi_{ij} = 0$ and $\Psi_{ij} = \Psi_{ij}$ respectively. Following the expenditure function in equation (5) and estimated coefficients; income (Є$_i$), uncompensated and compensated (own-price (e$_{ii}$) and cross-price (e$_{ij}$)) elasticities are derived as

Income elasticity

$$Є_i = (\beta_i / S_i) + 1$$

Uncompensated (Marshallian) price elasticity

$$e^u_{ij} = (\Psi_{ij} - \beta_i S_i) / S_i - \sigma_{ij}$$

One and Zero values of σ_{ij} indicate own price and cross-price elasticity respectively.

The compensated own and cross-price elasticities are calculated by using the Slutsky equation

$$e^c_{ij} = e^u_{ij} + S_i Є_i$$

Where, e^c_{ij} is the compensated (Hicksian) price elasticity

ESTIMATIONS AND RESULTS

This portion is divided in to three parts, in the first base on descriptive statistics of variables in the form of budget share and prices. In the second estimated coefficients are explained and in the last elasticities.

DESCRIPTIVE STATISTICS

TABLE 4.1   DESCRIPTIVE STATISTICS ABOUT BUDGET SHARES OF GROUPS

Commodity Group	Mean	Standard deviation	Min	Max
Budget share				
Meat	29.11	16.99	15.73	90.01
Milk	57.20	17.62	29.67	94.50
Fish	13.69	9.48	8.35	76.56
Price/ Unit				
Meat	624	41.80	552	752
Milk	480	36.62	391	589
Fish	560	29.29	501	778

Source: Author's calculations

From the table it observed that 29.11 percent of household budget share spend on meat while 57.20 and 13.69 percent spend on milk and fish respectively. Variation in the budget share with in minimum and maximum rage is shown in the last two columns.

PARAMETERS ESTIMATES OF AIDS MODEL

Parameters estimated by the AIDS Model and their corresponding R^2 and F values are revealed in Table 2. All the parameters are statistically significant. Sing of βs represent the elasticities of income while the sign and magnitude of Ψ's defines the elasticities with respect to own and cross price. Statistical inference of F statistic also reveals the overall goodness of fit, which verifies that all parameters are significant. On the other hand R^2 value in all three groups is low may be it return on cross-sectional data with limited observation (especially for fish group). β1, β2, β3, represent income elasticity of meat, milk and fish, 02663, .04730 and -0.7 respectively. It implies that as household income increase they raise their demand for meat, milk and decrease for fish.

TABLE 4.2 PARAMETER ESTIMATES OF THE /AIDS MODEL FOR ANIMAL FOOD COMMODITY GROUPS

Parameters	Estimates	Z	significance
α_1	-1.1041	-8.57	0.000
β_1	.02663	4.01	0.000
Ψ_{11}	1.1301	26.96	0.000
Ψ_{12}	-.3693	-10.55	0.000
Ψ_{13}	-.15313	-3.08	0.002
α_2	1.771	12.89	0.000
β_2	.04730	6.61	0.000
Ψ_{21}	-1.0624	-22.78	0.000
Ψ_{22}	.501039	14.08	0.000
Ψ_{23}	-.20019	-3.75	0.000
α_3	.33230	4.42	0.000
β_3	-.07394	-18.92	0.000
Ψ_{31}	-.06770	-2.70	0.007
Ψ_{32}	-.13169	-6.57	0.000

Ψ_{33}	.35332	11.42	0.000
group	R^2	F	P value
Meat	0.2586	294.07	0.000
Milk	0.1999	210.62	0.000
Fish	0.1767	181.02	0.000

Source: Authors' calculation

ELASTICITIES

The present study analyzes the household behavior related to animal food demand through Marshaling and Hicksian (own and cross pice) elasticities. Marshallian defines the uncompensated while Hicksian the compensated elasticities. Results are shown in table 3.3. All the elasticities are significant, except fish with cross price milk in case of uncompensated. The study prefers the Marshaling compensated elasticities because it includes both substitution and income effects of price change.

Theoretically, In case of own price elasticity, negative sign of elasticity defines the normal commodity while positive sign represents the giffen. Magnitude of elasticity also represents the nature of commodity groups in response of price change.it implies that if $e_i > 1$ the commodity group said to be elastic and if $e_i < 1$ group will be inelastic. Table displays the own price elasticities for meat, milk and fish are 2.9, -0.204, and 1.86 respectively.it implies that meat and fish group are elastic, milk is inelastic. Milk own price elasticity less than 1, which confirms that milk product necessary and meat products are luxuries. The result supports to the Farooq, *et al*., (1999) and Khoiriyah, *et al*., (2020) studies. But in case of meat and fish results are complicated, from elasticity it represents luxury but sign represent giffen. According to Andrew Bloomenthal "Veblen goods are similar to Giffen goods but with a focus on luxury items". So, here meat and fish are considered as Veblen goods. It may be due to the increase of inflation in Pakistan during the sample period (2018-2019)

TABLE 4.3 OWN AND CROSS-PRICE ELASTICITIES

Commodity group/ uncompensated	With respect to prices		
	Meat	Milk	Fish
Meat	2.9***	-1.35***	-0.570***
Milk	-1.83***	-0.204***	-0.39***
Fish	-0.685***	-0.443***	1.86***
Commodity group/ compansate			
Meat	3.231***	-0.73***	-0.42**
Milk	-1.513***	-0.41***	-0.24***
Fish	-0.551***	-0.18	1.90***

, * represent 5 and 10 % level of significance

Source: Authors' calculation

Table also shows the cross price elasticity. Theoretically positive sign of cross price elasticity represent the complimentary goods and negative represent the substitute goods.it implies that if one percent increases in the price of one commodity raises the demand of other commodity, then is said to be that second commodity is substitute to the first. In the present study all sings of cross price elasticities are negative. So meat, milk, and fish are substitute of one and other but their magnitude are different. Results suggest that in case of Pakistan hoseholds can consume these commodity groups to intake nutrients.

CONCLUSION

The study try to analyze the household consumption pattern related to demand for animal protein in Pakistan. In case of Pakistan past literature base on demand for different food baskets but

specifically demand for animal food in term of notorious is missing. To fill this gap present study finds demand for animal goods by taking HIES data 2018-19. Further three different basket of goods meat (mutton, beef, chicken), milk (fresh milk, lassi, Tatra Pack) and fish (frozen, Prawns and Shrimps) canned are taken. Preferences of household are evaluated by estimating the income, on price and cross price elasticities through Linear Approximate Almost Ideal Demand System (LA/AIDS). Empirical results reveal that all the commodity groups substitute to each other. Income elasticity for milk and meat group is positive while fish is negative. Further the outcomes of own price elasticties indicate that milk is necessary product and both meat and fish are luxuries as well as giffen. In the view of Andrew Bloomenthal if we focus on luxury items Veblen goods are similar to Giffen goods. So in this study both meat and fish are Veblen commodity groups. It may be due to hyperinflation with in the given sample period in Pakistan. So government should have to control the prices specially food items.

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