ANALYSIS OF MILK CONSUMPTION PATTERN IN PAKISTAN: USING LA/AIDS

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ABSTRACT

This paper provides the estimation of complete milk product demand elasticity matrix in case of Pakistan. Milk products are categorized into fresh milk, lassi and tetra pack milk.LA/ AIDS model is run by using HIES survey data from 2018to 2019. Own & cross-price and consumers' income elasticities are estimated to find the impact of variation in the price of milk products and income. The outcome of Marshallian own-price elasticity for milk products reveals that prices & demand of milk product has inverse relation. Expenditures elasticities of milk product expose them as luxury items (elastic goods). The results of uncompensated cross price elasticities reveal that fresh milk and tetra pack milk are substitutable commodities while fresh milk and lassi are complementary goods. In developing countries like Pakistan, it is necessary for food policy makers to considers the price elasticities while imposing the taxes on the milk product. Milk products are basic food items and imposition of tax on these products could reduce the consumption of low-class households as well as middle class household and both have to face the problem of food security.

Keywords: income elasticities, price elasticities, milk consumption of household
JEL Codes: D31, E31

I. INTRODUCTION

Consumer demand analysis play an important role in shaping the agriculture polices. A realistic estimation of demand elasticity is also helpful in structural analysis of food industry. Fluctuations in prices and income are peremptory factors for changing the structure for food demand. Food demand analysis is very important for developing countries because it is associated with food security. Food demand is the desire and purchasing power of a consumer to purchase a food commodity at given price in order to fulfilled his basic food need. Poverty, malnutrition, hunger and food insecurity are increasing day by day in developing countries including Pakistan. It is found that increasing prices of food items and reduction in real wages increased the food security in Pakistan by changing the consumption pattern of the people (Malik, et al. 2015). Demand elasticities are the important component of the future demand and could be helpful for understanding the growth habit in food consumption. Both change in the level of income and consumed food quantities affect the elasticities of demand. In order to get price and expenditures elasticities, the correct estimation of demand elasticities is necessary. Reliable estimation of future food demand is projected on the bases of demand elasticities. Demand elasticities are the prerequisite for designing the various polices regarding subsides and indirect taxes.

Many researchers have estimated consumer's consumption behavior for different food groups (Hayat et al. 2016). Numerous nourishment sets i.e. "beef and mutton, chicken, seafood, milk and yogurt, eggs, fruits and dry fruits, vegetables, sugar and sweet products, spices, edible oil and ghee, hoteling & home delivery of food, tea and coffee, soft drinks and bottled water, wheat, rice, pulse bakery products, and miscellaneous food items" are used(Akram,2020). However some prior researcher also estimate food demand by taking single food group i.e.; honey (Hambaryan, 2021), grains (Ullah, 2018), meat (McAfee et al., 2010), dairy products (Akaichi & Revoredo-Giha, 2014), poultry products (Adejobi et al; 2014), Meat (Basarir, 2013). In this study the food commodity group "Milk" is selected.Milk group comprises the data of "Fresh milk, cheese, butter lassi, yoghurt, powder milk and other milks (tetra pack milk)". Among them three products like fresh milk, lassi and tetra pack milk are selected for

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analysis. According to Economic Survey 2017-18 approximately 78% GDP of Pakistan comprises of household consumption. Although the availability of food commodity is improved but due to increasing population there is still food shortage and inflation which resulted in food insecurity (Akram.2020). It is investigated that outcomes of under nourishment are poor health which decline the individual productivity and GDP growth fall at aggregate level (Hayat et al. 2016).

In this paper LA/AIDS is use to analyze the milk demand in the Pakistan. Questionnaire base data of households is collected from HIES that is started in 1963. In 1999 HIES merge with PIHS that improve the quality of questionnaire. This questionnaire is further split into male & female. In this study female questionnaire is used. It has the data of 24086 households among then 1127 household use these items then price of commodity that is not used by survey consumer is missing and average price is used in place of missing price. Each product has coding scheme in HIES. These products are arranged by using SPSS then STATA is used for estimation of AIDS. Keeping in view the related importance of milk product, this study examines the household behavior regarding milk product. The rational of this study is that why milk products are luxuries and producing milk is not sufficient to fulfill the demand of individual consumer. Agriculture sector of Pakistan is improving but food shortage is still frequent phenomenon. (Ullah, 2018). Domestic level demand for milk products is increasing rapidly. Policy makers and development practitioners are not giving due importance to dairy sector. The food security policy must be the most priority of Government of Pakistan in order to fulfill the milk product deficiency. In this study it is interrogative that how change in income and prices affect the household consumption pattern regarding milk products?

II. LITERATURE REVIEW
Literature review provides an important role in understanding the depth of a research problem. It paved the way for presenting the theoretical and empirical bases of the study that will be helpful for the evaluation and solution of a research problem. Deaton & Muellbauer (1980) presented the almost linear demand system (LA/AIDS) and several researchers have used this model in their studied. A comprehensive overview of the existing literature has been presented in this section to get a deep understanding of (LA/AIDS) model to analyze the consumer's behavior. Numerous studies are documented in previous literature among them some most important are reviewed. Hameed et al. (2021) examine that food consumption at national and provincial level play significant role in policies making regarding food security. They use QAIDS model to estimates the demand for food by taking HIES data from 2015 to 16. This study investigates that demand for utmost commodities except for "fruit, meat, sugar and other products", is inelastic and "fruit, milk and meat", are demanded jointly as compare to "wheat, pulse and vegetables". This study found that more substitutes are made by urban area as compare to rural area. It is proposed that polices regarding food security should be reconsider. It suggests price keep constant and should be supported by price subsidization in case of increase in prices for deprived groups. They suggested that rural income generation activities should be concentrated by promoting agriculture, livestock and its related industries.

Hina et al. (2021) conducted a demand analysis by using HIES survey, 2005-06 to calculate the demand for milk for Karachi. The effect of socio-economic variables is also incorporated into the model. It is investigated that the demand for milk is more price sensitive (i.e., e>1) as it is a luxury good for the Karachi residents. Study further showed that there is direct relationship between education, level of income and milk. When level of income and education increase then people tend to purchase more milk. Akram. (2020) conducted a demand analysis by estimating the QA/AIDS model to find the desire of household for various products. To estimate the model, the data is collected from "household integrated income and consumption survey" 2015-16. They observe that factors like locality, ratio of dependency, having personal home, age and education play significant role in consuming food item. Results of the study indicated that "fresh juices, dry fruits, soda water, bakery products, mutton, sea foods, and beef" are luxury products while the "milk, pulses, tea, vegetables, oil, rice, and yogurt" are necessities. The price elasticities showed that the demand of beef, soda water, sea foods, eggs and mutton are more elastic as compare to other commodities.

Khoiriyah et al. (2020) intents to answer that "how the change in price, income and household size affects the demand patterns of eggs, chicken, milk-powder, beef, and fish for the case of Indonesian households?" In this regard, the study collected the data from socio-economic survey of Indonesia, 2016. The study took the support from LA/AIDS model to acquire the results. Results of the study demonstrated the positive income elasticity, while negative price elasticity for all the selected products. Results further demonstrated that the demand of chicken, beef and fish is more elastic as compare to milk powder, and eggs. Haider & Zaidi (2017) examine the changes in consumption patterns by using QUAIDS model. They use eleven compound food sets by taking micro level survey

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dataset of HIES over the period 2000 -2014. They investigated change in prices of product and income effect the household's consumption pattern along with differences in consumption and calorie bundles. They found that consumption behaviors are changed not only across the regions but also within the provinces. Lower income group spend more on wheat while people having higher income spend more on meat and dairy products. They also found that average household spends money on vegetables, sugars and edible oil.

Hayat et al. (2016) observed the food demand patterns of Pakistani households by using LA/AIDS model. Data was collected from Pakistan panel household survey. Results of study showed that meat and milk are luxury goods while grains, vegetables, ghee, pulses, and sugar are necessities. Marshallian uncompensated cross price elasticities showed that "ghee and meat", "vegetable and pulses" and "milk and sugar" are complementary goods while meat, "vegetables & pulses" are substitute items. The income & demand for "milk & meat" are positively related. The increase in household size has negative correlation with the demand of meat and milk products. Farooq (2016) investigated that livestock essential part of the country economy of Pakistan. Around 42.4 million tons milk is produced by dispersed producers, mostly in small quantities. Despite that, Pakistan is 3rd largest milk producer in the world, milk is imported and its products worth Rs.11.78 billion during 2013-14. At domestic level the demand for milk and its products is likely to increase in future. The policy makers and development practitioners are not given due importance to dairy sector.

Shah et al. (2009) determined that in past decade, at both local and national level live stocks was ignored. In preceding studies, the cost of milk production is not estimated. However, major problems faced by rearing farmers have been identified in these studies. Pakistan is ranked 5th position in regarding milk producing countries of the world but milk and milk products are importing (Nestle, 2003). They found the profit situations for promoting the livestock and milk products and draw policy that would be helpful to overcome the imbalances in milk markets. They find "increasing return to scale" in livestock and promotion of this sector could play an important role to lessen poverty in rural areas of Pakistan. Hayat et al. (2016) observed the food demand patterns of Pakistani households by using LA/AIDS model. Data was collected from Pakistan panel household survey. Results of study showed that meat and milk are luxury goods while grains, vegetables, ghee, pulses, and sugar are necessities. Marshallian uncompensated cross price elasticities showed that "ghee and meat", "vegetable and pulses" and "milk and sugar" are complementary goods while meat, vegetables and pulses are substitute goods. The income and demand for milk and meat has positive relationship. The increase in household size has negative correlation with the demand of meat and milk products.

Farooq (2016) investigated that livestock farming is an integral part of the rural economy of Pakistan. In Pakistan, 42.4 million tons of milk is produced by dispersed producers, mostly in small quantities. Despite that, Pakistan is 3rd largest milk producer in the world, milk is imported and its products worth Rs.11.78 billion during 2013-14. At domestic level the demand for milk and its products is likely to increase in future. The policy makers and development practitioners are not given due importance to dairy sector. Malik et al. (2015) explored the food consumption behavior among the Pakistani Households by using QA/AIDS model. For accomplishment of task the data is collected from HIES, 2010-11, and found the significant expenditure elasticities among the selected food items. They find the positive connection between income and the demand of fruits, and milk products. It investigates that wheat and rice are necessary items, and having less elastic demand. Mittal (2010) accomplish her study for calculating the elasticities of food demand in India under the framework of QUAIDS. She suggests that accurate projection of consumer's preferences plays an important role in designing polices regarding food. She finds that consumption patterns changes along with increase in per capita income and economy started to move from supply side to demand side. This research recommends that Indian's government while making food polices must keep in view two objectives, one is to improve the living standard of farmer and other is to consider the demand of consumer for food items. It is important that realistic food demand is projected on the elasticities of demand. Deaton & Muellbauer (1980) firstly estimate a new demand system named as AIDS by using British postwar data. They find that in existing conventional approaches when restriction of homogeneity is imposed then there is serial correlation among the system of equation and the restriction of homogeneity is rejected. In these approaches dynamic effect of consumer's behaviors are ignored. They use AIDS as it gives more appropriate result as compare to the conventional approaches.

III. MODEL SPECIFICATION AND EMPIRICAL RESULTS
III.I. DATA AND SOURCE
Data collection from consistent source is crucial to obtain the desirable results. To accomplish this study the micro level data from 2018 to 2019 is collected from HIES. The "cross-sectional" data-set is counted on monthly bases; the data of quantity consumed has been extracted by using the data of 1127 households and the income share and prices of selected milk group (i.e. fresh milk, lassi, tetra pack milk) are derived.

III.II. METHODOLOGY
Demand model is built on by using expenditure function that is specified below, where I, U, P represent total expenditure, utility and the price respectively. Theoretical background of the study is that the consumer wants to maximize his utility. There are two cases in which how to utility is maximize when level of income is given. This is the uncompensated or Marsallian utility maximization condition and it is obtained by solving the first order condition for utility maximization. Other case is that how to cost is minimize when utility constrain is given. This is compensated or Hicksian cost minimization condition. In this study Marsallian and Hicksian elasticities are measured but Marsallian elasticities are used because it gives more appropriate results.

III.III. DEMAND MODEL
Consumer theory is based on the set of commodities, utility function and the map of consumer's preferences. For analyzing the demand system, three approaches has been used(Stone,1954;Paris & Houthakker,1955;Deaton1986;Theil1969;Chrustensen et al,1975) .In this research AIDS model (Deaton & Muellbauer ,1980) is used to estimate the demand of selected milk products (i.e.,fresh milk,lassi,tetra pack milk). It is the flexible demand models, and several researchers have widely studied this (e.g., Green & Alston, 1990; Taljaard et al., 2003; Alnafissa & Alderiny, 2020; Adejobi et al., 2014). This model is obtained by using the "cost function", which shows the minimal cost required when utility is given (i.e., u), at a price level (p). The cost function is shown in equation 1.

$$\ln C\,(U,P) = \gamma + \sum_{1}^{n} \gamma 1 \ln P_i + \frac{1}{2}\sum_{i}^{n}\sum_{i}^{n} \alpha_{ij}\ln P_i \ln P_j + u\beta 0 \prod_{i} p_i{}^{\beta 1} --- (1)$$

In equation 1, ln C (U,P) is the cost function; γ_o , γ_1, α_{ij}, β_0 and β1 are the constant parameters; i and j are catalogs for symbolizing different food categories. Now shepherd's lemmas applied by taking first derivative of equation 1 with r_j respect to price.

$$w_i = \gamma 1 + \sum \alpha ij\,\ln p_j + \alpha_i \ln\left(\frac{X}{P}\right) ----(2)$$

In Equation (2) w_i represents the share of expenditure on i^{th} commodity, calculated as $Q_i = \frac{\partial C\,(u,p_i)}{\partial p_i}$, $\frac{piqi}{\sum piqi}$,p_j shows the price of jth good and X represents the expenditures on desired food commodities , P signifies the stones price index, which is specifies as: ln P = $\sum wlnp_j$, $\beta_i, \alpha_i, and\ \delta_{ij}$ are predictable parameters: where; β_i is intercept, α_i signifies the effect of "real income" relative to a change in expenditure shares of a product, α_{ij} deals with the effect of a "price change" of jth commodity, relative to the expenditure share of ith commodity.LA/AIDS model is comprised of some restriction, which is mandatory for the theoretical consistency of equation . Price & expenditure elasticities are also found. By using $\eta_i{}^E = \frac{\alpha i}{wi} + 1$ formula, expenditure elasticites are found. AIDS model satisfied three restrictions automatically. These three restrictions are enlisted as adding up restriction, symmetry and homogeneity.

IV. EMPIRICAL RESULTS AND DISCUSSIONS
This portion is divided in three to sub parts; in first portion the descriptive statistics of variables in the form of prices and budget shares are presented. In the second part the estimated coefficients are explained and in the last portion elasticities are discuss in detail.

IV.I. DESCRIPTIVE STATISTICS
In Table1, the results of descriptive statistics about the budget and price shares of "Fresh Milk","Lassi" and "Tetra Pack Milk" are shown respectively . These tables report the value of mean and SD along with CV for the selected food items. Results depicts that the value of SD of budget shares & prices does not lies very far away from its mean value which implies that the problem of normality does not exists in the data. After the rigorous examination of the mean values of the budget shares of different commodity groups, it observes that household spend the least proportion of budget on the consumption of milk product.

Table 1: Descriptive statistics about Price & Budget share

Milk Products Categories	Mean	SD	CV
Budget share			
Fresh Milk	0.6833553	0.1740693	25.588
Lassi	0.1491926	0.1260082	84.563
Tetra Pack Milk	0.1674521	0.1395084	83.333
Price share			
Fresh Milk	4.662261	0.1740693	2.618
Lassi	4.411762	0.2560242	5.818
Tetra Pack Milk	4.807491	0.1003137	2.081

Coefficients of LA/AIDS model are reported in table-2. These parameters are obtained by imposing the restrictions of homogeneity, additivity and symmetry for the theoretical consistency of the model. Results shows that parameters are significant at1% hence conclude that the demand of a particular product is significantly influenced by the change in own price, cross prices and real income. Hence, the proposed hypotheses of the study (e.g., H1-H3) are accepted.

Table 2: Parameters Estimates of LA/AIDS Model

Parameters	Parameter	Significance
Fresh Milk		
$\gamma 1$	-0.2184577	0.001
$\gamma 2$	-0.2420826	0.007
$\gamma 3$	0.950398	0.000
$\beta 1$	-0.0002343	0.000
$\alpha 1$	-0.1121165	0.006
Lassi		
$\gamma 1$	-0.0411681	0.000
$\gamma 2$	0.3085001	0.000
$\gamma 3$	-0.4699516	0.008
$\beta 2$	-0.0108404	0.000
$\alpha 2$	0.5605828	0.001
Tetra Pack Milk		
$\gamma 1$	0.2596258	0.000
$\gamma 2$	-0.0664175	0.000
$\gamma 3$	-0.4804463	0.001
$\beta 3$	0.0110747	0.001
$\alpha 3$	0.5515336	0.000

The mean square error of regression parameters of LA/AIDS model, adjusted R^2, and F-statistics along with the probability values are presented in table 3. It shows that the estimated results are accurate as the value of MSE for all the estimated regressions (Fresh Milk,Lassi and Tatra Pack Milk) are low. The value of R^2 is low because cross sectional data is used. Significant F-statistics shows that the overall models are good fitted.

Table 3: Goodness of Fitted Statistics

Homogeneity Constraint Estimates				
Equations	RMSE	R^2-Square	F-Statistics	P-Values
Fresh Milk	0.1725887	0.0204	5.85	0.000
Lassi	0.1244554	0.0280	8.07	0.001
Tetra Pack Milk	0.1390011	0.0108	8.07	0.006

IV.II. ELASTICITIES OF PRICE & EXPENDITURE

Estimated expenditure elasticities, Marshallian & Hicksian price elasticities are presented in table 4. Expenditure elasticities are synonymously used with income elasticities. Results of expenditure elasticities are presented in table 4. Table shows that the estimated η_i^E of Fresh milk,lassi and tatra Pack milk are greater than 1 (i.e., $\eta_i^E > 1$), which indicates that these food products are "luxuries". Results state that the milk products are more responsive with the change in real income. It is argued that people tends to increase the consumption of milk product (i.e., luxury

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products) when there is a real increase in their income. This is so because most of the household in Pakistan are having less purchasing power, and a largest share of their income goes to the fulfillment of their basic needs, and they contribute very minute share of their income on the luxury products (Besley, 1989). Households considered luxuries as "conspicuous consumption", which refers to the purchase of goods exclusively to show off one's wealth. Hence milk product being a luxury product, captures very minute share of budget from their income. But, when households face a real increase in their income, they are more likely to incline towards the consumption of conspicuous products (i.e. Fresh milk, lassi and tetra Pack Milk). Although both Marshallian & Hicksian elasticities are estimated but Marshallian elasticity is discussed in detail because it provides more accurate results as compare to Hicksain elasticity (Hayat et al.2016). According to the economic theory, commodity (e_i) has negative relation with its own price and quantity. Magnitude of e_i tells us about the nature of the commodity (i.e., elastic or inelastic). A product is said to be as "elastic" if $e_i > 1$. While, a product is said to be inelastic if $e_i < 1$. Table shows that the own price elasticities for Fresh milk,lassi and tatra Pack Milk are -1.320, -1.095 and -3.891 respectively. According to the results milk products (Fresh milk, lassi and tetra Pack Milk) are "elastic goods" as their own price elasticity is greater than 1 (e.g., $e_i > 1$). Results show that 1% increase in the prices of the selected milk products; households will tend to reduce the quantity demand of fresh milk by 1.320%, lassi by 1.095 % and tetra pack milk by 3.891 %. Results suggest that households are comparatively sensitive to change in price of milk product, as the percentage ΔQd of milk product is greater than the percentage ΔP.

IV.III. CROSS- PRICE ELASTICITIES (e_{ij})

Cross- price elasticity (e_{ij}) measures the change in the Qd of one product (e.g., product fresh milk) due to change in the price of another product (tetra pack milk). Cross price elasticity show "weather the products are substitutes or complements". Positive sign with the e_{ij} indicates the substitutability, whilst the negative sign indicates the complementary relation among two or more items. Cross price Marshallian elasticities are presented in table 4. Results shows that Fresh milk & Tetra milk pack are substitute to each other (see positive sign with the elasticity coefficients). For instance, people substitute fresh with tetra pack milk and vice versa when they face the rise in the prices of one commodity. Therefore, when people face a rise in the prices of fresh milk (tetra pack milk), they substitute. Some people also substitute the fresh milk for tetra pack milk due the hygienic issues. There are also some behavioral factors (i.e., taste and preferences of individuals) which persuade them to switch the consumption from fresh milk to tetra pack milk. It is evidenced that milk has sufficient amount of calories which are mandatory to fulfill minimum threshold of daily nutritional requirements. Results further shows that fresh milk & lassi are complementary products (see negative sign with elasticity coefficients). General name for buttermilk is Lassi. It is the blend of water and yogurt. Some people also add salt while some like to drink sweet lassi. In Punjab especially rural areas, a meal is considered incomplete without lassi. In the warm summer months, lassi is refreshing, cooling and probiotic drink. It is the bland of yogurt & water. Yogurt is prepared by fermenting the milk with adding a culture of bacteria, so without milk not yougrat nor lassi could be prepare. When the prices of milk increase than the demand for lassi decrease. Lassi is reach source of calcium and also helpful for healing the stomach because it loaded with health bacteria. Lassi has useful proteins those play an important in building muscles mass. It also increase bone mineral density. Increasing prices of fresh milk reduce the demand for lassi. Table 4: uncompensated own & cross price elasticities (Marshallian elasticities)) show that fresh milk and lassie are complementary goods.

Table 4: Elasticities of price & income

Expenditure elasticities			
$\eta_i{}^E = \frac{\alpha i}{wi} + 1$ Fresh Milk Lassi Tetra Pack Milk			
1.2 1.011 1.0103			
Uncompensated own & cross price elasticities (Marshallian elasticities)			
	Fresh Milk	Lasi	Tetra Pack Milk
Fresh Milk	-1.320***	-0.354***	1.391***
Lasi	-0.255	-1.095**	-3.126***
Tetra Pack Milk	1.531	-0.422	-3.891***

Compensated own and cross price elasticities (Hicksian elasticities)			
	Fresh Milk	Lasi	Tetra Pack Milk
Fresh Milk	-0.636**	-0.205	1.558***
Lasi	0.379	1.234***	-2.971**
Tetra Pack Milk	2.260**	-0.263	-3.712***

V. CONCLUSION

In this study effort is made to analyze the household consumption pattern related to demand for milk product in Pakistan. In case of Pakistan past literature based on demand for different food baskets but connection between productive and availability of milk product is missing. To fill this present study finds demand for milk products by taking HIES data 2018-19. Preferences of household are evaluated through LA/AIDS. Result indicates that fresh is a luxury good and with increase in income, consumer increase their expenditures on milk products. Income elasticity for milk group is positive. Outcomes reveal the fresh milk and tetra pack are substitute to each other while fresh milk and lassi are complementary goods. This study reviews the range of methodologies but the neglected areas assessing the difference between demand and supply of milk product could not be identified. In connection with the consumer demand analysis, effort is made to highlight methodological gaps in order to find "why milk product are luxuries items", although Pakistan is among top ten milk producing countries of world. However, there are some limitations in this study in the construction of econometric model including "increasing population" as a variable and run AIDS model. Due to time shortage the relationship between growing population and elasticities of milk product could not be estimated. It is suggested that such channels should be traced due to them milk product are luxury in context we are an agrarian economy. There is a need for research with a more homogeneous approach to know the current real situation of consumer's consumption behavior regarding milk specially lower and middle class household of Pakistan.

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