Surmising Consumer Demand System & Structural Changes Using Time Series Data

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BZU Multan

2006

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Wednesday, May 26, 2010

Consumer demand for food and non-food items in Pakistan has attracted the attention of various researchers. They have employed different parametric approaches, like single equation, double log models, linear expenditure system and extended linear expenditure system. Most of the studies were based on household income and expenditure survey data. Like other household surveys, HIES data do not give information about prices, due to which price elasticities could not estimated. This task could not be accomplished partly because, in order to examine the existence and the nature of structural change and estimation of price elasticities, time series data was required. In this context the present study is a step ahead. In this analysis time series data has been used on meat group from 1950-51 to 2003-2004. We estimated the linear approximation of almost ideal demand system (LA/AIDS). The model is used to estimate the parameters of meat demand equations. Furthermore, the existence and the nature of the structural change is checked by using LA/AIDS. The results from LA/AIDS model show a shift in consumer demand in case of chicken in 1991-92. Price and expenditure elasticities have also been calculated. The estimates of price and income elasticities are also consistent with economic theory.

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1. INTRODUCTION

There is hardly an area of economic theory which does not require at least some knowledge of household consumer behavior. For most of the economic policies the importance of empirical evidence on consumer behavior seems indisputable. The close interaction between the theoretical considerations and empirical specification along with the availability of new types of data and innovating computational technology have particularly made the analysis of the consumer behavior an attention-grabbing field of research in recent years.

The analysis of consumer behavior is applicable to a wide range of economic problems, such as growth and distribution of income, the impact of alternative tax structures, the implications of rationing and credit constraint, the cost benefit analysis, the choice of cost of living index, the inter temporal allocation of consumption and the dynamics of asset accumulation, the determination of real rate of interest and the economics of uncertainty and information.

The most widely explored area of consumer behavior in empirical literature has been the estimation of the consumer demand in a static framework. Since the appropriate panel data are rarely available, most of the empirical studies have been restricted to the estimation of the Engle curves. Several attempts have been made, however, to study price responsiveness of consumers.

The former empirical research on this subject has been constricted by the limitations of the available functional forms for the demand models. However, in recent years, the duality theory has produced a large number of attractive flexible functional forms which include the Translog System, the Quadratic Expenditure System, the Generalized Cobb Douglas and Leontief System, the Rotterdam Model and the Almost Ideal Demand System. During the past ten years or so, a large volume of empirical literature has also appeared in Pakistan,[1] but, most of the researchers used restrictive functional forms, such as double log and linear expenditure system. The inherited drawbacks of these functional forms, in detail, are listed in section 2.

Not surprisingly, the evidence on price and income elasticities from the existing studies on Pakistan is mixed, mainly, due to the variety of methods employed and the data used. This study shows that during the past two decades food consumption patterns have changed. This change can partly be explained by movement in relative prices of food and partly by change in income distribution and poverty.[2] However, we cannot rule out the possibility that some non-price factors, such as changes in tastes, which may also have been instrumental in bringing about a structural change in consumer preferences. This phenomenon has received no attention, whatsoever, in previous consumer demand studies. The fact to the matter is that the existing studies on Pakistan could not estimate changes in consumer preference because of using cross sectional data.

[1]See, for example, Rehman (1963), Bussink (1970), Khan (1970), Siddique (1982), Malik (1982), Malik and Ahmad (1985), Ali (1985), Malik, Abbas and Ghani (1987), Ahmad and Ludlow (1987), Ahmad, Ludlow and Stern (1988), Alderman (1988), Malik, Mushtaq and Ghani (1988), Burney and Akmal (1991), Burney and Khan (1991) and Burki (1997).

[2]For further details, see Burki (1997).

The objective of this study is to estimate consumer preferences for meat group using Pakistan's annual time series disappearance data from 1950-51 to 2003-2004. The study tests for the existence of and the nature of the structural change in meat group by

a) Examining the trends in per capita consumption of meat group,

b) Estimating consumer preferences in the conventional framework of parametric demand analysis.

On the parametric demand analysis side the linear approximate version of the Almost Ideal Demand System (LA/AIDS) of Deaton and Muellbauer is used to estimate the parameters of the food demand equations, price and expenditure elasticities. Most of the estimated price (own and cross) and income elasticities are significant and reasonable in magnitude. The inclusion of constants and dummies in LA/AIDS allows us to gain some insight about the structural change in consumer preferences.

2. STUDIES ON CONSUMER DEMAND IN PAKISTAN

Several empirical studies have been demeanour on consumption patterns in Pakistan. The studies discussed here are almost exhaustive in the area of consumption analysis. These studies have addressed different issues relating to household consumption patterns in rural and urban households. Most of these studies have been published in late 1980's or early 1990's. For an easy exposition a tabular demonstration is added, by the end of this section, containing a bird's eye view on these listed studies. Before 1980s, the field of consumer demand analysis in Pakistan was quiescent. This was mainly due to non-availability of the Household Surveys especially in 1970's.

However, the publication of HIES 1979 and availability of computer software's generated interest in this area, which has produced several new studies.

The estimation techniques used for price and income elasticities range from simple double-log or semi-log form to most sophisticated AIDS model. The estimates obtained by Rehman (1963), Siddiqui (1982), Malik (1982), Malik and Ahmad (1985), Burney and Khan (1991) have employed the double-log, log linear or semi-log functional forms. However, it is well known that these forms violate the integrability condition and thus cannot be deduced by maximizing a utility function. A cohesive and more serious problem in applied work is that these forms also violate the Engel aggregation condition. Yoshihara (1969) noted that the criterion of Engel aggregation may be of a little consequence when only one equation is being estimated, but in a complete system, violation of this condition gravely affects the internal consistency of the results. If this condition is imposed on the system all the income elasticities become equal to one, which is not mesmerizing either.

The other popular approach for consumer demand analysis in Pakistan has been the LES of Stone (1954) and the ELES of Lulch (1973). For instance, Ali (1985), Ahmad and Ludlow (1987), Malik, Mushtaq and Ghani (1988), Ahmad, Ludlow and Stern (1988) and Burney and Khan (1990, 1991) have used the LES and ELES. One obvious advantage of using LES and ELES is that we can obtain estimates of subsistence quantities. Nonetheless, the functional form assumed by ELES is quite restrictive. King (1979, 1981) has pointed out that the property of approximate proportionality in LES between price and income elasticities does not have any theoretical or empirical support.

The LES has another defect that for certain values of prices and income the predicted expenditures become negative. However, this is clearly not satisfactory from a theoretical view point [Parks (1969)]. Furthermore, the inferior goods are excluded by LES. Inferiority can only occur for goods with $\beta_i < 0$; but this violates concavity and if permitted, would result in goods having positive price elasticity. Similarly, if concavity is to hold, no two goods may be complements; every good must be substitute for every other good. No one can claim to have "discovered" that goods are substitutes from the results obtained using LES. Moreover, the effect of relative prices on saving cannot be measured at all with LES. Since, the total expenditure is exogenously fixed no matter what happens to relative prices savings remain unaffected. Additive preferences in the LES imply that the marginal utility of one good is independent of the quantity of the other goods consumed. This is not a plausible assumption, especially for food commodities, and therefore, has been found invalid for even broader commodity groupings [Deaton and Brown (1972)].

More recently, Alderman (1988) has estimated consumer price and income elasticities by using the AIDS model of Deaton and Muellbauer (1980 a) on Micro data of the HIES 1979 and published price series of relevant commodities for the four quarterly rounds in which the Household Survey was conducted. More specifically, Alderman (1988) employed the linear approximation version of the AIDS model called LA/AIDS, but used the elasticity formulas of the AIDS, which is not appropriate. Clarifying on this point Green and Alston (1990) have reported that using AIDS elasticity formulas in LA/AIDS specification is only appropriate when either the preferences are homothetic or the group price is constant.

Burki (1997) has also implemented the LA/AIDS model, and has used the correct elasticities formulas; suggest by Green and Alston (1990), on time series disappearance data for nine food commodities. He also tested his data for consistency with Generalised Axiom of Revealed Preference (GARP). Based on his results, Burki (1997) identified structural change in the demand for chicken.[3]

[3]Bouis (1992) has proposed a new technique to estimate income and price elasticities, which uses prior information and thus is less data demanding. However, Burki (1997) fears that the information requirement in Bouis's method is much more than an econometric model.

Tabular Representation of Studies on Consumer Demand in Pakistan

Author	**Rehman (1963)**	**Bussink (1970)**	**Khan (1970)**	**Siddique (1982)**	**Malik (1982)**	**Malik and Ahmad (1985)**
Data Source	Micro data CSO survey of rural household 1959	Micro data Quarterly survey 1963-64	Time series data 1960-70	Group data HIES 1971-72	Group data HIES 1971-72	Group data (1979)
# of Commodities	8	29	10	12	7	7
Food	6	16	10	8	1	1
Non food	2	13	0	4	6	6
Functional Forms	Linear Double Log	Firch approach calculating M_{um}	x=f(x)pop	Linear, Log linear	Linear, Log linear, Double log, semi log, Hyperbolic	Linear, Log linear, Double log, semi log, Hyperbolic
Coverage						
Exp Elasticity	E_{ie}			E_{ie}	E_{ie}	E_{ie}
Income Elasticity		E_{iy}				
Own Price Elas						
Cross Price Elas		E_{ij}		E_{ih}		
Special Features		For three income groups in rural and urban.	Projection for 1975 for east and West, Rural and urban area.	Inter study comparison.	Income distribution, Lawrence curve for all Pakistan and rural urban areas.	For rural and Urban areas for all Pakistan.

Table Continued…….

Author	Ali (1985)	Malik, Abbas and Ghani (1987)	Ahmad and Ludlow (1987)	Ahmad, Ludlow and Stern (1988)	Malik, Mushtaq and Ghani (1988)	Aldermann (1988)
Data Source	Group data 1979	Group data based on 7 periods, 1963 -64 to 1984-85	Micro data HIES 1979	MNS 1976	Group data 1979, 1984-85	Micro data HIES 1979
# of Commodities	12	6	17	13	5	9
Food	1	1	9	9	5	7
Non food	11	5	8	4	0.00	2
Functional Forms	ELES	ELES	LES	LES	LES	AIDS
Coverage						
Exp Elasticity	E_{ie}		E_{ii}	E_{ie}	E_{ie}	E_{ie}
Income Elasticity	E_{iy}					
Own Price Elas	E_{ii}			E_{ii}		E_{ii}
Cross Price Elas	E_{ij}					E_{ij}
Special Features	Saving elasticity with respect to income and prices	Estimated for rural and urban areas year wise	Comparison with earlier studies in Pakistan with different functional forms	Estimation for rural & urban and for full sample	Applied two stage technique to test rural urban difference on intercept and slope using f-test	Price and spatial variation in rural and urban areas

Table Continued…….

Author	Burney and Khan (1990)	Burney and Khan (1991)	Burki (1997)
Data Source	Micro data HIES 1984-85	Micro data 1984-85	Time series data 1972-93
# of Commodities	6	12	8
Food	0	11	8
Non food	6	1	0.00
Functional Forms	ELES	LES, Log Linear	LA\AIDS
Coverage			
Exp Elasticity		E_{ie}	E_{ie}
Income Elasticity			E_{iy}
Own Price Elas	E_{ii}		E_{ii}
Cross Price Elas	E_{ij}		E_{ij}
Special Features	Estimation based rural and urban	Price wise estimation	

3. SPECIFICATION OF THE MODEL

Ever since Stone (1954) first estimated a system of demand equation, derived explicitly from consumer theory, there has been a continuing search for alternative specifications and functional forms. Many models have been proposed, but perhaps the most important in current use were the Rotterdam and the Translog models. Both of the models have been extensively estimated and have, in addition, been used to test the homogeneity and symmetry restrictions of the demand theory. In 1980, the Almost Ideal Demand System (AIDS) was proposed by Deaton A. and John Muellbauer (1980a, 1980b), which has considerable advantages over other models. The AIDS Model has become the model of choice for many applied demand analysts. It is relatively easy to account for this popularity. The model is grounded in a well-structured analytical framework, accommodates certain types of aggregation, satisfies the axiom of choice exactly, is apparently easy to estimate, and permits testing of the standard restrictions of the classical demand theory.

Linear approximate version of the AIDS (LA/AIDS) model is employed to estimate the demand parameters developed by Deaton A. and Jhon Muellbauer (1980a).[4] Symbolically, the LA/AIDS model is defined as

$$w_i = \alpha_i + \sum_j^n \gamma_{ij} \ln p_{jt} + \beta_i \ln\left(\frac{x_t}{p_t}\right) + \mu_t \qquad i = 1,\ldots,n \tag{3.1}$$

Where p is the price index defined by

$$\ln p_t = \alpha_0 + \sum_j^n \alpha_j \ln p_{jt} + \left(\frac{1}{2}\right)\sum_i^n \sum_j^n \gamma_{ij} \ln p_{it} \ln p_{jt} \qquad t = 1,\ldots,T \tag{3.2}$$

[4]For derivation of the model, see, Deaton A. and Jhon Muellbauer (1980a).

and the parameters $\gamma's$ are defined as

$$\gamma_{ij} = \left(\frac{1}{2}\right)\left(\overset{*}{\gamma}_{ij} + \overset{*}{\gamma}_{ji}\right) = \gamma_{ji} \tag{3.3}$$

Where W_{it} is the expenditure share of the i^{th} good, p_{it} is the price and x_t is total expenditure.

The most interesting feature of the LA/AIDS model, from an econometric point of view, is that it is close to being linear. Apart from the expression p in (3.1) the LA/AIDS model can be estimated equation by equation using the OLS. As defined by equation (3.2), p is a linearly homogenous function of individual prices. In many practical situations, where prices are relatively collinear, p will be approximately proportional to any appropriately defined price index. Such an index can be calculated directly before estimation so that equation (3.1) becomes straightforward to estimate, which is in sharp contrast to the estimation of the Translog model [Deaton, A. and John Muellbaur (1980a and 1980b)].

The theoretical restrictions, i.e, adding up, homogeneity, and symmetry, on equation (3.1) apply directly to the parameters. Adding up requires that the marginal propensities to spend on each good sum to unity and that the net effect of a price change on the budget be zero. The adding up conditions are given by

$$\sum_i^n \alpha_i = 1 \qquad \sum_i^n \gamma_{ij} = 0 \qquad \sum_i^n \beta_i = 0 \tag{3.4}$$

Whereas the homogeneity and the symmetry are defined, respectively, by

$$\sum_{j}^{n} \gamma_{ij} = 0 \tag{3.5}$$

$$\gamma_{ij} = \gamma_{ji} \tag{3.6}$$

Provided that restrictions in (3.4), (3.5), and (3.6) hold, equation (3.1) represents a system of demand functions which add up to total expenditure $\left(\sum w_{it} = 1\right)$, are homogeneous of degree zero in prices and total expenditure taken together, and which satisfy Slutsky symmetry conditions. In the absence of changes in relative prices and "real" expenditure $\left(x/p\right)$ the budget share are constant and this is the natural starting point for predictions using the model. Changes in the relative prices work through the terms γ_{ij}; each γ_{ij} represents 10^2 times the effect on the i^{th} budget share of a 1 percent increase in the j^{th} price with $\left(x/p\right)$ held constant. Changes in the real expenditure operate through the β_i coefficients; these add to zero and are positive for luxuries and negative for necessities. However, unrestricted estimation of the AIDS will only automatically satisfy the adding-up restrictions so that the AIDS once more offers the opportunity of testing homogeneity and symmetry.

For this linear approximate version of the AIDS model, using elasticity formulas of the AIDS model be inappropriate [Green and Alston (1990)]. Therefore, we use the expenditure and income elasticity formulas suggested by Green and Alston (1990).

More specifically, in case of n goods we have n^2 simultaneous equations for uncompensated elasticities of the form

$$\eta_{ij} = -\delta_{ij} + \frac{\gamma_{ij}}{w_i} - \frac{\beta_i}{w_i}\left(w_j + \sum_k w_k \ln p_k \left(\eta_{kj} + \delta_{kj}\right)\right) \tag{3.7}$$

Equation (3.7) can be expressed in matrix notation as

$$E = \left[BC + I\right]^{-1}\left[A + 1\right] - I \tag{3.8}$$

Where the typical elements are $a_{ij} = -\delta_{ij} + \left(\gamma_{ij}/w_i\right) - \beta_i\left(w_j/w_i\right)$ in A (an $n \times n$ matrix) where δ_{ij} is known the Kronecker delta $\left(\delta_{ij} = 1\right)$ $for\, i = j; \delta_{ij} = 0$ $for\, i \neq j; b_i = \left(\beta_i/w_i\right)$ in B (an $n \times 1$ vector); $C_j = w_j \ln p_j$ in C (an $1 \times n$ vector) and I an identity matrix. The income elasticities will be measured by N (an $n \times 1$ matrix) as

$$N = \left[I + BC\right]^{-1} B + i \tag{3.9}$$

Where N expresses an n-vector of expenditure elasticities, and i is an n unit vector. Compensated elasticities will be estimated as

$$\overset{*}{E} = E + NW' \tag{3.10}$$

Where E is the matrix of uncompensated price elasticities, N is the matrix of income elasticities and w' is an n-vector of budget shares.

4. DATA AND VARIABLES DESCRIPTION

Time series data from 1950-51 to 2003-2004 is used in order to estimate the parameters of the LA/AIDS model for consumer demand for meat group[5] in Pakistan. Data on personal consumption expenditures was searched out from the *Economic Survey*. Per capita consumption of meat was calculated by using the annual disappearance $\left\{ PCC = \frac{QP + IMP - EXP}{POP} \right\}$[6] data from *Statistical Yearbook of Pakistan*. We have got our hands on the data of population, consumer price index and implicit price deflator from the *Economic Survey*. We have acquired price data, which is an average of twelve centres, from Monthly *Statistical Bulletin* of the Federal Bureau of Statistics [Government of Pakistan (various issues)].

5. EMPIRICAL RESULTS

The system of equation for the LA/AIDS model was estimated using iterative Zellner efficient procedure. Time series data from 1950-51 to 2003-2004 is used for four meat commodities (meat group) and an equation for other goods. Homogeneity and symmetry restrictions, in terms of model parameters, are imposed. Since the shares add up to one, only four out of five equations are independent. Therefore, to ensure the non singularity of the error co-variance matrix, the equation for others is deleted. The estimated parameters are invariant to the deleted equation since iterative Zellner efficient method is followed.[7] The parameters of the deleted equation are recovered using the restrictions for homogeneity and symmetry.

[5]Meat group include beef, mutton, chicken and fish.

[6]Per capita consumption (PCC) = [Total quantity produced in the economy (QP) in the specific year say 1950-51+ Imports of that year (IMP) - Export of that year (EXP)] / Total population (POP).

[7]For further details on iterative Zellner efficient method, see, Berndt (1991), Chapter 7.

The time series analysis assumes that the structure of demand and the values of the co-efficient remain stable over the period under consideration. It is possible that structure over time may gradually change. The effects of such shift on demand co-efficient have been recognized [George and King (1971)]. If the change in structure is clearly identifiable, a shift variable can be introduced in the regression equation. Shift variable could be introduced in the demand function through dummy variable whose values are either zero or one, depending upon the period of the observation. Another way to handle changes in structure is to break the period in to sub periods during which no change in structure has occurred. One difficulty with this approach is that the number of observations per sub period may be small for statistical analysis. Because the exact time for the expected structural change was also not known, therefore, we varied the breakpoints for one period dummy to investigate structural change.

Econometric estimates and associated t-values of the parameters in the LA/AIDS model with homogeneity and symmetry restriction imposed are in Table 5.1. Table 5.1 shows that the intercept terms for beef, mutton and fish are positive and statistically significant at 10% level of significance except for fish and chicken. This indicates an exogenous growth in the demand for these commodities, independently from the movement in prices and income. The exact time for the expected structural change was not known, therefore, we varied the break time for one period dummy between 1950-51 to 2003-2004. It is analyzed that the dummy for fish is statistically significant at 10% level of significance for the period 1991-92. The trend growth for fish has a negative sign. The negative and significant dummy for fish suggests that the

exogenous growth in the share of fish demand has declined after 1991-92. The observed decrease in the demand of fish after 1991-92 may be explained by changes in tastes.

The estimated expenditure elasticities and uncompensated price elasticities are exhibited in Table 5.2. The expenditure elasticities for all commodities are positive ranging from a minimum of 0.61434 (for mutton) to 0.79037 (for fish). The expenditure elasticity for fish is comparatively higher as compared to other meats. The expenditure elasticities for chicken and beef are 0.64644 and 0.66123 respectively. These results imply that the component of meat group in Pakistan have the status of necessities. This is expected due to the smaller shares of expenditures on meat in our sample.

All the uncompensated own price elasticities are negative except for mutton and are reasonable in magnitudes. The own-price elasticities vary from -0.1819 (for fish) to -0.4771 (for beef). While for mutton it is 0.0989. The positive sign for own price elasticity of mutton may be explained by the violation in curvature condition[8] since only four of the five eigen values were negative and one eigen value was positive. The cross price substitution effects between beef and mutton, beef and chicken and beef and fish show that they are substitutes while the cross price effects between mutton and fish, chicken and fish show their complementary relationship. In other words, we find that red meats (beef and mutton) are substitutes in nature.

[8]One should note that checking for compliance of the curvature condition is not a statistical test of these properties. If the curvature conditions are not satisfied they will not necessarily be rejected by a statistical test. Researchers must be aware that violation of curvature or other theoretical properties may simply be due to sampling error or to other problems, such as data errors, model misspecification, or simultaneous equation bias.

Table 5.1 Parameter Estimates of the LA/AIDS Model

Parameter Estimates					
Equation	**Beef**	**Mutton**	**Chicken**	**Fish**	**Others**
Constant	0.022 (1.806)*	0.0418 (1.672)*	0.011 (1.299)	0.023 (1.36)	-0.098 (-1.864)*
Expenditure	-0.012 (-1.042)	-0.24 (-1.041)	-0.035 (-0.442)	-0.072 (-0.475)	0.046 (0.972)
Dummy	0.14 (0.41)	-0.017 (-0.242)	-0.004 (-0.174)	-0.079 (-1.687)*	0.864 (0.6)
Beef	0.177 (2.648)***	-0.006 (-0.063)	0.015 (0.358)	0.0096 (0.172)	-0.019 (-1.246)
Mutton	-0.006 (-0.063)	0.066 (3.273)***	0.062 (0.85)	-0.078 (-0.732)	-0.064 (-1.975)**
Chicken	0.015 (0.358)	0.062 (0.85)	0.065 (1.09)	-0.035 (-0.735)	-0.011 (-0.941)
Fish	0.0096 (0.172)	-0.078 (-0.732)	-0.035 (-0.735)	0.028 (2.971)***	-0.018 (-0.909)
Others	-0.02 (-1.25)	-0.64 (-1.975)**	-0.11 (-0.941)	-0.018 (-0.909)	0.112 (1.702)*

Note: Figures in parentheses are asymptotic t-values.
*** Significant at 1%, ** significant at 5% and * significant at 10%.

Table 5.2 Uncompensated Elasticities for the LA/AIDS Model

Elasticity Estimates for					
Equation	**Beef**	**Mutton**	**Chicken**	**Fish**	**Others**
Expenditure	0.66123	0.61434	0.64644	0.79037	1.05374
Uncompensated Price Elasticity of					
Beef	-0.4771	0.0031	0.0472	0.0416	-0.2576
Mutton	0.0042	0.0989	0.1054	-0.1109	-0.6909
Chicken	0.1652	0.6449	-0.3495	-0.3371	-0.7507
Fish	0.0354	-0.2109	-0.0993	-0.1819	-0.0103
Others	-0.0247	-0.0775	-0.1298	-0.0229	-0.9786
Mean Share	0.035	0.061	0.01	0.035	0.859

Table 5.3 Compensated Elasticities for the LA/AIDS Model

Elasticity Estimates for					
Description	**Beef**	**Mutton**	**Chicken**	**Fish**	**Others**
Beef	-0.4542	0.0436	0.0538	0.0646	0.3107
Mutton	0.0255	0.1365	0.1115	-0.0896	-0.1629
Chicken	0.1876	0.6845	-0.3430	-0.3147	-0.1952
Fish	0.0628	-0.1625	-0.0914	-0.1545	0.6689
Others	0.0118	-0.0129	-0.0024	0.0137	-0.0130

Comparison of our result with other studies is not easy to make due to different data sets and estimation techniques used by earlier studies. Most of the studies used double log forms, linear expenditure system or its extension. Only studies by Alderman (1988) and Burki (1997) offer results that can be compared with our results, since they employed LA/AIDS model. The magnitudes of our elasticities are smaller than Aldermans, which is as expected.

However, a comparison with Burki (1997) and Alderman (1988) is possible because both have employed LA/AIDS model for their analysis. Alderman has estimated price elasticities by introducing price variations using for quarterly prices for which four rounds of survey was completed. However, the problem with Alderman's estimation is that it uses incorrect elasticity formulas for the AIDS model. The magnitude of elasticities from cross sectional data is expected to be smaller than the time series data. Likewise the magnitude of our elasticities are relatively smaller than Alderman's, who used HIES data. On the contrary, the higher magnitude of Alderman's elasticities for composite commodities is surprising. Composite commodities assume that all the included commodities have same income as well as price elasticities, which is again misleading. The estimates of expenditure or income elasticities obtained in various studies are arranged in Appendix B1. The cross price as well as own price are reported in Appendix B2.

6. CONCLUSIONS

This study estimates consumer demand and their responsiveness to prices and income for meat group using Pakistan's time series data from 1950-51 to 2003-2004.

LA/AIDS model is adopted to estimate consumer preferences. The commodities included in the meat group beef, mutton, chicken and fish.

The LA/AIDS model was estimated using iterative Zellner efficient procedure with adding-up, homogeneity and symmetry conditions imposed. Tests of structural change with the LA/AIDS model do support a shift in demand for fish in 1991-92. More specifically, the negative and significant dummy for fish suggests that the exogenous growth in the share of fish demand has declined after 1991-92. The observed decrease in the demand of fish can be explained by changes in tastes. The estimated own price elasticities for beef, chicken and fish are negative and reasonable in magnitudes. However, the sign for mutton's own price elasticity was positive, which is surprising. This may be explained by the violation in the negativity condition. The cross-price substitution effects between beef and mutton shows that these are substitutes while all other combinations depict complementary relationships. We also find that expenditure elasticities for all included commodities are positive and less than unity, which means that all components of meat are normal commodities.

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Appendix

Table B1:
Estimates of income elasticities obtained in various studies

Author	Model specification	Data Source	Income Elasticities				
			Beef	Mutton	Chicken	Fish	Meat
Burki (1997)	LA/AIDS	Time Series	0.53	0.86	1.15	0.46	NA
Alderman (1988)	RFEM[1]	HIES	NA	NA	NA	NA	1.51
	RPCM[2]	----	NA	NA	NA	NA	1.50
	UFEM[3]	----	NA	NA	NA	NA	1.30
	UPCM[4]	----	NA	NA	NA	NA	1.28
Siddique (1982)	Linear Form	HIES	NA	NA	NA	NA	1.86
	Log-Linear Form		NA	NA	NA	NA	1.18
Bussink (1970)	Frich Approach	Micro Data	NA	NA	NA	NA	1.19

1=Rural Fixed Effect Model; 2=Rural Pooled Cross sectional Model
3=Urban Fixed Effect Model; 4=Urban Pooled Cross sectional Model

Table B2:
Estimates of own and cross price elasticities obtained in various studies

Author	Model specificati-on	Commo-dities	Cross & Own Price Elasticities of				Own Price Elasticity of Meat only
			Beef	Mutton	Chicken	Fish	
Burki	LA/AIDS	Beef	-0.58	0.24	0.20	-0.10	NA
		Mutton	0.13	-0.29	-0.22	-0.55	NA
		Chicken	0.69	-1.37	-0.22	0.37	NA
		Fish	-0.10	-1.02	0.12	-0.53	NA
Alderman	RFEM[1]	----	NA	NA	NA	NA	-0.29
	RPCM[2]	----	NA	NA	NA	NA	-0.07
	UFEM[3]	----	NA	NA	NA	NA	-1.01
	UPCM[4]	----	NA	NA	NA	NA	-1.06

1=Rural Fixed Effect Model; 2=Rural Pooled Cross sectional Model
3=Urban Fixed Effect Model; 4=Urban Pooled Cross sectional Model