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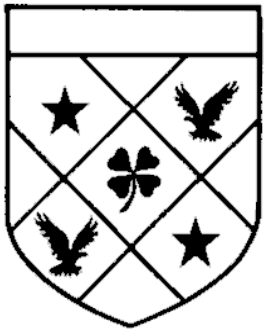

CONSUMER BEHAVIOR ANALYSIS OF VARIOUS ZONES IN PUNJAB

BY

SAIMA ISHAQ

MASTER OF PHILOSOPHY
IN
APPLIED ECONOMICS

MAY, 2014

NATIONAL COLLEGE OF BUSINESS ADMINISTRATION & ECONOMICS

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A dissertation submitted to
School of Business Administration

In Partial Fulfillment of the
Requirements for the Degree of

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IN THE NAME OF ALLAH

THE MOST BENEFICENT

AND THE MERCIFUL

NATIONAL COLLEGE OF BUSINESS ADMINISTRATION & ECONOMICS LAHORE

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Dissertation Committee:

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Chairman

_____
Member

_____
Member

_____
Rector
National College of Business Administration & Economics

DECLARATION

It is to declare that this research work has not been submitted for obtaining similar degree from any other university / college.

SAIMA ISHAQ
May, 2014

DEDICATED
TO

My Parents
&
My Family

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I am indebted to many of my teachers and colleagues for helping and guiding me in research completion. Just to name a few Dr. Mumtaz Muhammad Khan, Dr. Khalil Ahmed, Dr. A.R. Chauhdary, Sir Khawar Ata, Sir Irfan, Usman and Irum. I was always looking for their feedback in many situations which were easier said than done. I owe many thanks and hearted gratitude to Dr. Mumtaz for his kind assistance in data analysis.

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I will remain indebted all my life to my parents for the endless encouragement and love, and to my family and close friends for their support and prayers.

Lastly, I am grateful from the core of my heart to Almighty Allah 'the Greatest to All' for granting me love and blessings of my Parents, Family, Friends and supportive circumstances throughout the life.

RESEARCH COMPLETION CERTIFICATE

Certified that the research work contained in this thesis entitled **"Consumer Behavior Analysis of Various Zones in Punjab"** has been carried out and completed by **Miss Saima Ishaq** under my supervision during her **M.Phil. Applied Economics** Programme.

(Muhammad Abdul Quddus)
Supervisor

SUMMARY

In this study, behavior of farm and nonfarm rural households for consuming 10 basic food items is being estimated by linearly approximated almost ideal demand system (LA-AIDS). The data of farm and nonfarm households is taken from Punjab Economic Research institute (PERI) for rural households of three crop agro ecological zones, named as Barani, Partial Barani and irrigated zones in Punjab of Pakistan. For wheat, rice, cereals, milk, desighee, vanaspati ghee, mutton, beef, eggs and poultry, compensated and uncompensated price elasticities and expenditure elasticities are being calculated separately in the years 2009 and 2010 for farm, nonfarm and all households. Age and education level of the head household along with family size of the household are also taken as explanatory variables along with the real expenditures for calculating coefficients of budget share equations. The coefficients of budget share equations are significant as well as the impact of socio economic factors (age, education and family size) is found to be significant on overall consumption of food items.

Expenditure elasticities show all food items as normal goods for farm households, except of cereals as inferior food item for nonfarm households in both years. The Resulted price elasticities with few exceptions reveal no big differences for the consumption patterns of farm and nonfarm households. Wheat, Rice, Milk, vanaspati ghee, beef, eggs and poultry are necessities for both groups of households, whereas mutton, desi ghee and cereals are found as luxury on average. Also some of the food items are found as necessities for farm households and appear with differing status of luxuries for nonfarm households. Desighee and mutton are having highest price elasticities in all cases for the year 2009. Remaining food items mostly are inelastic to price changes in both years. Over all comparison of elasticities for two years indicates relative higher economic status of farm households as compared to nonfarm households.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Pakistan is a country of diversified cultures, languages, geographical locations, traditions and customs. It has large urban metropolitan cities as well as backward rural areas. For buying decisions consumers are well influenced by the cultural, social and personal factors. Along with budget, location and occupation, there are many socio economic factors including age, family size, gender, and education level which may have some influence on the consumption decisions of consumers. In this study we consider the impact of income, prices, and some socio economic factors like family size, age and education for investigating about the consumption patterns of rural farm and nonfarm households in Punjab.

This study uncovers the consumption patterns of 632 farm and nonfarm households in the rural Punjab of Pakistan for two years 2009 and 2010. Rural Punjab is divided into crop agro ecological zones by Punjab Economic Research Institute (PERI). PERI classifies Punjab into two regions on the basis of source of irrigation. These regions include Barani region (rain fed) and irrigated region. The Barani region is further subdivided into Barani and partial Barani, while the Irrigated region is further subdivided into crop agro ecological zones named as cotton-wheat zone, rice-wheat zone, and mixed wheat zone (Ata and Quddus, 2010)

Linear version of Almost Ideal Demand System LA-AIDS is the linearly approximated Almost Ideal Demand System proposed by Deaton and Muellbauer in 1980. This is a first complete demand system, which satisfies first and second order conditions of utility maximization as well as it satisfies axioms of demand theory (detailed discussion is provided in methodology section). This demand system is applied to calculate coefficients of budget share equations as well as price and expenditure elasticities. Price elasticity measures the change in quantity demanded of chosen food items given a 1% change in the price of the food item. Based on economic theory, normal goods are expected to have negative own price elasticity. Thus all price elasticities are expected to be negative in this case. The cross price elasticities measures the complimentary and substitutability relationships between all possible combinations of the food items, while expenditure elasticity shows the

percentage change in the quantity demanded for percentage change in the expenditure.

The food items chosen for the analysis are wheat, rice, milk, cereals, desighee, vanaspati ghee, mutton, beef, poultry, and eggs. The data for the prices of food items, quantities, family size, education and age of the head household is taken from PERI. To expand the demand system LA-AIDS, seemingly unrelated regression model is used.

1.2 CONSUMER BEHAVIOR MEASUREMENT

In applied microeconomics, consumer behavior is traced by observing the actual buying decisions of individuals. The buying decisions are taken as the description of their preferences within budget, prices and other real life constraints. As economics is a social science and its theories always rely on certain assumptions so does demand theory. Assumptions about consumer behavior are introduced into the theory of demand through the specification of a utility function. The utility function measures the level of satisfaction an individual experiences as a result of consuming a particular bundle of commodities (goods and services) per unit of time.

There are two broad approaches to measure consumer behavior. In first approach we define a utility function which satisfies certain axioms of choice. Consumer optimizes his utility at the point of tangency of indifference curve and budget constraint, and the optimization of utility function subject to budget constraint gives birth to the demand function. Alternatively, we start estimation with a predefined demand system (Predefined demand system is the system of demand equations based on demand theory, it relies on axioms of demand theory, linear expenditure system, Rotterdam model and AIDS are examples of predefined demand systems) and impose the restrictions of demand theory including completeness, transitivity and non satiation of preferences (Blanciforti et al., 1986).

For working with predefined demand systems either nonparametric functional forms or parametric flexible functional forms can be used. In nonparametric functional forms no restrictions are set for the nature of parameters. Whereas parametric flexible functional forms impose restrictions on the nature of parameters and can easily capture linear and nonlinear trends of micro and aggregate data (Barnett and Serletis, 2008). Amongst flexible functional forms Almost Ideal Demand System is considered the best because of its distinguished features of satisfying first and second order requirements of optimizing consumer behavior. As well as it satisfies axioms of choice

theory including aggregation, symmetry, and negative semi definite substitution matrix (Alston et al., 1994) and (Muellbauer and Van de Ven, 2004). The linearly approximated AIDS or LA-AIDS also provides a first order approximation to the expenditure function. It satisfies the axioms of consumer choice and allows for investigating interdependence amongst products as well.

The purpose of using demand system is to measure the responsiveness of consumer's demand towards different factors including income, prices, tastes, location, family size, gender, age and so on. This response is being measured by reading conventional price and income elasticities as well as other elasticities specific to the objective of the study. When a commodity faces a fall or rise in its price, the consumer becomes worse off or better off. The fall/rise in the price brings real income changes and only price changes. The uncompensated or Marshellian price elasticities measure both the income and price effects of these changes whereas compensated or Hicksian elasticities, are used to measure only price effects (Green and Alston, 1990).

1.3 SIGNIFICANCE OF THE STUDY

We find immense treatment of demand system measurement internationally. Over the past three decades this area has been explored owing to the invention of complete demand systems (Barnett and Serletis, 2008). For Pakistan we find most of the studies relying on forsaken techniques of consumer behavior measurement based mostly on aggregate data (Aziz and Malik, 2010). Most recently Haq et al. (2011), Mudassar et al. (2012) applied LA-AIDS on households data of Household Integrated Economic Surveys (HIES) for urban and rural Punjab.

Parameters estimated based on national data cannot depict consumption behavior of specific community or region vice versa price elasticities computed for food groups are restrictive to elaborate demand behavior for single food items in that group. This is the prime justification for selection of food items rather than food groups for rural households of Punjab. This is the first study exploring and comparing consumption patterns of farm and nonfarm households of rural Punjab. Prior to it Farooq et al. (1999) investigated farm households consumption patterns for 6 food groups on primary data of 121 households for three districts of rice wheat zone.

1.4 RESEARCH QUESTION

- What are the differences between farm and nonfarm households' consumption patterns for the selected food items?

1.5 OBJECTIVES OF THE STUDY

The overall aim of this study is to estimate and interpret the demand relations of basic food items of rural consumers of Punjab by means of a system approach. The objectives of the study are

- To estimate the model, through which the demand relations of selected food items can be estimated and compared by calculating uncompensated, compensated price elasticities as well as expenditure elasticities.
- To compare farm and nonfarm consumption patterns for the same food items.

1.6 HYPOTHESES OF THE STUDY

We studied consumption patterns of three groups of farm households, nonfarm households, and of combined farm and nonfarm households. To check the differences in the consumption patterns of these rural households, we checked whether the selected food items are necessities for each group of households, luxuries for each group of households or some food items are necessities for one group and luxuries for another group. In this way we diagnosed the difference of consumption patterns by estimating price elasticities, and expenditure elasticities. The following sets of hypotheses were tested for each group of rural households.

Hypotheses	Based on Price Elasticities
H_o	Wheat is not a necessity food for farm households, for nonfarm households, and for all households.
H_o	Rice is not a necessity food for farm households, for nonfarm households, and for all households.
H_o	Cereal is not a necessity food for farm households, for nonfarm households, and for all households.

Hypotheses	Based on Price Elasticities
H_0	Desi ghee is not a necessity food for farm households, for nonfarm households, and for all households.
H_0	Vanaspati ghee is not a necessity food for farm households, for nonfarm households, and for all households.
H_0	Milk is not a necessity food for farm households, for nonfarm households, and for all households.
H_0	Mutton is not a necessity food for farm households, for nonfarm households, and for all households.
H_0	Beef is not a necessity food for farm households, for nonfarm households, and for all households.
H_0	Poultry is not a necessity food for farm households, for nonfarm households, and for all households.
H_0	Eggs are not a necessity food for farm households, for nonfarm households, and for all households.

Hypotheses	Based on Expenditure Elasticities
H_0	Wheat is not a normal food for farm households, for nonfarm households, and for all households.
H_0	Rice is not a normal food for farm households, for nonfarm households, and for all households.
H_0	Cereal is not a normal food for farm households, for nonfarm households, and for all households.
H_0	Desi ghee is not a normal food for farm households, for nonfarm households, and for all households.
H_0	Vanaspati ghee is not a normal food for farm households, for nonfarm households, and for all households.
H_0	Milk is not a normal food for farm households, for nonfarm households, and for all households.

Hypotheses	Based on Expenditure Elasticities
H_0	Mutton is not a normal food for farm households, for nonfarm households, and for all households.
H_0	Beef is not a normal food for farm households, for nonfarm households, and for all households.
H_0	Poultry is not a normal food for farm households, for nonfarm households, and for all households.
H_0	Eggs are not a normal food for farm households, for nonfarm households, and for all households.

1.7 ORGANIZATION OF THE STUDY

The arrangement of next chapters includes chapter two covering literature review with reference to Pakistan and international studies on consumer behavior measurement. Chapter three is devoted to discussion on methodological aspects and chapter four covers results and discussion. Lastly we mention some conclusive remarks with policy implications.

CHAPTER 2

LITERATURE REVIEW

The present section describes the literature review relevant to Pakistan and international research on consumer demand estimation. Consumer behavior measurement heavily relied on Engel curve estimation prior to invention of complete demand systems. Since 1980, this area of microeconomics is directed towards behavior measurement based on models which are coherent with axioms of demand theory and utility optimization.

Deaton and Muellbauer (1980a) presented Almost Ideal Demand System (AIDS) for measuring consumer behavior in static and dynamic framework of time. The system was claimed to be Almost Ideal because of its capacity to serve as an ideal tool for demand analysis. The writers explained and estimated coefficients of budget share equations. Restrictions of additivity, symmetry and negative semi definiteness were imposed and verified within the model. The generic version of model was being tested on British household's data for eight nondurables from 1954 to 1974 to calculate expenditure and own price elasticities. AIDS can work well with aggregate and micro data was justified by numerical derivations also.

Bhalotra and Attfield (1998) done a comprehensive study on the intra household resource allocation across rural Punjab. The writers have calculated the impact of household size and composition on the consumption patterns of the households. The main outcome is the nonexistence of discrimination amongst different family ties. There is no confirmation of systematic differences in the consumption patterns of children, adult, female workers, female dependents, and elderly dependents as well. This study highlighted the social norms of Pakistani rural society, where the elderly and dependents are served as good as breadwinners.

Farooq et al. (1999) measured the demand behavior of paddy and wheat growing farm households of the rural Punjab. Almost Ideal Demand System is applied to calculate income and price elasticities incorporating household size and age groups for three broad categories of children, adolescent, and adults. The primary data is collected from 177 households of Daska, Gujranwala, and Ferozewala tehsils in the rice wheat zone of irrigated Punjab. The general restrictions of the demand theory are rejected, whilst the own price elasticities are found to be negative and significant.

Haq et al. (2011) exploited HIES data of 5972 households of Pakistani Punjab. They explored the demand pattern for eight categories of food. The main segregation is of the rural and urban Punjab households. The additional explanatory variables to compare the demand patterns are the literacy level and profession of the household heads. The demand system employed is LA-AIDS. Most of the compensated and uncompensated elasticities are found to be significant and having expected signs, while fruits, meat, and cooking oil appear as normal goods for all household. In this case we don't find the evidence for general phenomenon of the same thing to be luxury at low income levels and necessity or normal at high income levels.

Sher et al. (2012) measured the impact of income size on food demand for Pakistani consumers by using Pakistan Social and Living Measurement household survey data for year 2007-2008. They applied double logarithmic form for measuring the income elasticity. Engel Law is being tested on five ranges of income groups. The Engel Law was verified for most of the food items for high income groups. High income groups share on food consumption declined opposite to low income groups whose share on food consumption rises with the income.

Lazaridis (2004) investigated about the olive oil consumption and other three food oils in Greece. He estimated the elasticities by LA-AIDS by time series data and seemingly unrelated regression technique. The Heckman Procedure is used to solve the system. Simultaneously analysis is done for the sample of self-producing households and for those households who buy olive oil. The resulted elasticities are being compared for both kinds of households. Log linear analogue of Laspayers price index instead of conventional stone price index is used as price index. The most striking factor behind household demand patterns is taste in real life which is being used as an additional explanatory variable. Taste is taken as a function of education, family size and location. The results indicate self-production of olives impacts significantly to consumption of olive oil.

Raknerud et al. (2007) estimated LA-AIDS in quarterly time series scenario by applying seemingly unrelated regressions. The analysis is done for nine non-durable commodities and relevant year income and price elasticities are being estimated. The effect of random variables such as season and time trend are also being augmented on the traditional AIDS model. Income and own price elasticities are calculated under homogeneity restrictions. Although the homogeneous model is formally rejected by statistical tests, it performs well with respect to interpretability, parameter stability and forecasting.

Şahinli (2013) have studied the demand patterns of Turkish households over the time range of 2002-2011. The study used panel data mode because of the combination of 12 districts and 10 years. AIDS demand system is exploited to measure the expenditure elasticities as well compensated own price elasticities for twelve major categories of household expenditures of durables as well as non-durables. All expenditure elasticities are significantly positive showing all goods as normal goods. The price elasticities are significant and negative for all groups. Clothing, furniture, house appliances, home care services, entertainment health, food away home and other goods and services found to be highly price elastic. Ordinary least square technique was applied. Negative and positive serial correlation was also detected amongst few items.

Mhurchu et al. (2013) worked on national household surveys of 2008, 2009 for New Zealand. They measured own price and cross price elasticities for 24 food categories. The comparison of statistics is provided for the two ethnic groups under consideration of household income size on quintile base. From the top quintile to the lowest income quintile five groups are being divided, for income range of 16,373$ to 180,259$. The overall comparison is done by applying AIDS model to the data for each year. Out of 24 food groups, 12 appear as non responsive to income changes. The real life phenomenon of high income and low expenditure share on food is also justified in this analysis, as households belonging to uppermost income group spend only 8% of their expenditures on food, whilst the lowest ones income groups spend around 23% on food items. Additionally price elasticities are 40% more high in lowest income groups revealing their weak purchasing power. Income wise price elasticities are significant as well the patterns of Maori households' expenditures are more sensitive to income changes.

Bett et al. (2012) done the demand analysis of indigenous chicken, exogenous chicken, beef, mutton, goat as well other meat options for 930 urban and rural households in Kenya. The study collected primary data from the six counties under the governance of Kenya. They considered socioeconomic factors such as household size and proportion of different ages, location, family size, education and age of the head of the households for measuring the impact on consumption decisions. The resulted uncompensated and compensated elasticities are found to be significant. The socioeconomic variables also found to be significant as well.

Barnett and Serletis (2008) provide an up to date survey of empirical demand systems. They discussed about advancement in demand estimation techniques starting from stone analysis (1954) to recently introduced demand systems such as EASI. The relative pluses and minuses of different techniques with reference to econometric stability and reliability is being discussed. The

quadratic version of Almost Ideal Demand System is supported for its empirical edge over other flexible functional forms, and for its econometric superiority of having highest possible rank.

Aziz and Malik (2010) applied conventional Engel curve technique for measuring expenditure elasticities of various food items on aggregate base. The data is taken from Household Economic Surveys of Pakistan (HIES) for year 2004. The researchers calculated also the impact of household size and rural urban location on the consumption patterns by introducing dummies for each category in standard double log specification of Engel curves. The resulted elasticities are found to be significant mostly at 1 percent level.

Glewwe (2001) addressed regional differences in response to meat demand for North America, Europe, and Asia. Meta Regressions are used as a tool for the measurement of regional comparisons in price elasticities of beef, lamb, fish and poultry. For North America, prices were found least responsive towards the fluctuations in prices of beef, fish and lamb, whereas very few significant differences had emerged in price elasticities across regions. Since the regions share many differences, so the same parameters were calculated for random effects by ordinary least square regression technique.

Kumar et al. (2011) applied two stage budgeting framework for measuring the dietary patterns of Indians within the four income groups ranged from low poor to high non poor. For this purpose households national data base is used over the time range of 1983, 1993, and 2004. The quadratic version of AIDS is employed to calculate compensated and uncompensated price elasticities of the four quintiles. The elasticities verified the legitimacy of Engel law with reference to India. The items chosen for analysis captured all major categories of food such as rice, wheat, vegetables, pulses, fruits. The interesting feature is the side by side employment of Haddad (1992) model named food characteristic demand system. This model showed the impact of various sources of utility such as tastes, energy and variety with reference to the given four divided income classes. The impact of all of these utility sources is found to be effective in structuring food basket choice and food consumption patterns.

Mudassar et al. (2012) estimated the static version of LA-AIDS model for rice, wheat, milk, chicken, fish, mutton and oil of rural and urban areas of Pakistan. The data source is Household Integrated Economic Survey of Pakistan for 2007 and 2008. The usual compensated and uncompensated price elasticities are estimated for these food items, and the signs of elasticities are conventional to demand theory. Fish and meat are found to be luxury goods across urban and rural settings. However most of the estimated parameters for

share equations are insignificant, and the reported elasticities majorly describe the insensitivity of consumers to price changes. The study verified the expected complementary and substitutes relationships amongst different combinations of the food items as well.

Ogundari (2012) considered the differential impact of quantity as well as quantity on meat demand in Nigeria, the broad food categories chosen for analysis were beef, chicken and fish meats. The data source is primary and the sample selected consists of 134 household by random sampling. The model incorporated quantity and quality aspects by measuring income elasticity as well the elasticities for demand for quality. The impact of income changes was significant and positive for changes in demand for quality. To measure the nonlinearities, quadratic version of Engel curve measurement methodology is applied by incorporating the impact of household demographics such as household size and age, gender of the head household as well location dummy. The impact of household size is significant and positive, along with age impacts positively the demand for beef, negatively for chicken and stays inconclusive for fish in the study area. Nevertheless the demand for quality also differed location wise indicating people of Akure South more conscious for quality changes in beef and chicken. Whereas subjects of Akure North demanded were more responsive for quality in fish.

Taljaard et al. (2004) measured demand for various meats in South Africa. The analysis is done for measuring demand changes in red meats consumption over the period of 30 years. Two demand model specifications, the Rotterdam and (LA/AIDS) are being applied on the data to check the best fit. The issue of seperability is handled by the F test and likelihood ratio tests. A Restricted Seemingly Unrelated Regression (RSUR) was used to estimate models on annual time series data. Since the problem of unit root happens in time series data so that the author dealt with it by converting the series into stationary series in first difference. Although the magnitudes of most own price and cross-price elasticities were significantly lower than previous estimates of demand relations for meat in South Africa, several reasons are presented as explanations for these differences. The uncompensated own price elasticity for beef (-0.7504) is the largest in absolute terms, followed by mutton (-0.4678), pork (-0.36972) and chicken (-0.3502). In terms of the compensated own price elasticities, which contain only the pure price effect, pork (-0.30592) was the most elastic, followed by mutton (-0.27713), chicken (-0.1939) and beef (-0.16111). The expenditure elasticities of beef (1.243) and mutton (1.181) are greater than one, indicating that beef and mutton are luxury goods in South Africa. The expenditure elasticity for beef is the most elastic; indicating that South African consumers in one piece will increase their beef consumption as the total expenditure on meat products increase.

Bashir et al. (2013) investigated about the rural households' food security with practical perspective. They collected primary data of 1152 households by random sampling technique. The main findings were around the impact of socioeconomic factors on the food security of households. The chi square tests indicated monthly income, family size, family structure, household head's age and educational levels as the major correlates of rural household food security.

Nzuma and Sarker (2010) searched for the changes in the demand patterns for major cereals including maize, wheat, rice and sorghum in Kenya. The time series data covering time period 1963 to 2005 has been employed. The short run dynamics are incorporated through error correction version of AIDS as the long run equilibrium relationship exists between the variables. To handle with the unit root problem Augmented Dicky Fuller (ADF) test is applied. Short run and long run elasticities are calculated to compare the responsiveness of consumers in long run and short run. The results suggested *Lechatlier* principle holds well as the short run elasticities were smaller in magnitude than long run elasticities. All own-price elasticities have the expected signs and depict the complimentary relationship between maize for wheat and rice, while substitutability for sorghum.

Jung and Koo (2000) analyzed the demand patterns of Korean meat and fish products. LA/AIDS is used for estimation. Since the expenditure term is found to be endogenous, the three-stage least squares (3SLS) estimator is used to estimate the demand system. The data range is of 18 years and the analysis of parameters and elasticities is done on monthly, quarterly, and annual basis. The study also forecasts about the changes in the per capita consumption of meat and fish consumption in response to changes in income growth of the country and changes in prices of the products.

Doran et al. (2001) used LA/AIDS for measuring meat demands in Indonesia on Susana's Surveys of three years 1990, 1993 and 1996.16 meat types are modeled into four meat groups by Stochastic Hicksian Statistical technique. Two main regions which reside one third of whole Indonesian population are taken as case studies. Panel data is chosen for the analysis taking rural urban, provincial differentiation as well. Chicken and beef are found to be substitutes; beef is found least price and income elastic indicating it most preferred meat whilst chicken is found to be elastic in each case. The time and regional differences cast significant effect on consumption choices for meats in Indonesia.

Novelty

This is the only study investigating and comparing consumption patterns of farm/nonfarm households of rural Punjab using PERI data. Uncompensated, Compensated, and Expenditure Elasticities by demand system are calculated very firstly for comparison of consumption patterns of farm, nonfarm households of Punjab. Also the elasticities of single food items instead of elasticities of food groups are estimated very firstly for understanding consumption behavior of rural households of Punjab.

CHAPTER 3

METHODOLOGICAL FRAME WORK

3.1 THEORETICAL BACKGROUND

Neoclassical economic demand theory assumes that consumer demand is derived from constrained utility maximization. The basic axiom of the utility maximization process is that the rational consumer will always choose a most preferred bundle of goods from the feasible set of consumption bundles allowed by his budget. The rational consumer can react in two possible ways, he can maximize utility or minimize cost or expenditure. In either case his preferences for buying goods and services are well behaved. If the consumer's preferences are continuous, complete, transitive and consumer always prefers more on less we call the consumer a rational consumer having well behaved preferences.

It has been a conventional approach in Economics to define a utility function of income and price to measure its impact on demand of certain goods. We maximize utility function by Lagrangian method to get the price and income derivatives. These price and income derivatives are called price and income elasticities. The purpose of complete demand system is also to develop a functional form based on well define preferences. The derived functional form is differentiated to get price and income elasticities. Similarly in LA-AIDS demand system, Deaton and Muellbauer (1980a) derived the functional form of expenditure shares based on well behaved preferences. Then they calculated uncompensated and compensated price elasticities by differentiation of expenditure share equations.

Deaton and Muellbauer (1980b) are the pioneers of complete demand system economic modeling. Over the past four decades, the model named as LA-AIDS contributed immensely to consumer behavior measurement. The bold feature of this complete demand system is having theoretical plausibility of demand theory as well as potentiality for econometric treatment. Since consumer behavior measurement involves quantification of those factors which may influence consumers demand. This model can simultaneously find out the direct and cross effects of independent variables on consumer demand.

Most important assumption of any complete demand system modeling or specifically LA-AIDS modeling is the assumption of two stage budgeting. We assume consumers allocate their budget on goods or services in various

stages or at least two stages. In first stage they decide how much they are going to spend on groups named as food, clothes, fuels, housing, and bills and so on. In the second stage of expenditure allocation, consumers divide their budget precisely to each item of these groups. Because of two stages in budgeting, expenditure allocation to any good within a group can be written as a function only of the total group expenditure and the prices of goods within that group. The demand for any good belonging to the group must also be expressed as a function only of total expenditures on the group and the prices of goods within the group. Considering this we applied the demand system on selected basic food items of interest, and did not considered expenditures on all other groups of food and non-food items.

3.2 EMPIRICAL MODEL

The core reason for choosing demand system for estimating demand responses lies in the coherence of demand system with the integrability conditions of demand theory (Varian, 1992). The complete demand system estimation technique Almost Ideal Demand System (AIDS) was introduced and discussed by Deaton and Muellbauer (1980b) and Muellbauer and Van de Ven (2004). Later on various innovations were observed in this system including quadratic and generalized versions of AIDS. The complete demand system has the tremendous feature of observing own and cross price effects of products as well expenditure elasticities Buse (1994).

The linearized AIDS or LA/AIDS is very popular in empirical analysis of demand behavior for its particular characteristics. Eales and Unnevehr (1994) discussed various features in favor of the model including its convenience to estimation and relative easy interpretation. The system has got an edge over other estimation techniques such as Linear Expenditure System or Rotterdam model for having its local flexibility. Local flexibility allows for complete aggregation of consumers for demand measurement. Nevertheless its functional form satisfies the axioms of choice exactly and works well with micro data. The system has got well defined preferences based on price independent generalized log or PIGLOG class of preferences, which are well defined preferences in demand theory and work well with restrictions of homogeneity, symmetry of demand theory (Glewwe, 2001).

Budget Share equations in general form of LA-AIDS demand system are used for each of food item including wheat, rice, cereal, milk, desighee, vanaspati ghee, mutton, beef, poultry meat, and eggs (Haq et al., 2011). These equations are solved to quantify the impact of prices and real expenditures on

changes of expenditure shares in selected food items. The equation for measuring budget share equations for each of 10 food items is:

$$w_i = \alpha_i + \sum_{j=1}^{10} \gamma_{ij} \ln p_j + \beta_i \ln \frac{X}{P} + + \sum_{s=1}^{3} \lambda_s z_s + \varepsilon_i \qquad (1)$$

w_i is the budget (expenditure) share of the *i*th food item.

p_j is the nominal price of the *jth food item*.

$\ln X$ is the log of total expenditure on all 10 food items.

ε_i is the random or error term

γ_{ij} is the coefficient of cross price effect of jth food item on budget share of ith food item.

β_i measures the change in budget shares of each food item for a change in real income.

z_s is the set of socio economic variables (age, education of the head household, and family size)

λ_s is the coefficient to measure the impact of age, education and family size on consumption.

$\ln P$ is the stone price (linear) index suggested by many authors including Pashardes (1993), Alston et al. (1994), Buse (1994), Hahn (1994), Moschini et al. (1994), and Asche and Wessells (1997). All of them inquired about the relationship between the linear and nonlinear specifications of AIDS model. To compare the reliability of linear version LA-AIDS, they applied Monte Carlo studies and found the use of linear forms of the index in the LA-AIDS provided results which could be compared reasonably well to the AIDS model Buse (1994).

The linear or Stone Price Index is:

$$\ln P = \sum_{i=1}^{10} w_i \ln p_i$$

3.3 RESTRICTIONS OF DEMAND THEORY

Imposing general restrictions on the functional forms has been one usual approach to test demand theory. This approach really results in a reduction of the number of parameters in the system of demand functions, and easily tests whether the resulting functional forms satisfy basic properties of demand

functions or not. If the complete system of demand equations is considered, the degrees of freedom problem can be reduced by use of the restrictions on the parameters in an equation which are implied by consumer theory. The restrictions of (neo-classical demand theory) imposed on LA-AIDS are:

1. Adding up:

$$\sum_{i=1}^{10}\alpha_i = 1,\ \sum_{i=1}^{n}\gamma_{ij} = 0, \sum_{i=1}^{n}\beta_i = 0, \forall i \qquad (2)$$

This implies the sum of the estimated expenditures on the different goods equals the consumer's total expenditures at any given time period.

2. Homogeneity:

$$\sum_{j=1}^{n}\gamma_{ij} = 0 \forall j \qquad (3)$$

This implies if all prices and total expenditures are changed by an equal proportion, the quantity demanded must remain unchanged.

3. Symmetry:

$$\gamma_{ij} = \gamma_{ji} \forall i \neq j \qquad (4)$$

It implies symmetry of cross price derivatives of compensated demand functions.

3.4 PRICE AND EXPENDITURE ELASTICITIES

Expenditure elasticity shows percentage change in commodity's demand for one percentage change in total expenditure of consumer. Expenditure elasticities are positive for normal goods and negative for inferior goods. The own price elasticity shows the percentage change in demand of a commodity for the percentage change in commodity's own price. The cross price elasticity measures the percentage rise or fall in commodity's demand for a percentage change in other commodity's price. The own price elasticities are generally found to be negative for normal goods and positive for giffen goods.

The commodities included in the analysis are: rice, wheat, meats (beef, mutton and chicken), cereals, milk, desi ghee, vanaspati ghee, eggs. Thus, the system to be estimated consisted of a set of 10 budget share equations, one budget share equation for each food item. Since all budget shares sum up to unity they form a singular system of equations which cannot be estimated directly. Henceforth one of the share equations was to be dropped arbitrarily to make the system non-singular. All parameters of budget share equations (Appendix B) and Elasticities(chapter 4) were calculated by Seemingly Unrelated Regression Model.

Green and Alston (1990) have provided detailed discussion on various forms of uncompensated and compensated elasticities to be used in LA-AIDS model including the following equations:

(i) Uncompensated Price Elasticities:

Uncompensated or Marshellian elasticities are based on Marshellian demand functions, which are used to measure the impact of price changes on food demand.

$$e_{ij} = \frac{\gamma_{ij} - \beta_i}{w_i} w_j - \delta_{ij} \qquad (5)$$

(ii) Compensated Price Elasticities:

Compensated elasticities or Hicksian elasticities are based on Hicksian demand function. These elasticities are based on income effect of price changes. These elasticities also quantify the magnitude of household response for price changes and are more sensitive for real income changes of households.

$$e_{ij}^{\bullet} = \frac{\gamma_{ij}}{w_i} + w_j - \delta_{ij} \qquad (6)$$

Here δ_{ij} is the Kronecker delta which equals one for own price and zero for cross-price (Haq et al., 2011)

(iii) Expenditure Elasticities:

Expenditure elasticity shows percentage change in commodity's demand for one percentage change in total expenditure of consumer. Expenditure elasticities are positive for normal goods and negative for inferior goods

$$\rho_i = \frac{\beta_i}{w_i} + 1 \qquad (7)$$

The estimation of LA-AIDS was carried out using a system of equations comprising household budget shares for various commodity groups. Firstly we calculated all parameters of budget share equations for years 2009 and 2010 separately (Appendix B) and then we used the values of these parameters to calculate uncompensated, compensated and expenditure elasticities for all households, for farm households and for nonfarm households in years 2009 and 2010. Accordingly we have got three sets of elasticities for comparison (elasticities of all farm, nonfarm households, elasticities for farm households only and elasticities for nonfarm households only).

3.5 DATA SOURCE AND SAMPLING FRAMEWORK

PERI was established before partition in 1919, it publishes data reports on household's budget surveys of Punjab farm and nonfarm households since 1928. In order to give due coverage to all types of heterogeneity in units of rural households in Punjab, stratified sampling is done each year. At first, study area (Punjab) is divided into two regions on the basis of source of irrigation such as Barani region and Irrigated region. The Barani region is further divided into Barani and partial Barani, while the irrigated region has got three classifications as cotton wheat zone, rice wheat zone, mixed wheat zone. All these agro ecological zones are covered under 17 study centers of the 16 districts (the details of zones and districts are presented in Appendix A). To reach the final stage of selection of sample respondents, complete census of the population (farm and nonfarm households) is conducted. The number of sample farm households is determined by using the following statistical formula:

$$n - \frac{z^2 p(1-p) N.}{z^2 p(1-p) + n d^2}$$

where

n = sample size
Z = Normal variate
P = population proportion
d = maximum error deemed acceptable
N = target population

The sample size for nonfarm families is determined keeping in view the proportion of nonfarm households in the sample villages, while occupational activities are also given due consideration in this regard (Ata and Quddus, 2010).

CHAPTER 4

RESULTS AND DISCUSSION

This section presents the result of expenditure, compensated and uncompensated price elasticities. The elasticities are calculated by the formulas given in methodological section. All elasticities are derived from LA-AIDS for all households, for nonfarm households, and for farm households for 2009 and 2010 years separately.

4.1 PRICE AND EXPENDITURE ELASTICITIES 2009

When discussing price elasticities we find two types revealed under a complete demand system such as LA-AIDS, the own price elasticity and the cross price elasticity. The own price elasticity shows the response of change in demand for the change in items own price and the cross price elasticity measures the impact of changes in other items prices on the demand for the item under discussion. The own price elasticities are generally found to be negative for normal goods and positive for giffen goods. The cross price elasticity is negative if the cross product is a complimentary good and positive if the cross product is the substitute for the item under discussion.

In the present analysis all cross price elasticities are negative with few exceptions of positive inelastic own price elasticity for poultry, and vanaspati ghee and wheat. These positive elasticities might have resulted because of small sample size. Expenditure elasticities are positive for food items such as wheat, rice and milk and negative for inferior food items such as cereals.

4.2 COMPARISON OF ELASTICITIES FOR 2009

In this segment the comparison of elasticities is presented for three cases; for farm, nonfarm households, for only farm households and for only nonfarm households. Each food item's elasticity is discussed for years 2009 and 2010 separately.

Farm and Non-Farm Households 2009

Table 4.1
Uncompensated Price Elasticities

	Wheat	Rice	Cereal	Milk	Desi Ghee	Vanaspati Ghee	Mutton	Beef	Poultry	Eggs
Wheat	-0.272	-0.263	-0.017	0.194	0.174	-0.420	0.237	-0.109	-0.343	-0.042
Rice	-1.651	-0.242	0.185	0.189	0.207	-0.430	0.389	0.033	0.228	0.060
Cereal	-2.026	4.345	-7.425	-3.126	6.247	-2.878	7.273	-3.109	3.438	-2.561
Milk	0.090	0.023	-0.023	-1.337	-0.186	0.115	0.032	-0.006	0.132	0.020
Desi Ghee	0.809	0.179	0.302	-1.772	-0.777	-0.594	-0.526	0.336	0.185	-0.303
Vanaspati Ghee	-0.806	-0.127	-0.046	0.476	-0.113	-0.067	-0.187	0.180	0.111	0.039
Mutton	7.776	2.151	1.777	0.870	-2.617	-3.216	-4.807	-0.353	-3.548	-0.161
Beef	-0.760	0.029	-0.140	-0.035	0.346	0.436	-0.055	-1.178	0.202	0.025
Poultry	-2.515	0.282	0.176	1.158	0.252	0.332	-0.742	0.251	0.018	-0.080
Eggs	-0.697	0.164	-0.293	0.430	-0.646	0.232	-0.064	0.073	-0.178	0.042

Table 4.2
Compensated Price Elasticities

	Wheat	Rice	Cereal	Milk	Desi Ghee	Vanaspati Ghee	Mutton	Beef	Poultry	Eggs
Wheat	-0.009	-0.220	-0.015	0.485	0.212	-0.298	0.244	-0.067	-0.308	-0.026
Rice	-1.336	-0.191	0.187	0.538	0.252	-0.284	0.398	0.084	0.271	0.080
Cereal	-2.080	4.336	-7.426	-3.186	6.239	-2.903	7.271	-3.118	3.431	-2.565
Milk	0.438	0.080	-0.020	-0.951	-0.136	0.276	0.042	0.050	0.179	0.042
Desi Ghee	1.469	0.287	0.307	-1.041	-0.682	-0.288	-0.507	0.442	0.275	-0.262
Vanaspati Ghee	-0.641	-0.100	-0.044	0.658	-0.089	0.010	-0.182	0.207	0.134	0.049
Mutton	8.426	2.258	1.781	1.589	-2.523	-2.914	-4.789	-0.248	-3.460	-0.121
Beef	-0.415	0.085	-0.138	0.347	0.396	0.596	-0.045	-1.123	0.249	0.046
Poultry	-2.251	0.326	0.178	1.451	0.290	0.455	-0.734	0.293	0.054	-0.064
Eggs	-0.411	0.211	-0.291	0.747	-0.604	0.365	-0.056	0.119	-0.139	0.059

Table 4.3
Expenditure Elasticities

Wheat	Rice	Cereal	Milk	Desi Ghee	Vanaspati Ghee	Mutton	Beef	Poultry	Eggs
0.861	1.033	-0.177	1.141	2.162	0.540	2.129	1.131	0.867	0.938

Farm Households 2009

Table 4.4
Uncompensated Price Elasticities

	Wheat	Rice	Cereal	Milk	Desi Ghee	Vanaspati Ghee	Mutton	Beef	Poultry	Eggs
Wheat	-0.236	-0.250	-0.038	0.330	0.177	-0.466	0.227	-0.153	-0.421	-0.048
Rice	-1.563	-0.144	0.217	0.115	0.265	-0.588	0.459	0.124	0.090	0.009
Cereal	-4.962	5.093	-9.928	-3.573	6.242	-2.856	10.147	-4.885	4.177	1.046
Milk	0.215	0.011	-0.027	-1.457	-0.251	0.161	0.036	-0.020	0.169	0.013
Desi Ghee	0.863	0.250	0.299	-2.226	-0.964	-0.580	-0.418	0.397	0.321	-0.006
Vanaspati Ghee	-0.915	-0.187	-0.045	0.573	-0.113	0.004	-0.201	0.176	0.130	-0.009
Mutton	7.410	2.535	2.478	0.969	-2.115	-3.450	-4.881	-0.366	-3.954	-0.954
Beef	-0.998	0.126	-0.219	-0.096	0.402	0.444	-0.054	-0.848	0.183	0.034
Poultry	-3.055	0.120	0.215	1.495	0.399	0.411	-0.825	0.227	0.078	0.144
Eggs	-0.746	0.033	0.117	0.324	0.034	-0.092	-0.431	0.097	0.315	-0.488

Table 4.5
Compensated Price Elasticities

	Wheat	Rice	Cereal	Milk	Desi Ghee	Vanaspati Ghee	Mutton	Beef	Poultry	Eggs
Wheat	0.032	-0.206	-0.036	0.626	0.216	-0.342	0.235	-0.110	-0.384	-0.031
Rice	-1.253	-0.093	0.219	0.458	0.310	-0.444	0.468	0.174	0.133	0.029
Cereal	-5.114	5.067	-9.929	-3.742	6.220	-2.927	10.143	-4.909	4.156	1.037
Milk	0.566	0.068	-0.024	-1.068	-0.200	0.324	0.046	0.036	0.217	0.035
Desi Ghee	1.493	0.354	0.304	-1.529	-0.873	-0.288	-0.400	0.498	0.408	0.033
Vanaspati Ghee	-0.736	-0.157	-0.044	0.772	-0.088	0.087	-0.196	0.204	0.155	0.003
Mutton	8.120	2.652	2.483	1.756	-2.013	-3.120	-4.860	-0.252	-3.856	-0.910
Beef	-0.684	0.178	-0.217	0.251	0.447	0.589	-0.045	-0.798	0.226	0.053
Poultry	-2.813	0.160	0.216	1.762	0.434	0.523	-0.818	0.266	0.111	0.159
Eggs	-0.491	0.075	0.118	0.606	0.071	0.027	-0.424	0.138	0.350	-0.472

Table 4.6
Expenditure Elasticities

Wheat	Rice	Cereal	Milk	Desi Ghee	Vanaspati Ghee	Mutton	Beef	Poultry	Eggs
0.878	1.017	-0.500	1.149	2.064	0.587	2.328	1.026	0.790	0.837

Non-Farm Households 2009

Table 4.7
Uncompensated Price Elasticities

	Wheat	Rice	Cereal	Milk	Desi Ghee	Vanaspati Ghee	Mutton	Beef	Poultry	Eggs
Wheat	-0.425	-0.277	0.028	-0.765	0.021	-0.137	0.384	0.170	0.010	0.125
Rice	-1.804	-0.294	0.022	0.675	-0.053	0.121	-0.002	-0.272	0.302	0.034
Cereal	3.999	0.430	-6.175	1.870	1.559	2.220	-1.926	-1.515	-8.244	6.398
Milk	-0.681	0.122	0.011	-0.528	0.089	0.023	0.071	0.075	-0.121	0.112
Desi Ghee	-0.044	-0.088	0.083	0.465	-0.760	-0.286	-0.657	0.294	-0.275	-0.342
Vanaspati Ghee	-0.136	0.098	0.028	0.220	-0.044	-0.241	-0.052	-0.053	-0.154	0.065
Mutton	13.004	0.026	-0.466	2.369	-3.169	-1.292	-5.883	-1.596	0.633	-4.941
Beef	0.574	-0.343	-0.052	-0.042	0.270	-0.532	-0.337	-1.964	0.501	-0.586
Poultry	-0.113	0.216	-0.420	-1.129	-0.458	-0.212	0.070	0.112	-8.698	8.211
Eggs	0.998	0.226	0.751	0.660	-0.403	-1.325	-2.294	-0.455	19.137	-19.634

Table 4.8
Compensated Price Elasticities

	Wheat	Rice	Cereal	Milk	Desi Ghee	Vanaspati Ghee	Mutton	Beef	Poultry	Eggs
Wheat	-0.161	-0.233	0.030	-0.473	0.059	-0.015	0.392	0.212	0.046	0.142
Rice	-1.416	-0.230	0.025	1.104	0.003	0.301	0.009	-0.210	0.355	0.059
Cereal	4.421	0.499	-6.172	2.337	1.620	2.417	-1.914	-1.447	-8.187	6.425
Milk	-0.429	0.164	0.013	-0.248	0.126	0.140	0.078	0.115	-0.087	0.128
Desi Ghee	0.448	-0.007	0.086	1.009	-0.689	-0.058	-0.643	0.373	-0.208	-0.312
Vanaspati Ghee	-0.054	0.112	0.029	0.311	-0.033	-0.203	-0.049	-0.040	-0.143	0.070
Mutton	13.405	0.092	-0.463	2.813	-3.111	-1.106	-5.871	-1.531	0.688	-4.915
Beef	1.340	-0.217	-0.046	0.806	0.381	-0.176	-0.315	-1.840	0.606	-0.538
Poultry	0.626	0.337	-0.415	-0.311	-0.351	0.131	0.091	0.231	-8.597	8.257
Eggs	1.712	0.343	0.757	1.450	-0.300	-0.994	-2.274	-0.340	19.234	-19.589

Table 4.9
Expenditure Elasticities

Wheat	Rice	Cereal	Milk	Desi Ghee	Vanaspati Ghee	Mutton	Beef	Poultry	Eggs
0.866	1.271	1.383	0.828	1.610	0.267	1.314	2.510	2.421	2.340

4.2.1 Expenditure Elasticities Comparisons

1. Wheat: wheat is a normal good in all three cases and inelastic towards income changes, the expenditure elasticity is (0.86) on average in all three cases.

2. Rice: Rice is a luxury item in all three cases as for 1% rise in expenditures; we find more than 1% change in spending on average. The highest sensitivity is found for nonfarm households (1.27) followed by farm households (1.01).

3. Cereals: Cereals are inferior good and inelastic food item for all households and farm households. The reason for being inferior may be the relative low status of cereal for being by product of wheat. For nonfarm households we find cereals elastic food item. This is the first difference observed between consumption patterns across farm and nonfarm households.

4. Milk: For all households case we find milk as a luxury food item, having elasticity (1.14) vice versa for farm households only case. We observe change in spending on milk equal to 1.14% for a 1% rise in expenditures on all food items. Nonfarm households are slightly less responsive for changes in expenditure. As 1% rise in expenditures of these households leads to only 0.8% rise in spending on milk purchase, so for nonfarm households milk appears as necessity.

5. Desighee: Households are very much responsive for spending on desighee in case of expenditure rise. The elasticity ranges from 2.162 to 1.610 for all households to nonfarm households only. This shows desighee is a luxury food item for rural households.

6. Vanaspati ghee: vanaspati ghee purchase is not much influenced by expenditure changes in all cases, showing it very inelastic with elasticity range 0.2 to 0.5.

7. Mutton: Mutton consumption is highly influenced by expenditure changes, so it is undoubtedly a luxury food in all cases. Its elasticity range is 2.12 to 1.31.

8. Beef: Beef is also very much responsive for change in expenditure, for all households and nonfarm households its elasticity is 1.31, for farm households its elasticity is much greater i.e. (2.51).

9. Poultry: For poultry farm households do not show very much preference for consumption as their expenditure level changes. All households and farm households elasticity is less than 1 while nonfarm households show strong inclination for its consumption with elasticity equal to 2.42.

10. Eggs: The same is the case with eggs with a big difference of elasticity for nonfarm households (2.34). Farm households are not responsive to expenditure changes to spend on eggs and poultry.

4.2.2 Price Elasticities Comparisons

When discussing price elasticities we find two types revealed under a complete demand system such as AIDS, The own price elasticity shows the response of change in demand for the change in product price. The cross price elasticity measures the impact of changes in other products prices on the demand for the product under discussion. The cross price elasticity is negative if the cross product is a complimentary good and positive if the cross product is the substitute for the product under discussion. In the present analysis all own price elasticities are negative with a few exceptions positive own price elasticity of eggs, poultry and vanaspati ghee. But none of these elasticities has exceeded more than 0.07. In the following detailed comparison for three cases is presented for 2009.

4.2.3 Farm, Nonfarm Households Comparisons

1. Wheat is having much inelastic demand in all cases with least level of 0.2 uncompensated price elasticity and 0.009 compensated price elasticity. This justifies it well a necessity item for rural households. I found rice, cereals, vanaspati ghee, beef, poultry and eggs as complimentary food items for wheat, but all price elasticities are very less than 1 so none of these could bring change in the demand for wheat by price changes. Milk, desi ghee and mutton are substitutes for wheat and have less than 1 uncompensated and compensated price elasticities so also do not impact consumption decision for wheat.

2. Rice is also a necessity item for these households, much inelastic to price changes in all cases. Except wheat and vanaspati ghee, all other food items are substitute for rice. All cross price elasticities in all cases are quite far from 1. Which indicate no impact of price changes in any of the food items on the consumption of rice.

3. Cereals are highly responsive to price changes. Fall of 1% in price of cereals brings on average 9.9% rise in demand of cereals for farm households followed by relative less amount of response 6.1% rise in demand by nonfarmers. Wheat, milk, vanaspati ghee, beef and eggs are gross compliments, while rice, desighee, mutton and poultry are gross substitutes for cereals. All cross elasticities are greater than 1 and high in magnitude. So fall in the price of any of these leads households to raise the consumption of cereals.

4. For milk we find major differences in uncompensated and compensated price elasticities of both cases. The uncompensated own cross price elasticity -1.4 for farm households shows milk a luxury item for households on average, and 0.5 for nonfarm households shows nonfarmers less responsive for price changes. The highest cross price elasticity is observed for milk and wheat (0.5) for nonfarm households, which shows 1% fall in price of wheat can urge farmers to spend only 0.5% more on milk. In either case rural households are least influenced by changes in all other food prices for milk consumption.

5. Desi Ghee Nonfarm households are relatively less responsive for price changes (0.7) as compared to farm households with 0.96 elasticity. Milk, wheat and desighee have elastic cross price relationships with highest cross price elasticity -2.2 for farm households followed by 1.0 for nonfarm households so that fall in the price of these items can influence in desi ghee consumption by all households. A 1% fall in price of milk will induce households to spend 2.2% more on desi ghee on average. All other cross price relationships are inelastic except wheat which brings 1.4% change on average in desighee consumption by 1% change in its price.

6. Vanaspati ghee is also having very low uncompensated price elasticity (0.02), least responsive to price change by farm households. Since no cross price relationship is effective in any case which shows the ultimate option for rural households cooking is vanaspati ghee as desi ghee is quite expensive. Beef, poultry, eggs, and milk are gross substitutes and inelastic in usual way. Nonfarm households as well have inelastic demand for vanaspati ghee (0.2).

7. Mutton purchase is highly influenced by its price changes and relative products price changes as well. For farm households a 1% fall in price of mutton induces households on average to spend 4.8% more on its consumption. The 1% fall in price of poultry

also brings 3.5% rise in consumption of mutton on average. While the fall in the prices of wheat, rice, cereals and milk also leave households to spend more on consumption of mutton. Nonfarmers have more sensitivity to price changes (-5.8) in mutton followed by (-4.8) for farm households. The highest cross price elasticity is (-13.0) for wheat and mutton by nonfarm households.

8. Beef is also having elastic demand (-1.8) for nonfarm households which suggests these households will spend 1.8% on average for a 1% fall in its price. The change in other food prices is not casting any impact on average for consuming beef except of wheat. The farm households have all cross price elasticities inelastic and inelastic demand for beef as well(-0.8)

9. Poultry is having inelastic demand; it is influenced by the changes in price of wheat and milk, for 1% fall in price of milk we find on average 1.45% rise in consumption of poultry and, for 1% fall in price of wheat we find on average 2.25% rise in consumption of poultry. All other cross price elasticities are least elastic.

10. Eggs are also showing positive price elasticity, which contradicts general demand behavior. One explanation might be collected in winter, when demand for eggs rises even with a rise in prices. None of the changes in any other food items brings any change in the demand for eggs.

4.2.4 Comparison of All Cases of Households

In following the comparison of consumption patterns is presented for three cases: All farm and nonfarm households, Only farm households, Only Nonfarm households.

We find no major differences by comparing elasticities of farm households and nonfarm households with the all farm households' case. There are few items with reverse of signs in cross price elasticities which suggest the shift of relationships amongst food items otherwise uncompensated and compensated own and cross prices found once inelastic in all farm households remain in inelastic in other two cases. This scenario is explained with examples:

Wheat is having least own uncompensated elasticity for farm households followed by very low elasticities for nonfarm and all households. This indicates strongly the due importance of wheat for rural households. All

possible cross price relationships are not effective to change demand for wheat by rural households since elasticities are far below 1.

Rice also serves as necessity item for farm and nonfarm households as its elasticity is far below 1 in all three cases. The change in price of wheat casts impact on the demand for rice in all three cases with one exception of compensated elasticity for nonfarm households. On average for 1% fall in price of wheat leads to 1.5% rise in demand for rice for farm households, 1.6% rise in demand for rice by nonfarm households. All other cross price elasticities are not effective enough to impact demand for rice.

Cereals own price elasticity is the second highest in all households' cases. All cross price elasticities in all three cases are very high in magnitude. The relative strength of cross price elasticities is highest for all farm households followed by farm households and nonfarm households. High elasticities imply the role of cereal is not of a necessity item on average for all types of households as compared to rice and wheat.

Milk is also assumed to be a necessity item for households, but in case of farm households it does not acts as a necessity item having elasticity greater than 1. This might be due to the sample combination of farm households where more than 30% of households belong to negative income group. Milk is a necessity item for nonfarm households. It comprises of only 8% of all households belonging to negative income group. All possible cross price elasticities are not effective to impact demand for milk in any case of households

Desighee own price elasticity is quite less than 1 in any case. So we may say for price change, the demand is not responsive for desighee. One possible interpretation might be the traditional trend of rural Punjab i.e. households make ghee on their own by milk cream. This can be justified with the only found high cross price elasticity of milk for desighee for farm households. It shows a 1% fall in price of milk will induce farm household to spend 2.22% more on average for desighee purchase. The other cross price elasticities are inelastic with one exception of wheat for desighee in farm household's case. Here 1% fall in price of wheat induces to pay for desighee by 1.43% on average.

Vanaspati ghee is having inelastic price relationships for all other food items in all three cases.

Eggs also show striking difference of very high price elasticity (-19.63) to totally inelastic price elasticity for farm households (-0.48) sensitivity to

price changes is found for wheat and eggs (1.71),milk and eggs (1.45), and poultry, eggs (19.23) for nonfarm households.

Only nonfarm households are sensitive to great extent for price changes in poultry (-8.57). Only two cross price relations with wheat and rice are found elastic for farm households only.

Nonfarm households and all households have elastic demand for beef (-1.96) and (-1.17) respectively. Nevertheless only farm households have inelastic price elasticity (-0.84). All cross price elasticities are less than 1 except of one exception of wheat and beef (1.34) in nonfarm households case.

Mutton is the food item with highest price elasticity. For nonfarm households (-5.8) on average, followed by (-4.86) and (-4.78) by farm households and all households. The highest cross price relationship is found for wheat and mutton (13.405) in nonfarm household's case. Highest cross price elasticities of mutton with milk, desighee, vanaspati ghee, beef, and eggs are observed for nonfarm households. While only cereals and rice prices bring change in demand for mutton in other two cases of farm households and all households.

4.3 ELASTICITIES COMPARISONS FOR 2010

Here, we present rather concise comparison of elasticities for same three cases of all households, only farm households and nonfarm households.

Farm and Non-Farm Households 2010

Table 4.10
Uncompensated Price Elasticities

	Wheat	Rice	Cereal	Milk	Desi Ghee	Vanaspati Ghee	Mutton	Beef	Poultry	Eggs
Wheat	0.280	-0.307	0.104	-0.394	-0.064	-0.410	0.105	0.027	-0.057	0.021
Rice	-1.821	-0.318	0.195	0.332	0.559	-0.362	0.239	-0.062	0.318	-0.046
Cereal	20.234	6.606	-25.557	-2.803	2.168	-4.116	2.190	-2.754	4.790	-0.330
Milk	-0.431	0.032	-0.013	-0.693	0.033	0.050	-0.047	-0.053	-0.060	-0.010
Desi Ghee	-0.915	0.470	0.060	-0.302	-1.176	0.007	-0.178	-0.036	-0.391	-0.215
Vanaspati Ghee	-0.744	-0.101	-0.044	0.416	0.113	-0.018	-0.090	0.151	-0.061	-0.060
Mutton	2.676	1.184	0.338	-2.287	-0.922	-1.615	-0.122	0.015	-1.589	0.019
Beef	0.072	-0.063	-0.084	-0.334	0.046	0.355	0.015	-1.105	0.125	-0.019
Poultry	-0.599	0.430	0.197	-0.652	-0.479	-0.353	-0.413	0.164	0.299	0.181
Eggs	0.441	-0.134	-0.034	-0.012	-0.624	-0.586	0.029	-0.043	0.460	-0.037

Table 4.11
Compensated Price Elasticities

	Wheat	Rice	Cereal	Milk	Desi Ghee	Vanaspati Ghee	Mutton	Beef	Poultry	Eggs
Wheat	0.473	-0.273	0.105	-0.134	-0.030	-0.313	0.112	0.061	-0.033	0.031
Rice	-1.553	-0.271	0.197	0.693	0.607	-0.227	0.248	-0.015	0.352	-0.032
Cereal	20.114	6.585	-25.557	-2.964	2.147	-4.176	2.186	-2.775	4.775	-0.336
Milk	-0.099	0.090	-0.012	-0.247	0.092	0.217	-0.036	0.005	-0.018	0.007
Desi Ghee	-0.170	0.600	0.063	0.701	-1.044	0.381	-0.153	0.095	-0.297	-0.176
Vanaspati Ghee	-0.622	-0.079	-0.044	0.580	0.135	0.043	-0.086	0.173	-0.046	-0.053
Mutton	3.316	1.297	0.341	-1.425	-0.808	-1.293	-0.101	0.128	-1.508	0.053
Beef	0.348	-0.015	-0.083	0.038	0.095	0.493	0.024	-1.057	0.160	-0.005
Poultry	-0.258	0.490	0.199	-0.193	-0.419	-0.182	-0.401	0.224	0.342	0.199
Eggs	0.592	-0.108	-0.034	0.190	-0.598	-0.510	0.034	-0.016	0.479	-0.029

Table 4.12
Expenditure Elasticities

Wheat	Rice	Cereal	Milk	Desi Ghee	Vanaspati Ghee	Mutton	Beef	Poultry	Eggs
0.694	0.966	-0.430	1.191	2.677	0.437	2.302	0.993	1.225	0.541

Farm Households 2010

Table 4.13
Uncompensated Price Elasticities

	Wheat	Rice	Cereal	Milk	Desi Ghee	Vanaspati Ghee	Mutton	Beef	Poultry	Eggs
Wheat	0.398	-0.278	0.115	-0.432	-0.267	-0.313	0.105	0.009	-0.044	-0.015
Rice	-1.635	-0.178	0.248	0.212	0.413	-0.326	0.260	-0.049	0.251	-0.108
Cereal	22.719	8.462	-27.213	-5.125	5.262	-6.148	2.506	-3.172	4.886	-0.011
Milk	-0.459	0.012	-0.025	-0.747	0.092	-0.013	-0.046	-0.019	-0.035	0.015
Desi Ghee	-2.015	0.327	0.147	0.213	-0.329	-0.219	-0.250	0.139	-0.499	-0.072
Vanaspati Ghee	-0.571	-0.095	-0.068	0.219	0.022	-0.026	-0.068	0.185	-0.080	-0.056
Mutton	2.695	1.290	0.384	-2.252	-1.319	-1.253	-0.302	0.255	-1.882	0.070
Beef	0.053	-0.038	-0.099	0.059	0.240	0.501	0.065	-1.508	0.101	-0.056
Poultry	-0.442	0.341	0.198	-0.312	-0.630	-0.391	-0.489	0.122	0.399	0.138
Eggs	-0.212	-0.339	-0.005	0.701	-0.133	-0.522	0.063	-0.175	0.356	-0.147

Table 4.14
Compensated Price Elasticities

	Wheat	Rice	Cereal	Milk	Desi Ghee	Vanaspati Ghee	Mutton	Beef	Poultry	Eggs
Wheat	0.599	-0.243	0.116	-0.162	-0.231	-0.212	0.112	0.044	-0.019	-0.005
Rice	-1.381	-0.134	0.250	0.554	0.458	-0.198	0.268	-0.004	0.283	-0.095
Cereal	22.117	8.357	-27.216	-5.936	5.155	-6.451	2.486	-3.278	4.810	-0.043
Milk	-0.119	0.072	-0.023	-0.288	0.153	0.158	-0.035	0.040	0.008	0.033
Desi Ghee	-1.304	0.452	0.151	1.171	-0.203	0.138	-0.226	0.264	-0.409	-0.035
Vanaspati Ghee	-0.422	-0.069	-0.067	0.420	0.049	0.049	-0.063	0.211	-0.061	-0.048
Mutton	3.339	1.403	0.388	-1.386	-1.205	-0.930	-0.280	0.368	-1.800	0.104
Beef	0.243	-0.004	-0.098	0.315	0.274	0.597	0.071	-1.475	0.125	-0.047
Poultry	-0.145	0.394	0.200	0.087	-0.578	-0.242	-0.479	0.174	0.436	0.154
Eggs	-0.098	-0.319	-0.004	0.855	-0.112	-0.464	0.067	-0.155	0.370	-0.141

Table 4.15
Expenditure Elasticities

Wheat	Rice	Cereal	Milk	Desi Ghee	Vanaspati Ghee	Mutton	Beef	Poultry	Eggs
0.721	0.912	-2.167	1.224	2.558	0.536	2.313	0.683	1.066	0.412

Non-Farm Households 2010

4.16
Uncompensated Price Elasticities

	Wheat	Rice	Cereal	Milk	Desi Ghee	Vanaspati Ghee	Mutton	Beef	Poultry	Eggs
Wheat	0.490	-0.274	0.011	-0.580	0.072	-0.489	0.002	-0.025	-0.004	0.119
Rice	-1.690	-0.418	0.011	0.305	0.522	-0.201	0.229	-0.772	0.865	0.009
Cereal	2.087	0.340	-8.138	-0.603	1.243	-0.186	4.072	0.329	-0.450	0.104
Milk	-0.509	0.047	-0.002	-0.582	0.004	0.188	-0.003	-0.021	-0.078	-0.029
Desi Ghee	0.083	0.474	0.038	-0.289	-1.495	-0.072	0.103	-0.130	-0.283	-0.353
Vanaspati Ghee	-0.864	-0.027	-0.002	0.742	0.046	0.237	-0.417	0.113	-0.040	-0.072
Mutton	-1.026	1.040	0.639	-1.281	0.511	-6.891	2.794	2.473	-1.109	-1.471
Beef	-0.504	-0.812	0.011	-0.493	-0.115	0.078	0.490	-0.055	-0.506	-0.046
Poultry	-0.703	1.123	-0.017	-1.468	-0.380	-0.598	-0.269	-0.719	-0.013	0.223
Eggs	2.144	0.038	0.011	-0.754	-1.139	-0.822	-0.903	-0.095	0.620	-0.117

Table 4.17
Compensated Price Elasticities

	Wheat	Rice	Cereal	Milk	Desi Ghee	Vanaspati Ghee	Mutton	Beef	Poultry	Eggs
Wheat	0.678	-0.240	0.012	-0.326	0.105	-0.394	0.008	0.008	0.020	0.128
Rice	-1.373	-0.362	0.012	0.732	0.578	-0.042	0.240	-0.716	0.905	0.025
Cereal	2.421	0.399	-8.136	-0.153	1.303	-0.018	4.084	0.388	-0.408	0.122
Milk	-0.234	0.095	-0.001	-0.213	0.053	0.326	0.006	0.027	-0.044	-0.014
Desi Ghee	0.619	0.568	0.040	0.431	-1.400	0.197	0.121	-0.036	-0.216	-0.325
Vanaspati Ghee	-0.785	-0.013	-0.002	0.849	0.060	0.277	-0.415	0.127	-0.030	-0.068
Mutton	0.176	1.251	0.645	0.337	0.725	-6.287	2.834	2.685	-0.957	-1.408
Beef	0.039	-0.716	0.014	0.237	-0.018	0.351	0.508	0.040	-0.437	-0.018
Poultry	0.081	1.261	-0.013	-0.411	-0.241	-0.204	-0.243	-0.581	0.086	0.264
Eggs	2.427	0.088	0.012	-0.374	-1.088	-0.680	-0.894	-0.045	0.656	-0.102

Table 4.18
Expenditure Elasticities

Wheat	Rice	Cereal	Milk	Desi Ghee	Vanaspati Ghee	Mutton	Beef	Poultry	Eggs
0.679	1.139	1.201	0.986	1.924	0.285	4.321	1.951	2.821	1.016

4.3.1 Expenditure Elasticities Comparisons

Expenditure elasticities for all households, farm households, nonfarm households are discussed and compared in the following:

Wheat is a normal good for households in each case and inelastic to change in expenditures. The lest elasticity is found for nonfarm households, showing only .6 rise on spending on wheat on average by 1% rise in total expenditure on food items.

Rice is considered as a luxury item for nonfarm households with expenditure elasticity (1.13) followed by all households (0.96) and farm households (0.91). These two elasticities are near to cut off point between luxury and necessity products.

Cereals are inferior food item for farm households (-2.16) and all households (-0.43) and luxury food item for nonfarm households (1.20). This shows a divergence of preferences between farm and nonfarm households. One ea byproduct of wheat so rise in income does not leads to purchase it more.

Milk is a luxury item for all households (1.19), farm households (1.22) and near to luxury for nonfarm households (0.98) on average.

Desi ghee is highly elastic to expenditure changes, and a luxury item for households in each case with elasticities respectively (2.67), (2.55), (1.92) for all farm households, farm households, nonfarm households.

Vanaspati ghee is a necessity food item for all households.

Mutton is highly sensitive to expenditure changes, a 1% rise in total expenditure on food items leads to 2.30%, 2.31%, 4.32% rise in spending on average for all households, farm households, nonfarm households respectively.

Beef is a necessity for farm households (0.68), a luxury item for nonfarm households (1.95) and all households (0.99).

On average more is spent on poultry by all households when they face rise in expenditures, while eggs are more sensitive to expenditure changes for nonfarm households only.

4.3.2 Price Elasticities Comparisons

Wheat is having positive own price elasticity in all three cases, which shows its special reference to farm households as the farmers grow wheat themselves, rise in price of wheat on average leaves them better off, also wheat is an unmatchable item for households having no close substitute with elasticity greater than 1. All cross price relationships are in elastic for wheat in all households' case.

Again rice acts as a necessity item for households in three cases. It is the major part of necessities for rural households for they prefer it on all other items. The only food item influencing rice demand is wheat, fall of 1% in wheat price brings on maximum 1.82% rise in rice price for all farm households on average and vice versa for other two cases the impact of wheat price on rice demand is elastic. All other cross price relationships are not effective in any case.

Cereals again are most responsive to price changes, with 8.13 elasticity for nonfarm households, and 27.2 level of own price elasticity for farm households. This is the only item having eight cross price relationships highly elastic for farm households and all household. Nevertheless nonfarm households report relatively less cross price relationships. Wheat, desighee and mutton through price change impact the demand for cereals for nonfarm households.

Milk is a necessity item for all households, and not receptive to price changes. All cross price elasticities are very small in magnitude. The own price elasticity of desighee is 1.4 for nonfarm households followed by all rural households with 1.1 units, while farm households have inelastic demand for desighee on average. Only farm households have cross price elasticities between desighee, wheat and desighee, milk greater than 1. For nonfarm and all households' case we find no elastic cross price relationship.

The Rural farm households are not provided with much options for cooking oils variety, as the data questionnaires reveal only two options for cooking as desi ghee and vanaspati ghee. Desi ghee's price is as good as double to vanaspati ghee, so substitution is not found effective in demand for desighee case by price changes for farm households. Vanaspati ghee being the only economic option for most of the households remains very much inelastic to price changes. The only cross price relationship found bit near to 1 are of milk and wheat for nonfarm households with elasticity (0.7) and (0.8) on average. The remaining cross elasticities in other cases as well are least effective to change vanaspati ghee demand.

There is no common pattern diagnosed for mutton for each case, though farm and all farm households' response is more or less same. For these households mutton demand is not responsive on average to price changes. Wheat, rice, milk and vanaspati ghee have got elastic cross price relationships with mutton so these food items can change the demand for mutton by the change in their prices. Excluding cereals and desighee all left cross price relationships are elastic.

None of the food items influence the demand for beef through price changes. All cross price elasticities in three cases are far from 1. But farm and nonfarm households have difference of preference for beef. Beef is an elastic commodity for farm households with own price elasticity equal to 1.50 contrary to farm households with least elasticity 0.04.

Poultry is having inelastic demand in three cases along with cross price relationships ineffective. But there are two exceptions of elastic cross price elasticity of milk and rice with poultry for nonfarm households. Over all poultry is the basic source of protein for all households on average.

Eggs are again having very low cross elasticity indicating it as a necessity item for all households on average in each case. We find only two cross price relationships elastic for eggs and wheat and eggs and desighee in case of nonfarm households. This indicates fall in prices of wheat and desighee impacts households to spend more on buying eggs on average.

CHAPTER 5

CONCLUSION AND POLICY IMPLICATIONS

5.1 CONCLUSION

Consumer behavior analysis seeks for the measurement of consumer decisions for consumption choices. There might be various justifications for a specific consumer behavior including psychological, ethical, social, demographical, economic, and environmental. In this study, the impact of income, prices and socioeconomic variables such as age, education and family size is tested for the consumption choices of certain food items. The sample selected for the analysis consists of rural farm and nonfarm households of Barani, partial Barani, and irrigated zones of Punjab. We have estimated coefficients of budget share equations as well as expenditure, compensated and uncompensated price elasticities by applying LA-AIDS. The coefficients of all households, nonfarm households, and farm households are found significant. The impact of family size is significant in all cases, whereas age and education level of the head household also impacts consumption choices significantly for both years. The three set of compensated elasticities, uncompensated elasticities and expenditure elasticities are calculated and compared for all rural households, farm households, and nonfarm households for the years 2009 and 2010.

The expenditure elasticities for wheat, rice, vanaspati ghee, poultry, chicken and milk were less than 1 which showed these food items as necessities for all households, farm households and nonfarm households. Mutton remained luxury items with highest elasticity of (-5.87) for nonfarm households followed by relatively lower price elasticity of farm households (-4.8) and all households (-4.7) in the year 2009. In 2010 we observe a stark change in consumption of mutton by farm households and nonfarm households with the fall of elasticity up to (-0.92) The other red meat beef varied from luxury (-1.96) to (0.05) for nonfarm households, for all households where as farm households price elasticity for beef is far less than 1. Eggs also appeared as from luxury to necessity across farm and nonfarm households.

The consumption patterns over the period of only two years remain almost same with exceptions of big fall in the elasticities for mutton in the year 2010. Also, we observed major fluctuations in eggs, poultry and cereal consumption. The main finding is the relative better economic position of farm households in making consumption decisions for most of the food items as

these households have comparatively low compensated and uncompensated price elasticities compared to relative higher price elasticities faced by nonfarm households.

5.2 POLICY IMPLICATIONS

The ultimate response of consumer for demand depends on his economic position or purchasing power. The analysis of consumption patterns for food items response of rural households measures the strength of their economic standing. Generally sensitivity for price changes is expected to be different across different income groups, different locations, different occupations, different age groups, and different family sizes. The elasticities measured here have taken into account few of these factors behind measuring sensitivity for consumption of selected food items.

Ideally, policy makers are supposed to design such kind of economic policies which may maximize consumer's welfare. The resulted compensated, uncompensated, and expenditure elasticities can be taken as description of average behavior of rural households of Punjab for price changes, and may be used in simulation models of projecting likely impact of various price changes on demand of these food items.

Since we have calculated compensated as well as uncompensated price elasticities so we have measured income effect of price changes also, the analysis of income effects and price effects derived from estimated low price elasticities for wheat (-0.09), rice (-0.2), vanaspati ghee (-0.7), beef (-0.05), and milk (-0.006) may guide policy makers about the positive outcome of high food inflation for these food items. Since these items are necessities with lowest elasticities in almost all cases. Consistent and slow rise in the prices of these food items may not bring a fall to the revenues of suppliers. On the contrary there is expected negative impact of high price rise in price of few food items having highest elasticity including cereals (-3.1), mutton (-4.8).

Same policy options may result differently for farm households and nonfarm households. Consideration of this fact is very important for making basic food items affordable for every segment. The high magnitude of compensated price elasticity (-6.8) and uncompensated price elasticity (-6.2) for vanaspati ghee by nonfarm households suggests low purchasing power of these households for meeting their daily requirement of cooking food. It also indicates their vulnerability for supply shocks. Maintenance of poultry market in rural Punjab may bring high growth to this sector because of high demand in rural Punjab for all kinds of red and white meat.

In our data more than 20% of nonfarm families, and more than 28% of farm households fall in the category of negative income group (the households with monthly total income less than 10,000 rupees), income support programs targeting very low income families may bring more better options for consumption of basic foods. Most of the households are growers of wheat and rice as well, so offering good market prices can make their economic position better.

According to Haq et al. (2011) the international rise in essential food items has led to a hike in food insecurity and poverty in many developing countries as well Pakistan. Henceforth empirical research on this subject can serve as a tool for predicting future direction of demand in response to prices. More price elastic food items can raise government revenues if fall of prices is maintained by the government. Moreover disaggregated analysis can help in better understanding of rural consumer's consumption patterns creating right food policies for these households. The analysis of demand patterns also serves as a basis for welfare comparisons of farm and nonfarm households of rural Punjab.

5.3 LIMITATIONS AND FUTURE RESEARCH

More robust analysis is possible if all other items including 20 nonfood items, and other 11 food items of the household's data were also considered for complete demand analysis of the households, but the analysis of 41 items could be quite co cumbersome. As well prices faced by each household were provided by PERI for only 10 items, so we considered only those items with complete information of prices, quantities and demographics. In future average prices from consumer price index (CPI) of Pakistan can be taken as a source of missing prices for the particular data. Also more advanced extensions of AIDS complete demand system such as GAIDS and QUAIDS can be applied for rural farm and nonfarm household's consumption pattern comparisons.

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APPENDIX-A

This appendix presents some prime figures of interest. The data source Punjab Economic Research Institute covers 714 households of rural Punjab covering various ecological zones such as Barani, partial Barani and irrigated Punjab. The number of districts covered is 17 and the classification of zones is also provided, out of total sample 539 households are having agriculture as their main occupation for living.

Table A1
Stratification of Punjab Province by Various Crop Ecological Zones

Crop Ecological Zones	Number of Districts	Districts
Barani Zone	4	Attock, Chakwal, Jhelum, Rawalpindi
Partial Barani / Thal Zone	4	Bhakkar, Khushab, Layyah, Mianwali
Irrigated Area	11	Gujranwala, Gujrat, Hafizabad, Kasur, Lahore, Mandi Bahauddin, Nankana, Narowal, Okara, Sheikhupura, Sialkot
Rice Zone		
Cotton Zone	12	Bahawalnagar, Bahawalpur, Dera Ghazi Khan, Khanewal, Lodhran, Multan, Muzaffargarh, Pakpattan, Rahim Yar Khan, Rajanpur, Sahiwal, Vehari
Mixed Zone	5	Chiniot, Faisalabad, Jhang, Sargodha, Toba Tek Singh

Table A2
Stratification of Punjab Province and the Selected Study Centres

Zone	District	Tehsil	Study Centres	No. of Sample Villages
BARANI ZONE	Rawalpindi	Kallarsaiedan	Kallarsaiedan	2
	Chakwal	Chakwal	Chakwal	2
PARTIAL BARANI	Bhakkar	Kalurkot	Kalurkot	2
	Khushab	Noorpur Thal	Noorpur Thal	2
IRRIGATED ZONE	Jhang	Jhang	Jhang	2
	Faisalabad	Tandilianwala	Tandilianwala	2
	Faisalabad	Faisalabad	Faisalabad	2
	Sargodha	Sargodha	Sargodha	2
	Okara	Dipalpur	Dipalpur	2
	Hafizabad	Hafizabad	Hafizabad	2
	Nankana Sahib	Nankana Sahib	Nankana Sahib	2
	Sialkot	Sialkot	Sialkot	2
	D.G Khan	D.G Khan	D.G Khan	2
	R.Y Khan	R.Y Khan	R.Y Khan	2
	Vehari	Burewala	Burewala	2
	Multan	Multan	Multan	2
	Khanewal	Khanewal	Khanewal	2

Table A3
Average Family Size and age of Sample Farmers

Zone/Farm Size Categories	Family Size (No.)	Below 10 Years (Percent) Family Members	Above 10 Years (Percent) Family Members
BARANI	**7.6**	**16.87**	**83.13**
Small- A	6.5	13.92	86.08
Small- B	9.1	20.07	79.93
Medium	7.5	18.00	82.00
Large	7.6	17.45	82.55
PARTIAL BARANI	**6.5**	**22.22**	**77.78**
Small-A	5.6	17.29	82.71
Small-B	5.8	26.09	73.91
Medium	7.1	22.14	77.86
Large	7.1	22.53	77.47
IRRIGATED	**7.0**	**19.42**	**80.58**
Small-A	6.1	18.93	81.07
Small-B	7.2	19.42	80.58
Medium	8.1	20.21	79.79
Large	8.8	21.20	78.80
OVERALL	**7.0**	**19.45**	**80.55**
Small-A	6.1	18.07	81.93
Small-B	7.3	20.05	79.95
Medium	7.7	20.44	79.56
Large	8.1	21.30	78.70

Table A4
Educational Status of Family Members of Sample Farm Households (Above 10 Years)

(Percent)

Zone/Farm Size Categories	Illiterate	Primary	Middle	Matric	Above Matric
BARANI	**23.8**	**18.5**	**25.5**	**22.2**	**10.0**
Small-A	19.1	16.8	22.5	27.2	14.5
Small-B	25.3	20.6	28.2	18.8	7.1
Medium	32.8	24.1	20.7	19.0	3.4
Large	25.9	3.7	37.0	18.5	14.8
PARTIAL BARANI	**47.3**	**11.7**	**14.2**	**17.7**	**9.1**
Small-A	57.1	11.4	11.4	15.7	4.3
Small-B	57.1	15.6	7.8	11.7	7.8
Medium	35.8	11.0	21.1	21.1	11.0
Large	45.3	9.5	13.7	20.0	11.6
IRRIGATED	**41.7**	**15.0**	**17.1**	**16.0**	**10.3**
Small-A	47.1	16.2	17.2	12.3	7.2
Small-B	42.5	15.0	15.1	16.9	10.5
Medium	27.4	13.5	22.2	22.2	14.7
Large	33.7	11.8	19.8	18.2	16.6
OVERALL	**39.8**	**15.1**	**17.9**	**17.1**	**10.1**
Small-A	43.2	16.0	17.7	15.0	8.2
Small-B	41.0	15.8	16.5	16.9	9.8
Medium	30.3	14.3	21.7	21.5	12.2
Large	36.6	10.4	19.4	18.8	14.9

Table A5
Average Family Size of Sample Non-Farm Households

(No.)

Zone / Study Centre	Average Family Size
BARANI ZONE	**6.50**
Kallarsaiedan	5.67
Chakwal	6.78
PARTIAL BARANI	**4.62**
Kalurkot	5.00
Noorpur Thal	3.33
IRRIGATED ZONE	**5.76**
Jhang	6.00
Tandilianwala	5.43
Faisalabad	5.55
Sargodha	5.92
Dipalpur	5.93
Hafizabad	6.88
Nankana	4.40
Sialkot	7.28
D.G Khan	4.73
R.Y Khan	4.29
Burewala	3.80
Multan	4.67
Khanewal	5.20
OVERALL	**5.72**

Table A6
Educational Status of Family Members of Sample
Non-Farm Households (Above 10 Years)

(Percent)

Zone/Farm Size	Illiterate	Primary	Middle	Matric	Above Matric
BARANI ZONE	**34.8**	**19.7**	**21.2**	**22.7**	**1.5**
Kallarsaiedan	31.3	12.5	25.0	31.3	-
Chakwal	36.0	22.0	20.0	20.0	2.0
PARTIAL BARANI	**59.1**	**20.5**	**9.1**	**6.8**	**4.5**
Kalurkot	55.9	23.5	11.8	2.9	5.9
Noorpur Thal	70.0	10.0	-	20.0	-
IRRIGATED ZONE	**57.2**	**17.1**	**15.5**	**7.9**	**2.3**
Jhang	65.6	12.5	9.4	9.4	3.1
Tandilianwala	75.0	14.3	3.6	7.1	-
Faisalabad	45.5	25.7	17.8	6.9	4.0
Sargodha	53.2	21.3	12.8	12.8	-
Dipalpur	71.7	6.7	13.3	6.7	1.7
Hafizabad	56.8	17.3	17.3	6.2	2.5
Nankana	38.9	22.2	27.8	5.6	5.6
Sialkot	57.3	20.8	13.5	8.3	-
D.G Khan	66.7	-	16.7	11.9	4.8
R.Y Khan	42.9	9.5	38.1	9.5	-
Burewala	64.3	21.4	14.3	-	-
Multan	72.7	18.2	-	-	9.1
Khanewal	41.2	23.5	17.6	11.8	5.9
OVERALL	**55.2**	**17.6**	**15.6**	**9.3**	**2.4**

Table A7
Distribution of Farm Households by Net Farm Income Groups

(Percent)

Income Groups (Rs.)	Barani	Partial Barani	Irrigated	Overall
Negative Income	18.1	23.9	30.7	**28.2**
Up to 10000	16.7	7.0	2.7	**5.1**
10001 to 15000	6.9	4.2	2.4	**3.2**
15001 to 20000	5.6	1.4	1.2	**1.8**
20001 to 25000	9.7	1.4	3.9	**4.3**
25001 to 35000	8.3	8.5	4.4	**5.4**
35001 to 50000	13.9	11.3	7.8	**9.0**
Above 50000	20.8	42.3	47.0	**43.0**

Table 8
Distribution of Non-Farm Households by Net Household Income Groups

(Percent)

Income Groups (Rs.)	Barani	Partial Barani	Irrigated	Overall
Negative Income	25.0	23.1	19.3	**20.0**
Up to 10000	-	7.7	10.4	**9.4**
10001 to 15000	8.3	7.7	6.7	**6.9**
15001 to 20000	8.3	23.1	5.2	**6.9**
20001 to 25000	8.3	7.7	5.9	**6.3**
25001 to 35000	8.3	7.7	8.9	**8.8**
35001 to 50000	16.7	7.7	15.6	**15.0**
Above 50000	25.0	23.1	28.1	**27.5**

APPENDIX-B

Estimated Parameters for 2009

Variable	All Households		Non-Farm Only		Farm Only	
	$N = 632$		$N = 136$		$N = 496$	
	Coefficient	**p-value**	**Coefficient.**	**p-value**	**Coefficient.**	**p-value**
α_1	-0.469	0.000***	-0.751	0.000***	-0.413	0.000***
α_2	0.245	0.000***	0.381	0.000***	0.222	0.000***
α_3	-0.048	0.05**	-0.014	0.018**	-0.041	0.018**
α_4	0.420	0.000***	0.744	0.003***	0.316	0.009***
α_5	0.131	0.011	0.176	0.023**	0.102	0.088*
α_6	0.174	0.000***	-0.182	0.058*	0.242	0.000***
α_7	0.014	0.064*	-0.113	0.075*	0.028	0.041**
α_8	0.137	0.000***	0.313	0.001***	0.127	0.001***
α_9	0.318	0.000***	0.250	0.018**	0.366	0.000***
α_{10}	0.078	0.000***	0.195	0.085*	0.052	0.000***
β_1	-0.029	0.000***	-0.022	0.190	-0.022	0.001***
β_2	0.002	0.036**	0.013	0.073*	0.001	0.066*
β_3	-0.002	0.021**	0.001	0.039**	-0.003	0.161
β_4	0.032	0.001***	-0.039	0.141	0.026	0.014**
β_5	0.044	0.000***	0.021	0.002***	0.038	0.000***
β_6	-0.050	0.000***	-0.081	0.000***	-0.043	0.000***
β_7	0.007	0.002***	0.000	0.099*	0.008	0.000***
β_8	0.004	0.119	0.051	0.000***	0.002	0.053*
β_9	-0.005	0.049**	0.043	0.000***	-0.006	0.036**
β_{10}	-0.002	0.016**	0.014	0.019**	-0.002	0.005***
γ_{11}	0.218	0.000***	0.172	0.022**	0.229	0.000***
γ_{21}	-0.083	0.000***	-0.089	0.000***	-0.078	0.000***
γ_{31}	-0.005	0.061*	0.009	0.070*	-0.011	0.032**
γ_{41}	0.035	0.071*	-0.235	0.000***	0.079	0.000***

Variable	All Households		Non-Farm Only		Farm Only	
	$N = 632$		$N = 136$		$N = 496$	
	Coefficient	p-value	Coefficient.	p-value	Coefficient.	p-value
γ_{51}	0.041	0.005***	0.001	0.099*	0.044	0.005***
γ_{61}	-0.121	0.000***	-0.029	0.036**	-0.137	0.000***
γ_{71}	0.070	0.000***	0.115	0.000***	0.067	0.000***
γ_{81}	-0.037	0.001***	0.035	0.020**	-0.049	0.000***
γ_{91}	-0.105	0.000***	0.001	0.099*	-0.128	0.000***
γ_{101}	-0.013	0.012**	0.021	0.065**	-0.015	0.003***
γ_{22}	0.038	0.000***	0.037	0.000***	0.043	0.000***
γ_{32}	0.009	0.002***	0.001	0.025**	0.011	0.006***
γ_{42}	0.010	0.099*	0.034	0.022**	0.006	0.038**
γ_{52}	0.011	0.040**	-0.001	0.092*	0.014	0.021**
γ_{62}	-0.022	0.000***	0.002	0.086*	-0.030	0.000***
γ_{72}	0.020	0.000***	0.001	0.093*	0.023	0.000***
γ_{82}	0.002	0.068**	-0.008	0.037**	0.006	0.020**
γ_{92}	0.011	0.006***	0.016	0.076*	0.005	0.034**
γ_{102}	0.003	0.130	0.007	0.046**	0.000	0.077*
γ_{33}	-0.014	0.003**	-0.011	0.000***	-0.019	0.002***
γ_{43}	-0.008	0.081*	0.004	0.033**	-0.010	0.094*
γ_{53}	0.013	0.004***	0.003	0.256	0.013	0.018**
γ_{63}	-0.006	0.021**	0.005	0.037**	-0.006	0.030**
γ_{73}	0.016	0.000***	-0.004	0.052*	0.022	0.000***
γ_{83}	-0.007	0.096*	-0.003	0.130	-0.011	0.035**
γ_{93}	0.007	0.068**	-0.018	0.182	0.009	0.065*
γ_{103}	-0.006	0.002***	0.014	0.287	0.002	0.030**
γ_{44}	-0.087	0.006***	0.157	0.006***	-0.125	0.001***
γ_{54}	-0.049	0.000***	0.022	0.017**	-0.071	0.000***
γ_{64}	0.031	0.004***	0.026	0.031**	0.047	0.000***
γ_{74}	0.013	0.033**	0.021	0.101	0.015	0.032**
γ_{84}	0.002	0.082*	0.001	0.096*	-0.004	0.066*

Variable	All Households		Non-Farm Only		Farm Only	
	$N = 632$		$N = 136$		$N = 496$	
	Coefficient	**p-value**	**Coefficient.**	**p-value**	**Coefficient.**	**p-value**
γ_{94}	0.045	0.000***	-0.044	0.040**	0.057	0.000***
γ_{104}	0.008	0.078*	0.014	0.055*	0.004	0.043**
γ_{55}	0.025	0.072*	0.014	0.058*	0.015	0.034**
γ_{65}	-0.035	0.000***	-0.021	0.019**	-0.032	0.001***
γ_{75}	-0.020	0.001***	-0.028	0.047**	-0.015	0.020**
γ_{85}	0.019	0.006***	0.024	0.114	0.020	0.006***
γ_{95}	0.009	0.018	-0.011	0.071*	0.014	0.041**
γ_{105}	-0.013	0.000***	-0.004	0.089*	0.000	0.092*
γ_{66}	0.144	0.000***	0.141	0.000***	0.151	0.000***
γ_{76}	-0.030	0.000***	-0.012	0.034**	-0.032	0.000***
γ_{86}	0.020	0.002***	-0.050	0.005***	0.022	0.002***
γ_{96}	0.015	0.019	-0.028	0.018**	0.018	0.006***
γ_{106}	0.005	0.140	-0.034	0.124	-0.001	0.057*
γ_{77}	-0.033	0.000***	-0.043	0.005***	-0.034	0.000***
γ_{87}	-0.002	0.066**	-0.013	0.028**	-0.003	0.067*
γ_{97}	-0.031	0.000***	0.006	0.076*	-0.035	0.000***
γ_{107}	-0.001	0.059*	-0.043	0.034*	-0.008	0.000***
γ_{88}	-0.008	0.031**	-0.017	0.043**	0.008	0.039**
γ_{98}	0.010	0.078*	0.029	0.119	0.009	0.015**
γ_{108}	0.001	0.063*	0.002	0.093*	0.002	0.044**
γ_{99}	0.042	0.000***	-0.318	0.000***	0.045	0.000***
γ_{109}	-0.003	0.019	0.367	0.000***	0.006	0.005***
γ_{1010}	0.020	0.000***	-0.345	0.000***	0.010	0.000***
agehead	-0.005	0.001***	0.003	0.040**	-0.005	0.001***
eduhead	-0.009	0.015	0.001	0.093*	-0.011	0.067*
Fsize	-0.024	0.000***	-0.060	0.000***	-0.023	0.000***

Estimated Parameters for 2010

Variable	All Households		Non-Farm Only		Farm Only	
	$N = 644$		$N = 136$		$N = 508$	
	Coefficient	p-value	Coefficient.	p-value	Coefficient.	p-value
α_1	-1.016	0.000***	-1.141	0.000	-1.028	0.000***
α_2	0.229	0.000***	0.247	0.000	0.202	0.000***
α_3	-0.102	0.000***	-0.022	0.001	-0.133	0.000***
α_4	1.195	0.000***	0.926	0.003	1.248	0.000***
α_5	0.539	0.000***	0.205	0.044	0.646	0.000***
α_6	0.024	0.065*	0.192	0.072	-0.018	0.079*
α_7	0.004	0.088*	0.094	0.030	0.016	0.063*
α_8	0.009	0.084*	0.186	0.064	-0.046	0.034**
α_9	0.129	0.000***	0.331	0.001	0.114	0.003***
α_{10}	-0.011	0.041**	-0.018	0.055	-0.001	0.094*
β_1	-0.060	0.000***	-0.037	0.015	-0.062	0.000***
β_2	-0.001	0.635	0.009	0.069	-0.005	0.119
β_3	-0.002	0.018**	0.000	0.076	-0.004	0.029**
β_4	0.054	0.000***	-0.012	0.063	0.074	0.000***
β_5	0.069	0.000***	0.029	0.002	0.069	0.000***
β_6	-0.064	0.000***	-0.049	0.000	-0.060	0.000***
β_7	0.011	0.000***	0.018	0.009	0.012	0.001***
β_8	-0.005	0.173	0.009	0.036	-0.017	0.000***
β_9	0.005	0.072*	0.034	0.000	0.002	0.058*
β_{10}	-0.007	0.000***	-0.001	0.054	-0.009	0.000***
γ_{11}	0.362	0.000***	0.417	0.000	0.395	0.000***
γ_{21}	-0.089	0.000***	-0.083	0.000	-0.080	0.000***
γ_{31}	0.030	0.000***	0.003	0.072	0.033	0.001***
γ_{41}	-0.167	0.000***	-0.190	0.001	-0.178	0.000***
γ_{51}	-0.051	0.000***	0.003	0.089	-0.105	0.000***
γ_{61}	-0.098	0.000***	-0.118	0.000	-0.075	0.000***
γ_{71}	0.024	0.001***	-0.010	0.076	0.024	0.002***
γ_{81}	0.004	0.075*	-0.026	0.034	0.004	0.076*
γ_{91}	-0.022	0.048**	-0.026	0.035	-0.016	0.019**

Variable	All Households		Non-Farm Only		Farm Only	
	$N = 644$		$N = 136$		$N = 508$	
	Coefficient	**p-value**	**Coefficient.**	**p-value**	**Coefficient.**	**p-value**
γ_{101}	0.007	0.128	0.031	0.005	-0.002	0.063*
γ_{22}	0.033	0.000***	0.029	0.000	0.040	0.000***
γ_{32}	0.010	0.000***	0.001	0.025	0.012	0.001***
γ_{42}	0.015	0.074*	0.017	0.027	0.007	0.046**
γ_{52}	0.027	0.000***	0.027	0.000	0.018	0.005***
γ_{62}	-0.017	0.000***	-0.011	0.019	-0.015	0.009***
γ_{72}	0.012	0.000***	0.012	0.021	0.012	0.000***
γ_{82}	-0.003	0.045**	-0.036	0.000	-0.002	0.062*
γ_{92}	0.015	0.000***	0.044	0.000	0.012	0.010**
γ_{102}	-0.002	0.185	0.001	0.086	-0.005	0.008***
γ_{33}	-0.036	0.000***	-0.010	0.000	-0.038	0.000***
γ_{43}	-0.005	0.027**	-0.001	0.040	-0.011	0.088*
γ_{53}	0.002	0.045**	0.002	0.001	0.006	0.020**
γ_{63}	-0.006	0.133	0.000	0.068	-0.008	0.077*
γ_{73}	0.003	0.102	0.006	0.006	0.003	0.119
γ_{83}	-0.004	0.142	0.001	0.059	-0.005	0.018**
γ_{93}	0.007	0.055*	-0.001	0.053	0.007	0.098*
γ_{103}	0.000	0.084*	0.000	0.080	0.000	0.097*
γ_{44}	0.163	0.000***	0.155	0.051	0.158	0.000***
γ_{54}	0.041	0.013**	0.001	0.098	0.068	0.001***
γ_{64}	0.005	0.067*	0.071	0.006	-0.018	0.023**
γ_{74}	-0.013	0.101	-0.002	0.093	-0.012	0.017**
γ_{84}	-0.017	0.016**	-0.009	0.068	-0.009	0.050*
γ_{94}	-0.018	0.063*	-0.031	0.196	-0.009	0.035**
γ_{104}	-0.005	0.016**	-0.011	0.115	0.004	0.031**
γ_{55}	0.024	0.084*	-0.016	0.027	0.064	0.001***
γ_{65}	-0.015	0.089*	-0.013	0.030	-0.023	0.043**
γ_{75}	-0.004	0.043**	0.011	0.034	-0.007	0.020**
γ_{85}	0.002	0.076*	0.003	0.076	0.006	0.053*
γ_{95}	-0.014	0.019**	-0.001	0.093	-0.021	0.002***

Variable	All Households		Non-Farm Only		Farm Only	
	$N = 644$		$N = 136$		$N = 508$	
	Coefficient	**p-value**	**Coefficient.**	**p-value**	**Coefficient.**	**p-value**
γ_{105}	-0.012	0.000***	-0.017	0.000	-0.005	0.040**
γ_{66}	0.152	0.000***	0.193	0.000	0.146	0.000***
γ_{76}	-0.017	0.000***	-0.071	0.000	-0.014	0.002***
γ_{86}	0.017	0.006***	-0.006	0.071	0.027	0.000***
γ_{96}	-0.014	0.020**	-0.034	0.028	-0.014	0.028**
γ_{106}	-0.007	0.002***	-0.012	0.035	-0.006	0.017**
γ_{77}	0.009	0.011**	0.039	0.021	0.007	0.043**
γ_{87}	0.001	0.085*	0.030	0.098	0.002	0.058*
γ_{97}	-0.014	0.000***	-0.002	0.093	-0.017	0.000***
γ_{107}	0.000	0.099*	-0.013	0.013	0.000	0.076*
γ_{88}	-0.005	0.049**	0.056	0.007	-0.025	0.003***
γ_{98}	0.006	0.021**	-0.012	0.048	0.004	0.039**
γ_{108}	-0.001	0.062*	-0.001	0.085	-0.002	0.227
γ_{99}	0.046	0.000***	0.053	0.021	0.049	0.000***
γ_{109}	0.006	0.005***	0.009	0.016	0.005	0.038**
γ_{1010}	0.014	0.000***	0.013	0.033	0.013	0.000***
agehead	0.000	0.096*	-0.003	0.043	0.007	0.039**
eduhead	0.000	0.098*	-0.004	0.047	0.004	0.081*
fsize	-0.020	0.000***	-0.052	0.000	-0.021	0.035**

Note: It is evident from the above two tables that most of the coefficients of expenditure share equations are significant in all three cases of all households, farm households and nonfarm households. This shows the importance of prices, and real expenditures for rural households. The role of socio economic factors is also significant in each year for each case of households.