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Effect of Income and Economies of Scale on Household Food Demand in Pakistan

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Authors' contributions

This paper work was carried out in collaboration among all authors. Author AR designed the study, wrote the protocol, and prepared the first draft of the manuscript. Author WJ designed the model and analysis of the study. Author SW read the paper and give his valuable comments and suggestions and author LN helped me in collecting the literature. Finally all authors read and approved the final manuscript.

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ABSTRACT

This paper determines the household food demand for various income groups in Pakistan namely, The Lower Income Group (≤ $ 93.023), Lower-middle Income Group ($93.034-139.534), Middle Income Group ($139.546-209.302), Upper-middle Income Group ($ 209.314-406.977) and Upper Income Group ($406.977+) United States dollars respectively. The Pakistani rupees are converted into US $ according to the average exchange rate of (2010-11).The study uses Pakistan Social and Living Standard Measurement Survey data (2010-11) conducted by the Federal Bureau of Statistics, Government of Pakistan, Islamabad. The food expenditures are the sum of monthly expenditures by each household on the following 16 major food items, wheat, rice, pulses, vegetables ghee, Milk (Fresh), butter, mutton, beef, chicken, fish, fruits, vegetables, salt, spices, sugar and gur. The household size and income elasticities are estimated to explain the food consumption trends in Pakistan. The results of the study indicate that all the income and household size elasticities are positive and significant at one percent level of significance. And the study also indicates that food income elasticity is the highest (0.901) for the Lower-Middle Income Group and the same is the lowest (0.716) for the

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Upper Income Group. Similarly, household size elasticity is the highest (0.181) for the Upper Income Group and the same is the lowest (0.067) for Lower Income Group. It is highly recommended that family planning system should be introduced in the country to keep away from the harmful impact of large family sizes upon the household food consumption, and it is also necessary for policy makers to make plan to improve the food availability and to increase family income to develop the standard and quality of the rural people of Pakistan.

Keywords: Household; food demand; income group; income elasticity; consumption trend; monthly expenditure.

1. INTRODUCTION

Household demand is a combination of two important words household and demand. Household refers to a single person or a group of persons who normally live together and share kitchen [1]. While demand is the quantities of goods and services that the consumers are willing and able to buy from the market at various prices [2]. Due to the importance of consumption in the economic theory, a number of researchers have carried out research on household performance in Pakistan and in other countries ranging from its simplest form to very difficult by using different types of data and variety of econometrics techniques. Engel's law (1857) states that as income increases the consumer's spending upon food decreases. It also implies that the income elasticity of food demand lies between zero and one. It means that increase in expenditures on food items by the consumers is less than the increase in income of the consumers [3]. A number of studies are accomplished both for developed and developing countries that confirm the Engel's law regarding the household's behavior evaluation. Houthakker studied the comparison between household expenditure of four consumption items for about 30 countries is based upon 40 urban household surveys which are conducted after World War II in the concerned areas. The double logarithmic functional form of Engel curve is estimated with the help of Ordinary Least Square technique. Engel's Law is confirmed for all countries and the higher elasticities are observed for United States and Canada. The clothing is observed as a luxury while housing as necessity for all the countries. All expenditure and household size elasticities with respect to food and miscellaneous items are same, but unequal while the size elasticities for clothing and housing are irregular for all countries [4]. Ndanshau studied the household demand pattern for six commodity groups in Tanzania is based on household survey data of 1989-90 was used to evaluate the validity of Engel's law by the use of Linear and Double logarithmic functional techniques. Household head education is positively while age is negatively related with the expenditure items and all the expenditure elasticities are positive and less than unity. The consumption expenditure response of wood fuel and clothes are less significant as compare to food, cooking oil and utensils [5]. The validity of the Engel's law regarding the consumption patterns of the household have been tested by research studies. Western households in the United States consume less food energy, protein, iron, thiamin and niacin but more calcium and vitamin A as compare to Southern households consumption of vitamin A, vitamin C and calcium is largely affected by income [6]. Functional description of Engel's Law is known as Engel curve which describes that how household expenditure on a particular commodity varies with change in total income. Budget share Engel curves depict how the share of household expenditures on a specific commodity changes with variation in income [7]. Engel curve of a commodity reflects its income elasticity and indicates whether a particular good is an inferior, normal or a luxury good [8]. No established theory could explain the pragmatic shape of Engel curves and their associated income elasticity values.

Ernst Engel himself argues that households have a hierarchy of wants that determines the shape of Engel curves. As household income rises, some incentives become more prominent as far as household expenditures are concerned that dominates consumption patterns such as starvation, ultimately become satisfied at higher income levels [8]. In Pakistan the family size are very large as compare to their family income and the food consumption demand of the family is increasing day by day, the above study is conducted to address these problems.

The specific objectives and the key questions of the present study are following.

1.1 Objectives of the study

1) To determine the household food demand pattern among different income groups in Pakistan.
2) To measure the economies of scale effect in household consumption by including the household size as an independent variable in Engel curve equation.
3) To estimate Engel elasticities and finally to suggest some policies.

1.2 Justification and Importance of the Study

This study is important because of their helpfulness to increase the income of the people, to control the population of the country and to address the problems of food shortages in Pakistan. Since Pakistan is a developing and an agricultural country, which faces food crisis, severe and acute food shortages every year in the country. Being an agricultural country Pakistan is not self sufficient in food, and importing food from other countries. This study was conducted in depth understanding the food shortages problems in Pakistan, so that we can make food policy to maximize food self-sufficiency and ensure safer and cheaper food to the people of Islamic republic of Pakistan.

2. LITERATURE REVIEW

Several national and international views about the household food demand and consumption have been presented below. Since JM Keynes consumption theory about "Employment, Interest and Money" was established in1936 and a lot of other Western scholars also studied the consumption function as a vital basis for macroeconomic theory, they empirically tested and verified this theory that consumption will increases with the increase in revenue, but its marginal propensity to consume is diminishing. First, Simon Kuznets applied on income in the United States by analyzing the actual data from 1869-1933 and said that short run marginal propensity to consume is less than average propensity to consume regardless of the average propensity to consume is quite stable in the long run, Thus this phenomenon is called "Kuznets mystery." This gave rise to other economists to study consumption theory, highlighting the relative income hypothesis, permanent income hypothesis and Franco Modigliani life cycle hypothesis [9]. Liu Bin, Zhang Hui et al. studied the "gray correlation analysis and trend forecasting consumption structure of rural residents". The first application of gray correlation method is to analyze the current situation of China's consumption structure of rural residents by predicting future net income and per capita consumption [10]. Hu Yu, Wang Xiong also used the "gray correlation analysis to study the relationship between Hunan farmers income and prediction of consumption structure for the year 1995-2005. Line quantitative analysis and the use of gray prediction method for the period 2006-2010 farmers' income levels and consumer spending were all forecasting rural residents for

household equipment, medical care, transportation and communication expenditure affected by income. The extent of the weaker, indicating rural Hunan Province is still in the lower subsistence level, the overall rural consumption level is not high [11]. Jian Jin, Yuan Chang-Chih studied the relationship between the real income and consumption of rural residents in Hebei Province using the cointegration theory. And studied the relationship of real income and consumption of rural peoples in the Province by analyzing the data from 1983-2007 by using Granger-Sims test, which shows the impact of real income on the actual consumption of rural peoples in Hebei province is not significant, but as time goes on it Gradually become a significant influence on them [12]. Lilin Jie, Yu Fei empirically analyzed the income elasticity consumption of Rural Residents in Hebei by introducing a virtual Income variable. And studied the income elasticity of consumption of rural residents in Hebei Province from 1983 to 2004 by using different consumer elastic modulus. The results shows the overall income elasticity of consumption decreased during this period and the growth rate of most consumer demand is slower than the growth rate of per capita income [13]. Wang jian et al. studied per capita consumption and net income of rural peoples in Hebei province China by analyzing data from 2000-2009. Firstly described the demand structure of rural consumption by means of correlation tests, where the total consumption and total income of the long-term data have been calculated and the Engel coefficient shows the general developing trend of the consumption structure. Secondly calculate the marginal propensity to consume by ELES model, demand income elastic which clearly affects the economic factors of consumption. Lastly we establish the relationship between the consumption index and per capita net income by means of GRA quantitative method, and then we can forecast the trend of consumption and income of rural peoples. Then put forward the countermeasures and policy recommendations to develop the rural economy and consumer market in Hebei Province [14]. Deaton and Paxson predicted the economies of scale model and shows that total food consumption expenditure increases with the surge in household size as per capita expenditure held constant. This paradox has significant implications for the measurement of poverty and inequality consistent with predictions of Barten model, that shows food and public goods increases with family size, and the elasticity of food with respect to family size is larger for poorer households. Therefore the Deaton Paxson Paradox cannot simply due to an incorrect theoretical model [15]. Andrew W. Horowitz studied positive relationship between food expenditures and household size at constant per-capita income [16]. Hina Amir et.al analyzed the “Consumption Pattern of Different Commodities in Pakistan” using the cross-sectional data of the household integrated economic survey, studied the impact of per capita consumption on different household income group by using ordinary least square method for the estimation purpose and identified exact relationship between household average incomes to the average expenditures and calculated per capita consumption of each income group with respect to per capita income. Per capita income becomes independent, because each household faces the same commodity prices prevailing at the time of household survey. The overall results shows that with the increase in income, expenditure increases for luxuries and decreases for necessities, but it will differ in rich and poor. Finally it is found that poor people consume more on necessities and rich people consume on luxuries as their income increases [17]. Safia Begum et.al determined the food consumption pattern in rural area of district Nowshera village Kaka Sahib. The major objective was to find out the influence of socio economic factors on food consumption patterns in rural areas of Khyber Pakhtunkhwa-Pakistan by random sample technique through a pre-designed questionnaire about household size, level of education, total monthly income and expenditure on various food commodities consumed. An ordinary least squares method was employed to analyze the data. The results indicated that an average household size of 8.5 persons with a literacy rate of 94 percent spent fifty-five percent of the total monthly income on food consumption. The empirical results revealed that wheat flour, milk,

rice, vegetables, sugar, edible fats and tea were positively correlated with household size, but meat, pulses, eggs and fruit were not significantly influenced by it. Similarly, household's total monthly income showed a positive relationship with the food commodities consumed, except wheat flour, vegetables and eggs. It may be concluded that majority of food commodities consumed had a positive relationship to household size and total monthly income. Therefore, it is vital for policy makers to make plan to improve food availability and to increase family income to enhance the quality of rural life [18].

3. METHODOLOGY

The data for this study is drawn from the Pakistan Social and Living Standards Measurement (PSLM) Survey 2010-11, conducted by the Federal Bureau of Statistics, Government of Pakistan, Islamabad. It is based upon two-stage stratified sampling design. This survey based on a national sample, covers the universe consisting of all the four provinces of Pakistan. This study uses a sample of 16320 households out of total 16341 households covered by the PSLM 2010-11 due to unreported and missing values for 21 households. The expenditures in the form of only paid consumption are used for calculation because the goal of study is to compare consumption patterns within various income groups. The food consumption groups are wheat, rice, pulses, vegetables ghee, Milk (Fresh), butter, mutton, beef, chicken, fish, fruits, vegetables, salt, spices, sugar and gur. Frequency of food items data in PSLM 2010-11 is of two types i.e. fortnightly and monthly. The 14 days data is first converted into monthly information and then both of these groups are joined to make the household total food consumption during the month. Thus the dependent variable is the natural log of the monthly expenditures on food items. The total household expenditures are used as an alternative for income as an independent variable because of the fact that income data generally suffers from measurement errors and may also include a transitory component of income [19]. The use of total expenditures instead of income is a common practice in Engel curves estimation because the expenditures mostly reflect the permanent income of the households. Household total expenditures and household size are calculated in the form of natural log and then are used as an independent variable in this regression analysis. Household size indicates the numbers of persons living in the single house. This variable is computed in the natural log form of total family size of the household. Having certain advantages, the family size is used as a separate independent variable. The same is valuable to directly determine the economies of scale effect, avoids the loss of information problem and gives more efficient results regarding the household members [20].

In order to determine the food demand pattern and to make the consumption comparison; households are divided into five income groups. Table 1 shows the household distribution with respect to different income groups at the national level, measured in US $. Income groups include: The Lower Income Group (≤$ 93.023), Lower-middle Income Group ($ 93.034-139.534), Middle Income Group ($139.546-209.302), Upper-middle Income Group ($ 209.314-406.977) and Upper Income Group ($ 406.977+) United States dollar respectively.

For calculating income elasticities, the Ordinary Least Squares (OLS) method of regression analysis is used on the basis of both common practice as well as convenience. The cross section data is based on the assumption that all the households face the same prices for every commodity so it is difficult to capture the impact of price variation on consumption pattern. The price effects can be determined by using the unit values, calculated as the expenditures of consumption items divided by the quantities of items used as a proxy for prices [22]. The economic theory of consumer behavior is based upon the assumption that

consumer attempts to maximize the utility of goods and services subject to the given budget constraint. Consumption of various commodities are usually taken in terms of expenditure rather than quantities in the Engel's curve approximation because the expenditure takes much care of the quantity and the quality of the goods consumed to seize the problem of aggregation of heterogeneous items [23]. It is further assumed for cross sectional data that all the households face same prices for all commodities. So the Engel curve equation can be written as:

$$E_i = \alpha_i + \beta_i Y + \mu_i \quad (1)$$

Where E_i is quantity demanded or expenditure on ith consumption head by ith household, and it is total income of the household, α and β are the unknown parameters to be estimated and μi is the stochastic error term. The choice of an appropriate functional form in estimating the Engel's curve has been a matter of great interest. There are so many functional forms that are used to estimate the Engel curves but yet no single form found its general acceptance [24]. Thus by incorporating total expenditure and household size as independent variables in Engel curve equation and taking the natural log the functional form gives as follows:

$$LnF_i = \alpha_i + \beta_i \, LnE_i + \gamma \, Ln \, HS_i + \mu_i \quad (2)$$

In formula (2) Fi is the food expenditure by ith household, and E_i is total expenditure by ith household, HS_i *i*s household size and μi is the stochastic error term.

Table 1. Households distribution among different income groups

Monthly Income	Number of Household	Percentage of Household
Lowe Income Group	3762	23.05
Lower Middle Income Group	6300	38.60
Middle Income Group	2803	17.18
Upper Middle Income Group	1342	8.23
Upper Income Group	2113	12.94
Overall	16320	100

Source: Calculations using PSLM 2010-11 data [21]

4. RESULTS AND DISCUSSIONS

The present study uses double logarithmic and OLS method of regression analysis to compute the household food demand pattern by computing its relationship with household total expenditures and household size. Estimation of double logarithm and OLS method of regression analysis (Equation 2) gives estimates of food expenditure and household size elasticities. The computed food expenditure or income elasticities and household size elasticities are given in Table 2 and 3. The computed food expenditure elasticities at Pakistan level are given below in Table 2.

Table 2. Food income elasticities by different income group

Income Group	Food Income or expenditure elasticity
Lower Income Group	0.869
Lower Middle Income Group	0.901
Middle Income Group	0.845
Upper Middle Income Group	0.819
Upper Income Group	0.716
Overall	0.781

Source: Calculation from PSLM data Analysis

Table 3. Household size elasticities of food by different Income groups

Income Group	Household Size elasticity
Overall	0.137
Lower Income group	0.067
Lower-Middle Income Group	0.085
Middle Income Group	0.154
Upper Middle Income Group	0.158
Upper Income Group	0.181

Source:-Calculation from PSLM data Analysis

All the expenditure elasticities are less than one and significant at one percent level of significance implying that all food items include in the analysis are necessities in the whole calculation. Table 2 shows that food income elasticity is the highest (0.901) for the Lower-Middle income group and is the lowest (0.716) for the upper income group. Overall analysis depicts that the food consumption initially increases with increase in income but gradually declines for higher income groups. The expenditure elasticities show a little cyclical trend of elasticities in different income groups. The reasoning for this pattern may be explained in terms of quantitative as well as qualitative changes in terms of consumption basket. For a given quality of a commodity the immediate concern of a household is to consume the commodity up to a certain minimum desired level. If the household are not consuming the said commodity in the desired minimum level then the expenditure on that commodity increase with the increased level of income. Once the desired quantity is achieved the expenditure on that commodity decline with increase in income. As income continues to increase the household switch to a better quality of products thus expenditures starts increasing again. This pattern is repeated as income continues to increase.

The household size is also used as an independent variable in order to determine the economies of scale effect in the food demand pattern for various income groups. The calculated household size elasticities at Pakistan level are given in Table 3. Table 3 shows that household size elasticity is the highest (0.181) for the upper income group and the same is the lowest (0.067) for lower income group. Economies of scale effect may occur because the public goods within the household can be shared and the same serve their function without needing to be replicated in relation to the number of individuals within the household. Larger households may receive quantity discounts because they buy larger quantities. The household size elasticities are also significant at one percent level and depict the specific effect in the food demand patterns analysis. The analysis of this study resembles with the analysis of the study of Estimation of Urban-Rural Expenditure and Size elasticities of Food items in Pakistan: Evidence from PSLM Data and Consumption Pattern of Different Commodities in Pakistan.

5. CONCLUSION

The study evaluates the double logarithmic analysis and OLS method of regression analysis to determine the household food demand pattern in Pakistan. The data for this purpose is drawn from Pakistan Social and Living Standards Measurement Survey (2010-11). The households are divided into five income groups. All the coefficients of food income elasticity and household size elasticities are positive and significant at one percent level of significance. The legitimacy of Engel's law is verified because the proportion of food consumption is lower as compared to income. The household size analysis confirms the existence of economies of scale for food consumption among various income groups. The planning for future increase in food supply is mostly dependent upon accurate prediction of future demand. As the estimates presented in this study are based on recent household level data, so they are much beneficial to predict the true consumption pattern accurately. In particular, income specific estimates are helpful to provide a better understanding of changes in food consumption pattern by enabling policy makers to focus on households in different income groups. Overall results explain that with the increase in income expenditure increase for luxuries and decrease for necessities, but it will differ in rich and poor. Finally it is found that poor people consume more on necessities and rich people consume on luxuries as their income increase.

6. RECOMMENDATION

In the light of the above study it is highly recommended that the family planning system should be introduced in the country to overcome the harmful impact of large family sizes upon the household consumption. The large family sizes make the household poorer for most of consumption heads so population control measures should be properly implemented. It may be concluded from this study that to meet the growing demand for food commodities of an increasing population, where there is a need to enhance production, the need to develop processing and marketing facilities cannot be ignored for better management of the essential food commodities. This indeed would provide better employment and investment opportunities and to raise the income of rural and urban communities in the country. This would go a long way to improve the standard of living in the rural areas restricting the migration trend towards big cities in search of better life for the household. Hence a two prong strategy is recommended to develop production and marketing facilities to improve the food availability and as well as indirectly provide better income opportunities to the people.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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