Socio-economic Determinants of Household Food Insecurity in Pakistan

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Abstract

This study investigates the determinants of food insecurity for both general and farmer households. It is based on Pakistan Social and Living standard Measurement (PSLM) 2007-08 survey conducted by the Federal Bureau of Statistics, Pakistan. After having descriptive analysis of the important determinants of food insecurity, we have used logit model to find the probability for being household secure or insecure. The model is initially fitted with 16 (for general) and 19 (for farmer households) variables, selected from factors identified by previous researchers that affect food insecurity. Twelve out of 19 variables for farmer households are found to be significant such as household size, household size square, household income, number of rooms, dependency ratio, electricity connection, irrigation facility, age and age square of household head. To our surprise female education variable is insignificant for general household model. The results obtained are further analyzed to compute partial effects on continuous variables and change in the probabilities on discrete variables for the significant factors in the logistic models. Household size, education of household head, annual income and agricultural income are some of the most important factors influencing the household's food insecurity status.

1. Introduction

"Hunger is exclusion – exclusion from the land, from income, jobs, wages, life and citizenship. When a person gets to the point of not having anything to eat, it is because all the rest has been denied. This is a modern form of exile. It is death in life…" (**Josue de Castro)**

Food is the basic need of each and every human but the prevalence of food insecurity in today's world is not deniable. In 1996, a commitment was made by all member countries of United Nations at World Food Summit (WFS) to eradicate hunger and the very first Millennium Development Goal (MDGs) was set to halving hunger by 2015. It seems difficult at the moment to achieve this goal due to various reasons which ranges from increasing trend in food prices to lack of political commitment on the part of most of the governments of developing countries.

South Asia is the most food insecure region in the world. It has more than 500 million people who go to bed hungry despite the fact that Pakistan and India are among the largest cereal producers in the world. Pakistan, apart from terrorism, suicide bombing, militancy, poor governance and corruption, is also facing high food insecurity—a problem whose manifestations are grave. According to Sustainable Development Institute Policy (SDPI) report on Pakistan's food insecurity crises, nearly 48.9% of the population is food insecure and country is ranked 11th at 'extreme risk' on the Food Security Risk Index (FSRI). The SDPI study evaluates the severity of the food insecurity in Pakistan by dividing the country into four categories, in respect of food security; (i) extremely insecure, (ii) insecure, (iii) at the borderline, and (iv) reasonably secure. Results from this report indicate that Pakistan at the household, district, province and country level has become more food insecure compared to 2003. Many districts became food insecure, while others became extremely food insecure. The number of extremely food insecure districts has increased from 38 in 2003 to 45 in 2009 out of total 102 districts. The food security situation at the household level is much more severe. This reflects the emerging intensity of food insecurity in the country.

Pakistan is also worst hit by high food prices. According to World Food Program (WFP) report 2008, additional 10 million people have become food insecure owing to the high food prices. So, the high rate of underfed population and ongoing food insecurity trend in the country indicate that it would be less likely for Pakistan to meet the target of halving hunger by 2015.

All this is very challenging for the development experts as Pakistan is an agrarian country, and supposedly, food self-sufficient' for that reason. However, the prevailing conditions indicate that food security is directly related to the socio-economic access to food, besides production. Therefore, the objective of this study is to identify and evaluate the socio-economic characteristics which affect the household's food insecurity status. Rest of the study is organized as; section 2 describes the concept/definition of food insecurity and the method used to assess the food insecurity status of a household. Main determinants used in the study and empirical models are also defined in this section. Section 3 discusses data and empirical results. In the end, section 4 contains our findings regarding the household food insecurity and its determinants in Pakistan.

2. Overview of the food insecurity

2.1 Concept and definition of food insecurity

Since the World Food Conference in 1974 due to major food crises and famine in the world, the terminology of food insecurity was introduced, evolved, developed and diversified by different researchers. Maxwell and Smith (1992) listed more than 180 studies in relation to the concept and definition of the food insecurity and some about the indicators of food insecurity. They list some 30 definitions of food insecurity which have either been influential in literature or summarized the views of different agencies. Currently the standard definition of food security in use is:

"*Food security exists when all people, at all times, have physical, social, and economic access to the sufficient food which meets their dietary needs and food preferences for an active and healthy life" (FAO, 1996).*

This definition points out four distinct but interrelated elements of food security, which are essential to achieve food security.

- Availability**:** The term food availability refers towards the availability of sufficient quantities of food with appropriate quality (FAO, 2006). The food availability is a function of home production, stocks, imports as well as the donations. It reflects the physical availability of food in the country.
- Accessibility**:** The lack of purchasing power deprives a person/household to access food or food commodities, even though the food is available to lead active and healthy life. Food accessibility means that individual have sufficient resources to obtain appropriate foods for nutritious diet (FAO, 2006).
- Utilization**:** Food utilization relates to how food consumed is translated into nutritional and health benefits to individuals. In this regard, consumption of foods both in quantity and quality that is sufficient to meet energy and nutrient requirements is the basic measure of food utilization (Babu and Sanyal, 2009). Adequate food utilization is realized when "food is properly used, proper food processing and storage techniques are employed, adequate knowledge of nutrition and child care techniques exists and is applied and adequate health and sanitation services exits" (USAID, 1992).
- Sustainability**:** A population, household or individual having access to adequate food at all times reflects the sustainability dimension of food insecurity. It means that any sudden

shock (floods, earthquakes, price hikes etc.) or cyclical events (e.g. seasonal food insecurity) should not result into the risk of losing access to food for them (UN-ESCAP, 2009).

2.2 Measuring household food insecurity

Collecting data for a complete analysis of food insecurity at household level is very difficult task in a situation where food insecurity is subject to varying in interpretation. In our study, we have used 24 hour calories consumption method to assess the household's food insecurity status. In this regard, we calculate the daily required calories for each household's member depending upon the recommended (FAO, 1996) caloric requirement for a person considering age and sex of that person and sum it up for each household. These minimum caloric levels are recommended for an individual to maintain a healthy life depending upon sex and age. We also compute the consumed calories by each household that are acquired by the use of food items. So the state of food insecurity is defined by a dummy variable I_i such that

$I_i = 1$ If household consumed calories are less than the minimum required calories. (insecure household)

$= 0$ Otherwise (secure household)

However, there are various factors like dietary diversity, vulnerability etc. which are not taken into account as we have restricted ourselves only to caloric consumption level in this study.

2.3. Determents of household's food insecurity

We present variables which are considered as the most relevant in this study with their expected signs in table 2.1. These variables are selected on the basis of previous studies conducted in this area of research.

Table 2.1: Determinants of household food insecurity and their expected signs as per theory

Households characteristics	Expected signs	References
Provinces		
Region		
Household size/size square	+/—	Rose et al. 1998, Babutunde et al. 2007, Haile et al. 2005, Maharajan and joshi 2011
Log of income	—	Rose et al. 1998

Log of agricultural income	—	
Log of farm size	—	Joshi and Maharjan 2007, Haile et al. 2005,
Number of rooms	—	Irum and Butt (2004)
Dependency Ratio	+	Maharajan and joshi 2011
Household head age/squre	—/+	Hofferth, 2003
Household head education	—	Rose et al. 1998, Babutunde et al. 2007, Haile et al. 2005,
Gender	—/+	Maharajan and Joshi, 2011
Female education	—	Rose et al. 1998
Livestock ownership	—	Haile et al. 2005, Maharajan and Joshi, 2011
Occupational status	—	Rose et al. 1998
Electricity connection	—	Faridi and Wadood, 2010
Irrigation availability	—	Maharajan and Joshi, 2011
Fertilizer application	—	Haile et al. 2005
Access to safe water	—	

2.4. TheoreticalModel

The logistic regression model was chosen for this study because of the nature of the response variable which is dichotomous (Agresti, 2002). The dependent variableI_i is a binary variable; the food insecurity model can thus be called as a qualitative response model

$$\varphi_i = E(I_i = 1|X_i) = \frac{1}{1+e^{-\left(\beta_0+\sum_{j=1}^{n=k}\beta_j x_{ij}\right)}} = \frac{e^{\left(\beta_0+\sum_{j=1}^{n=k}\beta_j x_{ij}\right)}}{1+e^{\left(\beta_0+\sum_{j=1}^{n=k}\beta_j x_{ij}\right)}}$$

Where $I_i = 1$ if a household is food insecure

$= 0$ Otherwise

Where $\varphi_i$stands for the probability of household i being food insecure, I_i is the observed food insecurity status of household i, x_{ij} are the factors determining the food insecurity status for household i, β_j stands for the parameter to be estimated. Logit model will be of the form

$$ln\left(\frac{\varphi_i}{1-\varphi_i}\right) = \beta_0 + \sum_{j=1}^{n=k}\beta_j x_{ij} + \varepsilon_i$$

We calculate the sample probabilities for each household such as

$$\hat{\varphi}_i = \frac{e^{\left(\hat{\beta}_0 + \sum_{j=1}^{n=k} \hat{\beta}_j x_{ij}\right)}}{1 + e^{\left(\hat{\beta}_0 + \sum_{j=1}^{n=k} \hat{\beta}_j x_{ij}\right)}}$$

Once the conditional probabilities have been calculated for each sample household, the partial effects of the continuous individual variables on the food insecurity can be obtained by averaging the values of following expression

$$\frac{\partial \varphi_i}{\partial x_{ij}} = \hat{\varphi}_i(1 - \hat{\varphi}_i)\hat{\beta}_j$$

The "partial" effects of the discrete variables are obtained by taking the difference of the mean probabilities estimated for their respective categories$(e.g. x_i = 0, x_i = 1)$.

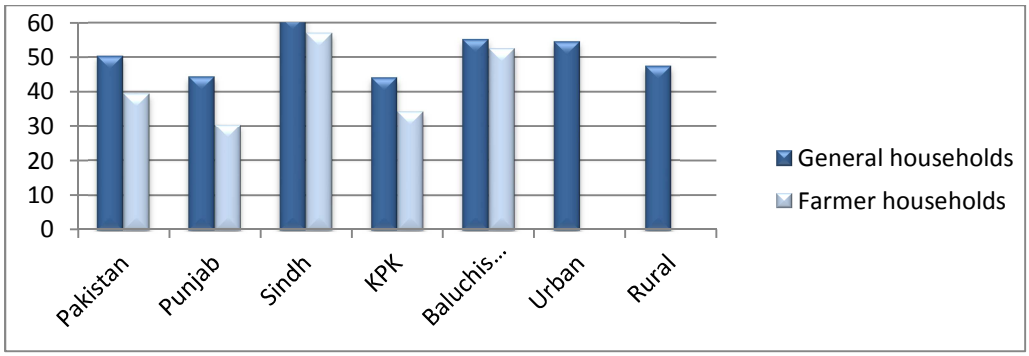
3. Empirical Results

Pakistan Social and Living Standard Measurement (PSLM) survey 2007-08 data are used for thisstudy. More details about data are available in Pakistan Social Living Measurement Survey report published by the FBS.A two-stage stratified sample design has been adopted in this survey. Keeping in view the objectives of the survey, the sample size for the four provinces (Baluchistan, Khyber Pukhtoon Khwa, Punjab and Sindh) has been fixed at 15512 households.

3.1. Descriptive Analysis

After some preliminary cleaning of data we have data on 14525 out of total 15512 households. 50.4 % are found to be food insecure and 49.6% are food secure. While out of 3518 farmer households 39.5% are found to be food insecure and 2127 60.5% food secure. The prevalence of food insecurity, however, is not evenly distributed throughout the population. Some more details about these indicators are given by Asghar (2011).

Figure 3.1%age of Food insecurity among provinces and regions



From Figure 3.1, difference in food insecurity level is observed among four provinces, in which Sindh is found to be the most food insecure. Figure 3.1 shows that proportion of food insecure household is high in Sindh for both general and farmer households. Difference in proportion of household food insecurity is also observed among rural and urban households. Urban households are found to be more food insecure than rural households.

Table 3.1 shows the household food insecurity with reference to various socio-economic characteristics such as gender, education, age and female education level. These factors are correlated with the food insecurity level of household i.e. household food insecurity varies according to these characteristics.

Table 3.1: Household food insecurity by household head characteristics and female education

Household characteristics	General households		Farmer households	
	Secure	Insecure	Secure	Insecure
Household head education				
Mean	9.74	9.23	9.15	8.89
Median	10	10	10	10
Primary(<=5) %	46.4	53.6	55.5	44.5
Secondary(6-10) %	48.0	52.0	60.3	39.7
Graduation (11-14)%	55.8	44.2	75.4	24.6
Higher (>14) %	70.6	29.4	75	25
Household head age				
Mean	45.64	46.48	47.39	48.39
Median	45	45	46	48
≤35 %	56.4	43.6	66.9	33.1
36-55 %	46.1	53.9	58.6	41.4
>55 %	51.0	49.0	59.0	41.0
Gender				
Male %	49.3	50.7	61	39.9
Female %	56.1	43.9	70	30.0
Female education				
Mean	8.23	7.96	7.83	7.85
Median	8	8	8	8

Primary(<=5)%	51.6	48.4	70.3	29.7
Secondary (6-10)%	48.1	51.9	59.2	40.8
Graduation (11-14)%	65.5	34.5	82.4	17.6
Higher (>14)%	78.8	21.2	83.3	16.7

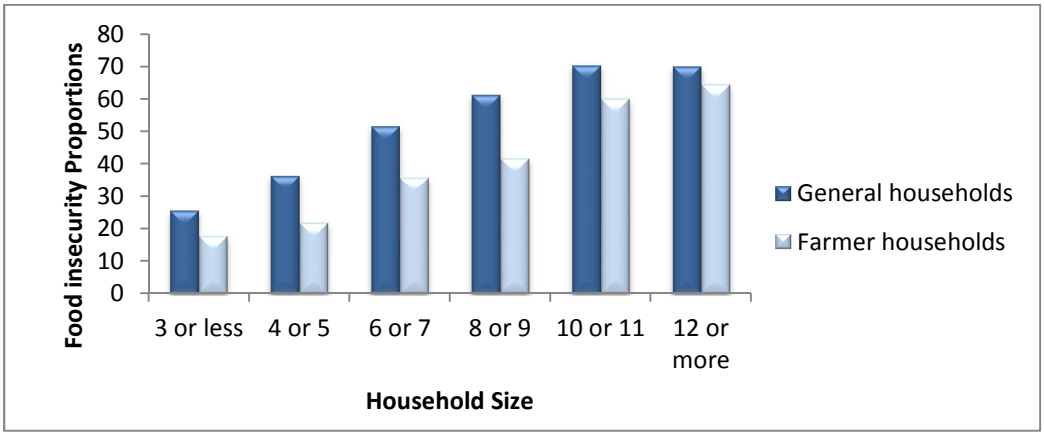
Education plays a significant role to adopt the modern agricultural practices which result into the high production as well as it opens more opportunities for non-forms income (Maharajan and Joshi, 2011).Education level of female is also important in a household's food security level as the food purchasing, preparation and serving etc. is most of the time concerned to female. The negative impact of education of household head and female on food insecurity status of a household, as literature review portrays, is reflected by the proportions given in table 3.1 for both general and farmer households.

Household head age is also considered an important factor pertaining to an individual's personality make up, since the needs and the ways in which an individual thinks are closely related to the number of years a person lived. According to Hofferth (2003), older people are more mature and may have better experiences in obtaining the types of the resources they required. As well as, older people are supposed to have more agriculture production practices, particularly in the rural settings where the agriculture is the mainstay. On the other hand, there is equal possibility that the older household heads have low tendency of adopting improved technology in agriculture and also economically not much active as compared to younger one. Rose et al. (1998) makes a point about the older people as they are less mobile, which might prevent them to reach at low cost stores etc. Therefore, it is interesting to know whether food insecurity varies among different age groups of households in the observed data sets. Households having household head age less than 35 are found to be the least food insecure for both general and farmer households.

Household head gender may also affect the household food insecurity. Maharajan and Joshi (2011) argued that death of husband, separation, migration of husband outside the city or village may result into the female heading household. These household possess less physical access for agricultural activities, livestock and cultivate land they own etc. This will have a positive impact towards probability of being food insecure. However, there is another argument that food activities (purchasing, preparation etc.) is most of the time concerned with the female,

so a household having female household head is more independent in their spending on food as compared to household headed by male. So in this case a household having female head is less likely to be food insecure. Table 3.1 shows higher proportion of food insecurity among those households headed by male than those which are headed by females. But one must be careful while analyzing this result as sample size in both groups is different. Male headed households are 9 times more than female headed households. Household size (Figure 3.2) is also an important factor for the assessment of food insecurity. Household size is measured by the number of family members in a household. Increase in family size tends to exert more pressure on consumption on the household. Larger the household higher the chances to be food insecure as it requires more money in order to meet both food and other daily needs for more persons. But simultaneously there may be an increase in income level as there can be more bread earners in the house.

Figure 3.2: %age of food insecurity for different household sizes

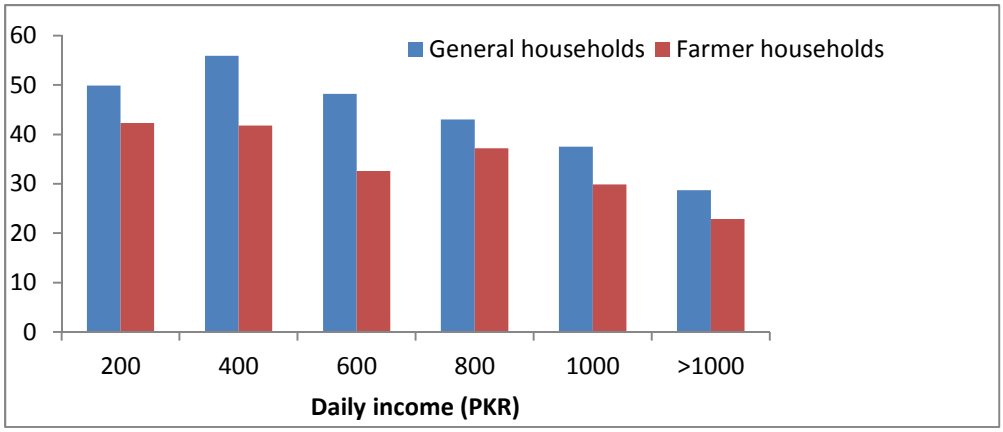


Another important factor to assess the food insecurity of the household is income level of household. Households having higher income are obviously less likely to be food insecure, as compared to households with low income. Households with high income can spare more money on food after meeting other needs. Results given in table 3.2 shows the mean/median income of insecure households is less than secure households for both general households and farmer households groups. Figure 3.3 shows a negative association of household food insecurity with the income levels of households i.e. households having high (daily) income are found less food insecure as compared to the households with low income with some exceptions.

Table 3.2: Mean income for secure and insecure households

Household income	General households		Farmer households	
	Secure	Insecure	Secure	Insecure
Annual Income				
Mean	149653.72	121824.89	137383.95	116353.57
Median	96865	96000	90140.00	82500.00
Agricultural Income				
Mean	---	---	18391.91	140402.94
Median	---	---	93000	83000

Figure 3.3: %age of food insecurity by daily income



Number of rooms available in a household is also considered as a determinant of food (in) security in this study. It is directly linked with income and living standards. Dependency ratio (ratio of number of peoples in dependent age by independent age in household) shows that higher the dependency ratio more the burden on a household to meet food demand. Mean/median dependency ratio is less for food secure households than for food insecure households.

From table 3.3, we observe that owners are less food insecure than renters for both general and farmer households. Dwelling type independent house/compound and other dwelling types have not much difference among each other in terms of food insecurity. Household having an electricity connection are less in proportion of food insecurity than the households not having an electricity connection. However, the proportion of food insecurity is high for household

having access to safe water. This is not the result as per our expectations for both groups of households (general and farmer households).

Table 3.3: %age of food insecurity according to some additional characteristics of households

Household characteristics	General households		Farmer households	
	Secure	Insecure	Secure	Insecure
Number of rooms				
1	48%	52%	59.7%	40.3%
2	48%	52%	59.1%	40.9
3	49.6%	50.4%	60.1%	39.9
4	51%	49%	61.6%	38.4%
5 or more	60%	40%	66%	34%
Occupational status				
Renters	48.5%	51.5%	58.5%	41.5%
Owners	49.8%	50.2%	60.6%	39.4%
Dependency ratio				
Mean	.95	1.06	1.02	1.12
Median	.75	0.86	0.8	0.88
Dwelling type				
Independent house/compound	50.1%	49.9%	---	---
Apartment/flat	48%	52%	---	---
Part of large unit	48.8%	51.2%	---	---
Part of compound	44.7%	55.3%	---	---
Other	51.5%	48.5%	---	---
Electricity connection				
Not Available	44.7%	55.3%	50.4%	49.6%
Available	50.8%	49.2%	64.5%	35.5%
Access to safe water				
No	52.4%	47.6%	58%	42%
Yes	49.3%	50.7%	61%	39%
Livestock Ownership				
Not have	---	---	60.5%	39.5%
Have	---	---	60.4%	39.6%
Irrigation				
Not available	---	---	65.7%	34.3%
Available	---	---	58.9%	41.1%
Fertilizer use				
No	---	---	60.8%	39.2%
Yes	---	---	60.4%	39.6%
Land size				
1	---	---	55.7%	44.3%
1-2.5	---	---	65.2%	34.8%
2.5-4	---	---	60.1%	39.9%
>4	---	---	60.2%	39.8%

3.2 Parameter estimates of logistic regression:

In this section we will discuss the results of logit models for general and farmer households. The dependent variable is household food insecurity which takes a value equal to 1 if household is unable to meet its minimum calorie requirement, 0 otherwise. Table3.4 shows four models for general households. In model-I, we include eight variables such as provinces, region, household size, household size square, log of total income, dependency ratio, occupational status and number of rooms in a household. These all variables are found to be highly significant. All these variables have the signs according to the theory reviewed in literature except for the dependency ratio. In our estimated model dependency ratio is negatively associated with the household food insecurity. This means that food insecurity reduces as the number of dependents increase in a household which is not as per expectation. Sindh is to be found more food insecure as indicated by the positive sign of its coefficient (Baluchistan is reference category). Household size is positively associated with household food insecurity while its square has a negative sign. Households having their own homes are found less probable to be food insecure than renters. Number of rooms and log of annual income are also negatively associated with food insecurity. In model-II, we include four more variables related to household head. Household head age is positively associated with the household food insecurity. Household head education is negatively associated with the household food insecurity. In model-III, we include the remaining four variables. Female education is insignificant while the sign of the variable 'access to safe drinking water' is not favorable. We end up with model IV as our final model after eliminating insignificant variables. In model IV all variables are significant and have the signs as expected except the dependency ratio and access to safe water. We use this model to calculate partial effects of each variable.

Table 3.4: Parameter estimates of logit models for general households

Household characteristics	Model I		Model II		Model III		Model IV	
	Estimates (S.E)	P-value	Estimates (S.E)	P-value	Estimates (S.E)	P-value	Estimates (S.E)	P-value
Provinces (Baluchistan)								
Punjab	-0.226**	.000	-0.228**	.000	-0.245**	.000	-.244**	0.000
	(0.055)		(0.055)		(0.058)		(0.058)	
Sindh	0.454**	.000	0.465**	.000	0.467**	.000	.468**	0.000
	(0.060)		(0.061)		(0.064)		(0.064)	
KPK	-0.505**	.000	-0.491**	.000	-0.501**	.000	-.502**	0.000
	(0.063)		(0.064)		(0.065)		(0.065)	
Region	0.68**	.000	0.697**	.000	0.7**	.000	.697**	0.000
	(0.041)		(0.041)		(0.043)		(0.043)	
Household size	0.513**	.000	0.49**	.000	0.492**	.000	.494**	0.000
	(0.018)		(0.018)		(0.018)		(0.018)	
Household size square	-0.013**	.000	-0.012**	.000	-0.012**	.000	-.012**	0.000
	(0.001)		(0.001)		(0.001)		(0.001)	
Ln of total income	-0.554**	.000	-0.555**	.000	-0.542**	.000	-.547**	0.000
	(0.029)		(0.031)		(0.032)		(0.031)	
Dependency ratio	-0.161**	.000	-0.145**	.000	-0.146**	.000	-.147**	0.000
	(0.022)		(0.023)		(0.023)		(0.023)	
Occupational status (renters)	-0.17**	.002	-0.17**	.002	-0.155**	.006	-.154**	0.006
	(0.055)		(0.056)		(0.056)		(0.056)	
Number of rooms	-0.168**	.000	-0.154**	.000	-0.149**	.000	-.150**	0.000
	(0.015)		(0.040)		(0.016)		(0.016)	
Age			0.04**	.000	0.038**	.000	.039**	0.000
			(0.008)		(0.009)		(0.009)	
Age square			-0.0004**	.000	-0.0004**	.000	-.0004**	0.000
			(0.000086)		(0.000086)		(0.000086)	
Education of household head			-0.03**	.000	-0.029**	.000	-.031**	0.000
			(0.006)		(0.007)		(0.006)	
Gender of household head			0.253**	.006	0.245**	0.008	.246**	0.000
			(0.092)		(0.092)		(0.092)	
Female education					-0.011	0.277		
					(0.011)			
Electricity connection (not available)					-0.149**	0.003	-.148**	0.004
					(0.051)		(0.051)	
Dwelling type (other)								
Independent house/compound					.378*	0.087	.378*	0.087
					(0.221)		(0.221)	
Apartment/flat					0.544**	0.033	.537**	0.035
					(0.255)		(0.255)	
Part of the large unit					0.510**	0.027	.510**	0.027
					(0.232		(0.230)	
Part of compound					0.122	.600	.122*	0.600
					(0.323)		(0.232)	
Access to safe water (not access)					0.131**	.037	.132**	0.036
					(0.063)		(0.063)	
Constant	4.087**	.000**	3.288**		2.861**	.000	2.825**	0.000
	(0.320)		(0.361)		(0.418)		(0.417)	

**..Sig. at 0.05 level of significance. *..Sig. at 0.10 level of significance. Values in parenthesis are Standard deviations while in first column parenthesis showing base category for each variable.

Table 3.5 contains four models for farmer households. In model-I, eight variables are included such as provinces, household size, household size square, log of the income, log of the agricultural income, log of the land size, number of rooms in housing and dependency ratio. All these variables are found to be significant except the log of land/farm size. Sindh is again found to be the most food insecure i.e. the sign of its coefficient is positive implying higher food insecurity than reference category which is Baluchistan.

Household size is also found to be highly significant as well as its square term. Household size is positively associated with the household food insecurity and household size square is found to be negative. Both agricultural and annual incomes are found to be negatively associated with the household's food insecurity. Dependency ratio here shows the decrease in household food insecurity i-e as the dependency ratio increases household food insecurity decreases.

We include four more variables in model-II related to household head and female education. Age and its square are found to be significant. In the model-III, we include seven more variables which include female education, livestock ownership, occupational status, electricity connection, irrigation availability, fertilizer application and access to safe water. In model-III, in total 12 variables are found to be significant and have signs as expected except than the dependency ratio and irrigation availability. Model-IV is our final model after dropping out the insignificant variables and we use this model to find out the partial effect of the significant variables.

Table 3.5: Parameter estimates of logit models for farmer households

Households characteristics	Model I		Model II		Model III		Model IV	
	Estimates (S.E)	P-value	Estimates (S.E)	P-value	Estimates (S.E)	P-value	Estimates (S.E)	P-value
Provinces (Baluchistan)								
Punjab	-.669**	0.000	-.666**	0.000	-.642**	0.000	-.631**	0.000
	(0.126)		(0.127)		(0.140)		(0.130)	
Sindh	.306**	0.026	.326**	0.019	.260*	0.082	.271*	0.057
	(0.137)		(0.139)		(0.149)		(0.142)	
KPK	-1.245**	0.000	-1.233**	0.000	-1.133**	0.000	-1.141**	0.000
	(0.150)		(0.151)		(0.157)		(0.153)	
Household size	.470**	0.000	.453**	0.000	.456**	0.000	.453**	0.000
	(0.035)		(0.036)		(0.036)		(0.036)	
Household size square	-.011**	0.000	-.010**	0.000	-.010**	0.000	-.010**	0.000
	(0.001)		(0.001)		(0.001)		(0.001)	
Log of income	-.363**	0.000	-.377**	0.000	-.355**	0.000	-.336**	0.000
	(0.062)		(0.064)		(0.065)		(0.063)	
Log of agricultural income	-.324**	0.000	-.325**	0.000	-.343**	0.000	-.353**	0.000
	(0.056)		(0.056)		(0.061)		(0.048)	

Log of farm size	-.020	0.687	-.023	0.648	-.011	0.840		
	(0.050)		(0.051)		(0.055)			
Number of rooms	-.091**	0.002	-.086**	0.004	-.073**	0.016	-.076**	0.012
	(0.030)		(0.030)		(0.030)		(0.030)	
Dependency Ratio	-.173**	0.000	-.156**	0.001	-.165**	0.000	-.161**	0.000
	(0.046)		(0.046)		(0.047)		(0.046)	
Household head age			.038**	0.027	.038**	0.031	.037**	0.034
			(0.017)		(0.017)		(0.017)	
Household head age square			.00036**	0.040	.00035**	0.046	-.0003*	0.053
			(0.00017)		(0.00017)		(0.00017)	
Household head education			-.022	0.153	-.026*	0.092	-.025*	0.107
			(0.015)		(0.016)		(0.015)	
Gender (female)			.272	0.241	.209	0.370		
			(0.232)		(0.233)			
Female education					.029	0.395		
					(0.034)			
Livestock ownership (not have)					-.077	0.320		
					(0.078)			
Occupational status (renters)					-.010	0.955		
					(0.179)			
Electricity connection (not available)					-.228**	0.014	-.230**	0.012
					(0.093)		(0.092)	
Irrigation availability (not available)					.215*	0.059	.220**	0.029
					(0.114)		(0.101)	
Fertilizer application (non-user)					-.063	0.0645		
					(0.136)			
Access to safe water (not have access)					-.129	0.311		
					(0.127)			
Constant	5.366**	0.000	4.575**	0.000	4.458**	0.000	4.656**	0.000
	(0.695)		(0.814)		(0.876)		(0.769)	

**Sig. at 0.05 *..Sig. at 0.10 Values in parenthesis are standard errors while in first column parenthesis showing base category for each variable.

3.3. Change in probabilities for discrete variables of the logistic regression:

The change in the probabilities of household food insecurity due to the discrete variables is presented in table 3.6. This change is calculated by the difference of mean probabilities of respective variable categories. Among provinces, mean probability of being food insecure is higher in Sindh than all other provinces for both general and farmer households. Households belonging to Sindh are found 17.35% (for general households) and 26.54% (for farmer households) more probable to be food insecure than the households belonging to Punjab. KPK has the lowest food insecurity among the four provinces. For general households, a shift from the urban to the rural region decreases the probability of food insecurity by approximately 7 percent. While a shift from the renter household to the owner household reduces the probability of being food insecure by 1.3%. Availability of electricity connection is another strong indicator of

household's welfare in terms of food security. Households with electricity connection are found 6% (for general households) and 14% (for farmer households) less probable to be food insecure than those who do not have the electricity connection. Households having female household head are 6.8% less likely to be food insecure than the household headed by male for general households while this variable is insignificant for farmer households.

Table 3.6: Partial effects of discrete determinants of food insecurity

Household characteristics	General households		Farmer households	
	Probabilities	Change in probabilities	Probabilities	Change in probabilities
Province				
Punjab	0.4444		0.3042	
Sindh	0.6179	0.1735	0.5696	0.2654
KPK	0.4422	-0.0022	0.3434	0.0392
Baluchistan	0.5515	0.1071	0.5241	0.5241
Region				
Urban	0.5464			
Rural	0.4747	-0.0717		
Occupational status				
Owners	0.502			
Renters	0.5151	0.0131		
Gender of the household head				
Male	0.5068			
Female	0.4393	-0.0675		
Electricity connection				
Have connection	0.4915		0.3548	
Not have connection	0.553	0.0615	0.4956	0.1408
Dwelling Type				
Independent house/compound	0.4991			
Apartment/Flat	0.5197	0.0206		
Part of large unit	0.5119	0.0128		
Part of compound	0.5529	0.0538		
Other	0.4848	-0.0143		

3.4. Partial effects of the continuous variables:

Partial effects are calculated for continuous variables to assess the marginal effect of a unit change in any of the variables that are found to be statistically significant on the household food insecurity status in the logistic model. The partial effects are calculated from the logistic regression to see the effect of a change in an individual variable on the probability of food insecurity when all other exogenous/explanatory variables are held constant. The results of the partial effects of the significant continuous variables are given in table 3.7. One percent change

in income (annual) reduces the probability of being food insecure by 27.56% and 13.29% for general and farmer households, respectively. A unit (room is a unit here) increase in housing reduces the probability of food insecurity by 7.56% (for general) and 3.01% (farmer households) respectively. A unit increase in (here unit is one year of schooling) education of the household head decreases the probability of a household food insecurity by 1.56% (for general) and 9.09% (for farmer). There is an increasing trend of food insecurity for both general and farmer households as household's size increases (Table 3.7). For general households, a shift of the household size from 3 to 4 and 4 to 5 increases the probability of a household being food insecure by 20.69% and 19.49%, respectively.

Table 3.7: Partial effects of the continuous determinants of food insecurity

Household characteristics	General households	Farmer households
	Partial effects	Partial effects
household size	0.2489	0.1791
household size square	-0.006	-.004
log of income	-0.2756	-0.1329
log of agricultural income		-0.1396
number of rooms	-0.0756	-0.0301
age of the household head	0.0196	0.0146
age square	-0.0002	-0.0001
education of the household head	-0.0156	-0.0909
Household characteristics	Change in probabilities	Change in probabilities
Household size		
4	0.2489(4-3)-0.006(16-9)=0.2069	0.1791(4-3)-0.004(16-9)=0.1511
5	0.1949	0.1431
6	0.1829	0.1351
Household head age		
40	0.0196(40-35)- 0.0002 (402-352) =0.023	0.0146(40-35)- 0.0001 (402-352) =0.0355
45	0.013	0.0305
50	0.003	0.0255

4. Conclusion:

According to the descriptive statistics of sample households, a priori expectations about the relationships between indices of food insecurity and factors influencing it are stratified for almost all the indicators which are considered in this study. 50.4%(general households) and

39.5% (famer households) are found to be food insecure. This shows a low tendency of food insecurity among farmer households as compared to general households.

The food insecurity related factors are studied through the logistic regression for general and farmer households. Binary logistic regression model findings are also in accordance with the results presented in descriptive analysis. Out of 16 factors included for general households, only female education was found to be insignificant. Access to safe water and dependency ratio variables impact on food insecurity is counterintuitive. Education level of head, annual income, number of rooms, household size square and age square are negatively associated with household food insecurity while household size, age have a positive association with food insecurity.

For farmer households, out of 19 factors twelve are found to be significant determinants of household food insecurity such as households size, households size square, annual income, agricultural income, number of rooms, dependency ratio, age, age square, electricity connection and irrigation availability. Educational level of head, annual income, number of rooms, agricultural income, age square and household size are negatively associated with household food insecurity. Household size and age of household head have a negative impact of household food insecurity. Agriculture income is very important determinant of food security for farmers. Factors like farm size, fertilizer application and irrigation availability are not significant to assess the food insecurity status.

Education, income and household size are found to be the most important factors for food security for both general and farmer household. Education plays a part in imparting knowledge and skill in modern agriculture practices and its adoption resulting into high production and agricultural income i.e. reducing the probability of a household being food insecure. Education also opens up more opportunities for income as well as has an impact on the ability of household nutritional decisions. As far as household size is concerned, large households have more people to feed as compared to small households thus, reducing the calories intake per household member increasing the food insecurity in those households. Households having low income are highly food insecure as they are left with very small amount to meet their dietary needs after sparing money for other needs. However, we believe that some other factors and elements that affect food security are complex and multifaceted in nature and not easy to comprehend may also be included. Therefore, effort has been made in this study to see the impact of some demographic and socioeconomic factors on household food insecurity.

From policy perspective our results highlight the importance of the factors which are already in the mainstream of development economics. These policies include increasing income particularly of lower income groups who are highly vulnerable to food insecurity. Increase in income of the poor will not only make them food secure but will also help in reducing population as parents will spend more on the education and health of their children. In the short run one may think of some targeted interventions like cash transfer or subsidies but the long run solution is to have economic growth which ensure not only increase in income but also help in making it possible to provide ample opportunities to the poor people to gain access to health, education and jobs.

Finally, we recommend that further studies should be conducted in the area of food insecurity by considering detail and accurate information on various variables including political, climatic and weather (rainfall and temperature), topology, natural disasters, ecological conditions and other factors that affect food insecurity. It is also recommended to conduct a study that compares status of food insecurity in rural households with urban households or among different provinces of Pakistan. There is also need for intersectoral linkages among various departments to ensure food security (Kabeer and Asghar 2012)

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