Competitive Social Sciences Research Journal (CSSRJ),3(1),79-94
ISSN(Print):2708-9029,ISSN(Online):2708-9037
www.cssrjournal.com

Estimating the Impacts of Agricultural Land and Livestock Ownerships on Insecurity of Food in Pakistan: Evidence from Quantile Regression Analysis

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ABSTRACT

Abstract

The present study employs quantile regression analysis henceforth QR on micro-level datasets from Pakistan to evaluate the role of agricultural land and livestock ownerships on the insecurity of food in Pakistan. The results indicate that the favorable effects of land, as well as livestock ownership on food insecurity, vary with quantile. The impacts of 11or more acres of land owned by wealthy households on food insecurity are about five times larger than those of poorer ones. whereas the impacts of livestock are more than double. The slope coefficients of Inter-quantile regressions for the above-mentioned variables are statistically significant. So, it is recommended that land should be provided to landless households through land reforms and there should be the arrangement of livestock for the households without it.

***Keywords*:** Insecurity of Food (IoF); Agricultural land; livestock; Quantile Regression (QR); Inter-Quantile Regression (IQR), Pakistan
JEL Codes: C21; Q15; I30; Q19.

To cite this article: Cheema, A,R., Imran, K. & Ul-Haq, J. (2022). Estimating the Impacts of Agricultural Land and Livestock Ownerships on Insecurity of Food in Pakistan: Evidence from Quantile Regression Analysis. Competitive Social Sciences Research Journal (CSSRJ), 3(1),79-94.

INTRODUCTION

Food security is an essential factor in the well-being of households at all levels: worldwide, domestic, and regional (Bickel et al., 2000). Economic growth is usually accelerated by food security (Timmer, 2005). Insecurity of food is a severe problem, particularly in underdeveloped economies. According to Human Development Report 2015, The

Sustainable Development Goals agenda's second development aim is "zero hunger." Since then, governments, researchers, and academics have paid close attention to it. There have been several studies conducted to identify food insecurity and its determinants at both the national and global levels. In these studies, three different methods (e.g. Probit/logit models, Ordinary Least Square regression, and Quantile Regression (henceforth QR)) have been used to find the factors influencing insecurity of food in the literature. The former models were employed by (Cheema and Abbas, 2016; Feleke et al., 2005; Mallick and Rafi, 2010; Kassie et al., 2014; Maitra and Rao, 2015; Hailu and Nigatu, 2007; Edgar Muhoyi et al., 2014; Aidoo et al., 2013). There are certain concerns with employing these regressions (WorldBank, 2002). All available data is not used in these regressions since the ratio of the ith family's mean per adult equivalent food expenditure (henceforth mpaefe) to two-thirds of mpaefe of all families is grouped into a categorical variable that assumes 1 if the family's mpaefe is less than two-third of mpaefe of all households, and 0 otherwise.

As a result, it is crucial to utilize complete information for the dependent variable. OLS regression is a superior solution for dealing with this issue (WorldBank, 2002). In the context of Pakistan, Iram and Butt Muhammad (2004) employed OLS regression analysis to discover the factors of food insecurity/security. OLS regressions measure the average impact of independent factors on dependent variables. However, insecurity of food is more prevalent in lower-level socioeconomic households (Akao and Mazur, 2003; Gao et al., 2009; Carlson and Frazão, 2012). Thus, the drivers of food insecurity should be predicted by employing QR, which may be a rational option in such a case. If conditional quantiles (henceforth CQ) are of interest, the QR may be desirable (Hennings and Katchova, 2005; Koenker and Bassett Jr, 1978; Koenker and Hallock, 2001; Yirga et al., 2018).

At the international level, there are two studies (Matchaya and Chilonda, 2012; Bhuyan and Sahoo, 2017) that have employed QR to find determinants of food security. The first study used data consisting of only 200 households and the Wald test was used to make sure, whether the slopes across the quantiles were the same or different to choose between OLS regression and QR. This does not consider differences in slope coefficients between any two quantiles (henceforth Q). To find between which two Qs, the gaps in slope coefficients are statistically significant, Inter-quantile regression (henceforth IQR) should be used (Hennings and Katchova, 2005). There is a single study at national that used these regressions (Cheema et al., 2021). Now, this study aims at using these regressions to find the role of land and livestock ownerships on the insecurity of food in Pakistan.

The study reveals that the impacts of agricultural land and livestock ownerships on the insecurity of food are favorable and statistically significant. Further, their effects on the insecurity of food vary across Quantiles. The impacts of wealthier households having 11 or more acres of land on the insecurity of food are nearly five times larger than those of lower-income households, whereas the impacts of livestock are more than double. The slope coefficients of Inter Quantile Regressions for eleven or more acres of land and livestock are statistically significant between different quantiles. Our results are reliable and are unaffected by the insecurity of food methods (i.e., Food Expenditure and Calorie intake).

Our work addresses a research vacuum in Pakistan by using the QR model to identify the contributions of farming fields and livestock holdings upon insecurity of food, which is indeed a superior technique to the traditionally used (i.e., Probit/logit and OLS) regression

models. Because of the heterogeneity of the individuals, it is possible that individuals may not share the same features (e.g., land ownership, livestock, education, age, and family size). Individuals may have distinct effects on the security of food at various Qs. Additionally, this work estimates IQRs to determine whether or not changes in slope coefficients between two Qs are statistically meaningful. We believe that this new methodology addresses all the concerns raised over the previous methodologies.

The remainder of the study is presented under: the second part deals with the data used and the empirical techniques analyzed. The third portion explains the findings, while the last piece summarizes and recommends policy implications.

DATA AND METHODOLOGY

The survey data of the Government of Pakistan's Pakistan Social and Living Standard Measurement (henceforth PSLM) for the year 2013-14, is used in this study ((Basheer, 2014; Basheer et al., 2019; bin Hidthiir et al., 2019; Basheer et al., 2018). This data is collected to assist the government to formulate poverty-reduction strategies within the context of the MDGs. Indicators in the sectors are generated at the state scale (e.g., education, earnings, and spending on food, non-food, power items, etc.).

Table 1: Definitions of the Variables

Variable	**Measurement**
L	mpaefe of ith household
K	2/3 of mpaefe of all households
Land0	Families having no land ownership=1, 0 otherwise
Land5	Families having 5 acres of land=1, 0 otherwise
Land10	Families having 10 acres of land =1, 0 otherwise
Land11	Families having 11 and more acres of land=1, 0 otherwise
Lvst	Livestock. Households having ownership of livestock=1, 0 otherwise
	Control variables
edu0	family head with zero education =1, 0 otherwise). This is the reference category
edu1	family head with education greater than 1 and less than or equal to 4 years=1, 0 otherwise)
edu2	family head with education equal to 5 years =1, 0 otherwise
edu3	family head with education greater than 6 and less than or equal to 9 years =1, 0 otherwise
edu4	family head with education equal to 10 or 11 years=1, 0 otherwise
Edu5	family head with education equal to 12 & higher years=1, 0 otherwise
Lage	The log of the family head's the age
lfamily size	log of size family

Punjab	Punjab =1 if province=Punjab, 0 otherwise
Sindh	Sindh =1 if province= Sindh, 0 otherwise
KPK	KPK =1 if province=Khyber Pakhtunkhwa, 0 otherwise
Urban	Urban=1 if region=urban,0 otherwise

Food Insecurity Incidence, Depth, and Severity Calculation

Food security is a vast topic, and scholars and researchers are divided on how to quantify it in a way that covers all facets of food security (Iram and Butt Muhammad, 2004; Kassie et al., 2014; Pinstrup-Andersen, 2009; Bank, 2012; Mallick and Rafi, 2010). Insecurity of food is a big challenge in emerging economies such as Pakistan. Although it has undoubtedly been calculated throughout the world, the study adds to the current literature by calculating it using the two most often used approaches. Using the food expenditure variable, this study calculated the FGT measures in terms of insecurity of food following Titus and Adetokunbo (2007), Agwu and Oteh (2014), Arene and Anyaeji (2010), Cheema and Abbas (2016), and Otunaiya and Ibidunni (2014).

$$Foodins_i = \frac{Mean\,real\ per\ adult\ Equivalent\ food\ \exp enditure\ of\ i^{th}\ household\ (l)}{2/3\ of\ mean\,real\ per\ adult\ Equivalent\ food\ \exp enditure\ of\ all\ households\ (k)} \quad (1)$$

If the Food is less than one, the household is vulnerable to insecurity of food; alternatively, the household is secure. The FGT (e.g. Foster et al. (1984)) was performed in the study to estimate the insecurity of food indexes following Hoddinott (1999), Cheema and Abbas (2016), Zhou et al. (2017);

$$Foodins_i(\alpha) = \frac{1}{N}\sum_{i=1}^{q}\left[\frac{k-l}{k}\right]^{\alpha} \quad if\ l < k \qquad (2)$$

Where k is the denominator of equation (1), l is the numerator of equation (1), and q is the number of food insecure families.

If α=0, the incidence of insecurity of food is measured. If α=1, it represents the gap of insecurity of food, and if α=2, it represents the squared gap of insecurity of food. All these food insecurity indexes have weaknesses and strengths. 1) The insecurity of food incidence is simple to calculate and comprehend. However, it does not take into consideration whether the individual welfare decreases or grows while being below the k. 2) As a result, it is crucial to assess the gap of insecurity of food, which evaluates how much of mpaefe is needed to get rid of the insecurity of food scenario. 3) The shortcoming of this index is that it does not consider if an individual's mpaefe moves to another whose mpaefe is less thank. As a result, estimating the squared gap of insecurity of food is mandatory that tackles this issue.

Furthermore, using the Calorie Intake method, the study assessed the three food insecurity indices indicated above. The Government of Pakistan recommends a daily calorie consumption of 2350 calories per adult equivalent (Anwar, 2006).

Empirical Strategy

To assess the factors influencing the security of food, the following food security function is used:

$$\frac{l}{k} = \left(landownership, livestock, control\ \text{var}\, iables \right) \quad (3)$$

Ownership of agricultural land by a household is evidence in itself of the household's security level of food. Kumba (2015); (Lee, 2011; Mahmood et al., 2016; Najafi, 2003) depicted that ownership of land had a favorable impact on the insecurity of food. So, the relationship between insecurity of food and ownership of agricultural land is expected to be a negative one.

As far as ownership of Livestock is concerned, it is ensuring the security of food in many regions. Livestock contributes 11.1 % to the overall GDP of Pakistan. It provides food, employment, and cash income to the farmer (owner) and is a major factor contributing to poverty alleviation and food security. Ownership of livestock causes income generation which leads to food security (Regmi and Paudel, 2017; Bashir and Schilizzi, 2013; Ali and Khan, 2013; Cheema and Abbas, 2016; Haile et al., 2005). Consequently, livestock is expected to affect the insecurity of food negatively.

This study also includes some control variables like education, household head age, household size, and provincial dummies. Existing research indicates a negative linkage between insecurity of food and education (De Marco and Thorburn, 2008; Olabiyi and McIntyre, 2014; Cheema and Abbas, 2016; Regmi and Paudel, 2017; Woertz, 2017). According to the research, wealthier families put their children in good schools (Useem and Miller, 1975). According to Oxform (2019), a poor family's child has seven times the odds of completing secondary school as a wealthy family's child. Another variable that impacts insecurity of food is the age of the household head. According to the research, there is a favorable correlation between the age of the family head and food security (Arene and Anyaeji, 2010; Bashir et al., 2012; Cheema and Abbas, 2016; Zhou et al., 2017). Furthermore, family size is also used as a control variable. According to research, there is an unfavorable link between both securities of food and family size (Cheema and Abbas (2016). Household size is projected to have a detrimental impact on the security of food. The research also included various geographical dummies, with the expectation of variations between them.

In this analysis, the two econometric models—OLS regression and QR—are computed. The latter regression was proposed to illustrate the application of sample Qs to conditional Qs as a function of regressors. It's an extension of the previous framework providing conditional functions at any Q. It allows for the determination of whether the effects of specific explanatory variables on the security of food vary based on the family's standing in the distribution of security of food. It depicts the entire conditional distribution of security of food assumed a set of covariates. The OLS regression constrains the effects of a particular explanatory variable on the security of food to be identical across all ratios of security of food. When the families are having no variations in terms of security of food, the coefficients of the slope of the CQ function at each point of the distribution of the dependent variable will be identical to one another, just like the coefficients of the slope of the OLS regression. When the households are heteroscedastic in terms of security of food, the coefficients of the slope of the CQ functions differ from one another and the coefficients

of the slope of the OLS regression. As a result, estimating CQ at various places along the distribution of dependent variable will allow us to estimate various marginal influences of the regressand to regressor fluctuations at these points. Moreover, when I.I.D errors are assumed, The QR estimation method could outperform the OLS estimation technique (Koenker and Bassett Jr, 1978; Hennings and Katchova, 2005). Also, it stands up to extremes.

Buchinsky (1998) offers the following generic QR model:

$$y_i = x_i'\beta_\theta + u_{\theta i} \quad i = 1...n \qquad (4)$$

Where Y_i represents Family I's security of food and the θ^{th} Q ($0<\theta<100$) of Yi's conditional distribution is a linear function of a K*1 vector of explanatory variables x_i and an unknown error term, $u_{\theta i}$.; β_θ is the unknown vector of regression parameters connected to the θ^{th} percentile. The CQ function can be written as $Q_\theta(y_i \mid x_i) = x'i\beta_\theta$. As an outcome, the QR estimator $\hat{\beta}_\theta$ may be calculated as the resolution to the preceding minimization problem:

$$\underset{\beta_\theta}{Min}\left\{ \sum_{y_{i\geq x'i\beta_\theta}} \theta \mid (y_i - x'i\beta_\theta) \mid + \sum_{y_{i<x'i\beta_\theta}} 1-\theta \mid (y_i - x'i\beta_\theta) \mid \right\} \qquad (5)$$

This research looks at nine QRs at the tenth, twentieth, thirty-first, fortieth, fortieth, fifty-first, sixty-first, seventieth, eightieth, and ninetieth Q. To generate a reliable estimate of the covariance matrix, it is imperative to use design matrix bootstrap estimation. (Variyam et al., 2002). QR is computed using this approach, which uses a random sample of N observations with supplementation from the initial sample. In this investigation, this approach was used a thousand times to generate bootstrap estimations.

Furthermore, an IQR is used in the study to determine the influence of the regressors on going from one quantile to the other. Consider the kth and mth Qs of a QR.

$$Q_K = \alpha_K + \beta_{1K}x_1 + \beta_{2k}x_2 + \beta_{jk}x_j + \mu_k \qquad (6)$$

$$Q_m = \alpha_m + \beta_{1m}x_1 + \beta_{2m}x_2 + \beta_{jm}x_j + \mu_m \qquad (7)$$

Then IQRs can be found

$$Q_K - Q_m = \alpha_K - \alpha_m + \beta_{1K}x_1 - \beta_{1m}x_1 + \beta_{2k}x_2 - \beta_{2m}x_2 + \beta_{jk}x_j - \beta_{jm}x_j + \mu_k - \mu_m \qquad (8)$$

The computed parameters demonstrate the diversity in family traits between Qs.

The technical model is as follows:

$$\frac{l}{k} = \alpha + \beta_1 land_5 + \beta_2 land_{10} + \beta_3 land_{11} + \beta_4 lvst + X_i + e_i \qquad (9)$$

The predictor and predictand are shown and synthesized the below table 1.

Results and Discussion

Food insecurity is a major obstacle to developing nations such as Pakistan. It is an agro-based- based economy, with agribusiness accounting for around 19.82 percent of GDP and employing 42.3 percent of the working force. Approximately 62 percent of the overall population is directly or indirectly dependent on this industry (Pakistan Economic Survey,

2017-18). It is the 26th biggest economy on the globe and delivers numerous primary products, yet it is at the same time has about 39.6% populace food insecure (Organization, 2014). So, an analysis of the condition of food insecurity and its factors within Pakistan is required. Estimates of all indices of the insecurity of food are presented in this section.

Incidence, depth, and severity of food insecurity

Generally, food insecurity prevails when there is a dearth of both economic and physical food access that must be adequate, harmless, and healthy for a dynamic and healthy life. Results show that at the national level, 28.28% of households of the studied population are food insecure. A higher prevalence of food insecurity is observed in Agricultural households (28.62 %) in contrast to non-rural communities (27.51). This may be because there are fewer opportunities in rural locations for income-earning as compared to metropolitan regions. These outcomes are congruent with those of the following studies (Cheema and Abbas, 2016; Bashir et al., 2010; Asghar, 2011). Further, results depict that there is a 5.46 % food insecurity gap in Pakistan. On a local basis, the household food security deficit is wider in agricultural regions (5.58 percent) as compared to urban communities (5.25 percent). Compared with the results of (Cheema and Abbas, 2016), the study has found that the food insecurity gap is reducing in Pakistan. As far as the squared food insecurity gap is concerned, it is 1.59 % among food-insecure households in the studied area. Food insecurity severity is also observed to be wider in traditional regions (1.62 %) than in urban ones (1.53 %).

Role of the Ownership of Agricultural Land and Livestock on Food Insecurity

Insecurity of food is one of the serious problems in a developing country like Pakistan. Thus, it is necessary to find the factors that may render a family to be food sufficient or food poor. This study estimates the role of agricultural land and livestock ownership in the reduction of food insecurity, using the cross-sectional data- the PSLM survey 2013-14.

Table 2: Descriptive Statistics

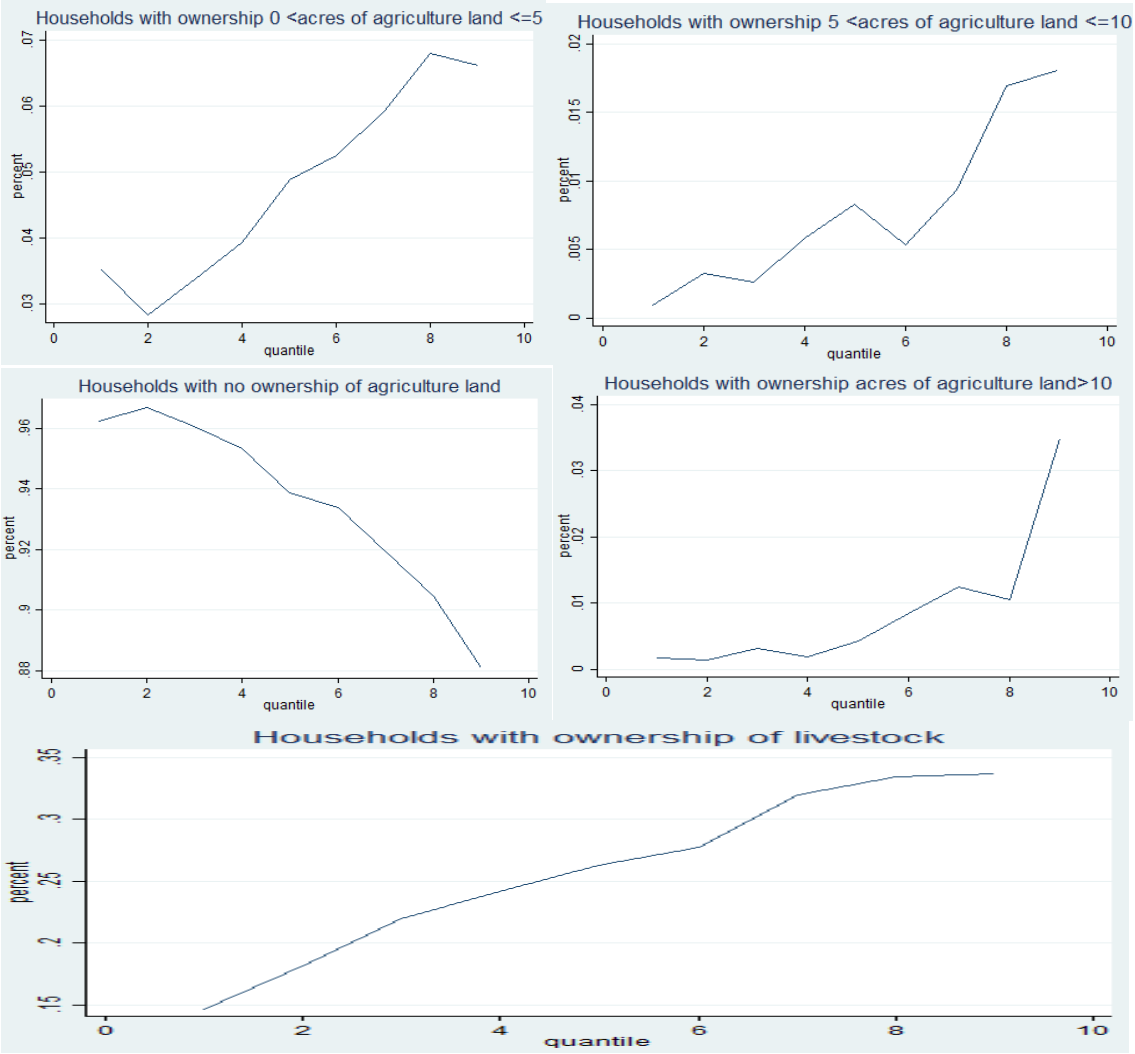
	Mean	10th	20th	30th	40th	50th	60th	70th	80th	90th
fsr	1.5	0.70	0.91	1.06	1.19	1.33	1.48	1.69	2.01	3.14
Land0*	0.9	0.96	0.97	0.96	0.95	0.93	0.94	0.92	0.91	0.89
Land5*	0.05	0.03	.025	0.03	0.04	0.05	0.05	0.06	0.07	0.07
Land10*	0.01	0.00	0.00	0.003	0.01	0.01	0.01	0.008	0.02	0.01
Land11*	0.01	0.00	0.00	0.004	0.01	0.01	0.01	0.012	0.014	0.033
Livestock*	0.25	0.126	0.17	0.201	0.22	0.26	0.27	0.317	0.33	0.33
Edu0*	0.44	0.579	0.55	0.525	0.49	0.44	0.45	0.38	0.36	0.27
Edu1*	0.05	0.06	0.06	0.051	0.05	0.05	0.05	0.048	0.04	0.038
Edu2*	0.14	0.15	0.15	0.135	0.15	0.16	0.14	0.146	0.13	0.11
Edu3*	0.09	0.08	0.08	0.085	0.09	0.09	0.09	0.104	0.08	0.10
Edu4*	0.13	0.08	0.11	0.12	0.12	0.14	0.14	0.153	0.16	0.15
Edu5*	0.14	0.04	0.06	0.087	0.09	0.11	0.13	0.166	0.22	0.33
Agehh*	45.3	44.7	44.5	44.69	45.7	45.2	45.8	45.24	45.9	46.7
hhsize	6.62	8.64	7.69	7.31	7.07	6.75	6.32	5.87	5.38	4.49
Punjab	0.42	0.21	0.41	0.38	0.37	0.39	0.38	0.412	0.45	0.53
Sindh	0.29	0.12	0.27	0.30	0.31	0.31	0.34	0.34	0.29	0.23
kpk	0.19	0.13	0.18	0.21	0.22	0.21	0.20	0.19	0.21	0.20
bal	0.09	0.20	0.13	0.11	0.10	0.08	0.07	0.05	0.04	0.03
urban	0.35	0.32	0.31	0.32	0.34	0.33	0.34	0.35	0.36	0.45
rural	0.65	0.68	0.68	0.68	0.66	0.67	0.67	0.64	0.64	0.55
Observations	17,9	1999	1998	1998	1,999	1,998	1,998	1,999	1,998	1,998

Fsr=food security ratio,hhsize=household size, kpk=Khybepakhtoo khawa, bal=Baluchistan
*These variables have been explained in table1,

Source: Authors' own calculations

Table 2 shows the descriptive analysis for the variables employed in the research. The observations are stable across the quantiles. Households with the highest food security proportion (i.e., 3.13) should be in the top Q. Families in the 10th Q, from the other side, had food and nutrition security proportions of only 0.70. As we progress from the poorest to the richest Q, the percentage of families that do not own land decreases. The percentage of families that do not own land has a concave appearance, whereas the same with greater than 0 and less than or equal to 5 acres of land is having a positive slope see figure 1. The percentage of households with ownership of greater than 5 acres of land increases almost at an increasing rate. The percentage of households with ownership of livestock increases at a decreasing rate (see figure 1). The non-linear connection between the food security ratio and the explanatory factors is reflected in the pattern of the variables.

Figure-1



This study employs the Multiple Ordinary Least Square regression and QR in Pakistan. The results are given in Table3.

Table 3: Role of Ownership of Land and Livestock on Food Insecurity

	Ols	.10	.20	.30	.40	.50	.60	.70	.80	.90
land5	0.093	0.069	0.106	0.128	0.141	0.135	0.125	0.109	0.123	0.124
	(4.07)**	(3.75)**	(5.08)**	(6.84)**	(6.59)**	(7.75)**	(6.50)**	(3.91)**	(3.26)**	(2.74)**
land10	0.274	0.168	0.236	0.260	0.209	0.224	0.244	0.213	0.281	0.350
	(3.74)**	(3.08)**	(4.06)**	(5.78)**	(5.12)**	(3.17)**	(3.98)**	(2.35)*	(2.50)*	(2.18)*
land11	0.691	0.291	0.413	0.412	0.397	0.484	0.597	0.666	0.842	1.463
	(7.83)**	(3.77)**	(6.78)**	(9.45)**	(7.63)**	(5.62)**	(6.20)**	(7.34)**	(3.28)**	(6.41)**
Livestock	0.432	0.222	0.259	0.287	0.329	0.369	0.406	0.454	0.498	0.535
	(23.93)**	(21.69)**	(28.67)**	(30.60)**	(32.81)**	(33.93)**	(34.25)**	(30.26)**	(26.36)**	(23.33)**
edu1	0.084	0.027	0.052	0.072	0.069	0.082	0.064	0.087	0.091	0.097
	(3.96)**	(1.48)	(2.63)**	(4.75)**	(4.03)**	(5.21)**	(3.23)**	(4.07)**	(3.33)**	(2.38)*
edu2	0.109	0.047	0.054	0.080	0.088	0.090	0.101	0.102	0.108	0.146
	(8.00)**	(4.52)**	(5.92)**	(7.75)**	(8.72)**	(8.51)**	(7.56)**	(6.90)**	(6.09)**	(5.23)**
edu3	0.167	0.091	0.106	0.127	0.126	0.119	0.135	0.151	0.203	0.271
	(9.82)**	(7.13)**	(9.92)**	(9.64)**	(10.25)**	(8.84)**	(7.76)**	(8.66)**	(7.11)**	(6.27)**
edu4	0.259	0.129	0.143	0.180	0.183	0.199	0.220	0.247	0.276	0.326
	(14.28)**	(11.26)**	(11.48)**	(14.93)**	(15.53)**	(14.23)**	(14.32)**	(12.77)**	(11.11)**	(9.73)**
edu5	0.623	0.247	0.309	0.353	0.408	0.470	0.536	0.611	0.719	0.952
	(28.27)**	(16.67)**	(21.47)**	(24.48)**	(26.08)**	(26.38)**	(30.02)**	(32.16)**	(19.66)**	(16.25)**
Lagehh	0.316	0.149	0.179	0.216	0.239	0.252	0.277	0.326	0.357	0.448
	(13.10)**	(10.83)**	(14.29)**	(17.25)**	(18.22)**	(18.87)**	(17.57)**	(18.99)**	(13.16)**	(14.86)**
Lhhsize	-0.737	-0.340	-0.394	-0.447	-0.502	-0.539	-0.595	-0.661	-0.745	-0.893
	(32.04)**	(31.98)**	(43.89)**	(43.68)**	(50.92)**	(49.82)**	(47.30)**	(52.73)**	(46.16)**	(35.04)**
Punjab	0.030	0.003	0.002	-0.001	0.016	0.027	0.037	0.071	0.069	0.125
	(1.29)	(0.25)	(0.14)	(0.10)	(1.30)	(1.82)	(2.57)*	(4.43)**	(2.71)**	(3.74)**
Sindh	0.032	0.114	0.111	0.098	0.087	0.079	0.061	0.048	0.012	-0.019
	(1.45)	(8.60)**	(9.18)**	(8.34)**	(7.37)**	(5.50)**	(4.38)**	(3.33)**	(0.51)	(0.73)
Kpk	0.188	0.143	0.146	0.145	0.160	0.170	0.177	0.190	0.190	0.225
	(6.74)**	(10.73)**	(11.55)**	(10.99)**	(11.65)**	(10.87)**	(11.59)**	(11.47)**	(7.45)**	(7.54)**
Urban	0.120	0.045	0.058	0.055	0.064	0.080	0.085	0.092	0.116	0.104
	(9.56)**	(4.99)**	(7.07)**	(6.75)**	(7.42)**	(8.96)**	(7.63)**	(7.56)**	(7.10)**	(3.73)**
Constant	1.237	0.747	0.842	0.882	0.974	1.066	1.172	1.204	1.396	1.565
	(13.01)**	(14.71)**	(18.34)**	(19.01)**	(20.38)**	(21.70)**	(19.84)**	(19.29)**	(15.30)**	(14.15)**
Observations	17985	17985	17985	17985	17985	17985	17985	17985	17985	17985

z statistics in parentheses
* significant at 5%; ** significant at 1%

The OLS regression findings indicate that the coefficients for varying acres ownership have a positive and substantial influence on the security of food. These results seem congruent with the predictions of the reviewed literature (Kumba, 2015; Lee, 2011; Mahmood et al., 2016; Najafi, 2003). As far as livestock is concerned; it also has positive impacts on food security. These results are in line with those of the following studies (Ali and Khan (2013) Bashir and Schilizzi (2013) Cheema and Abbas (2016) Haile et al. (2005) Regmi and Paudel (2017).

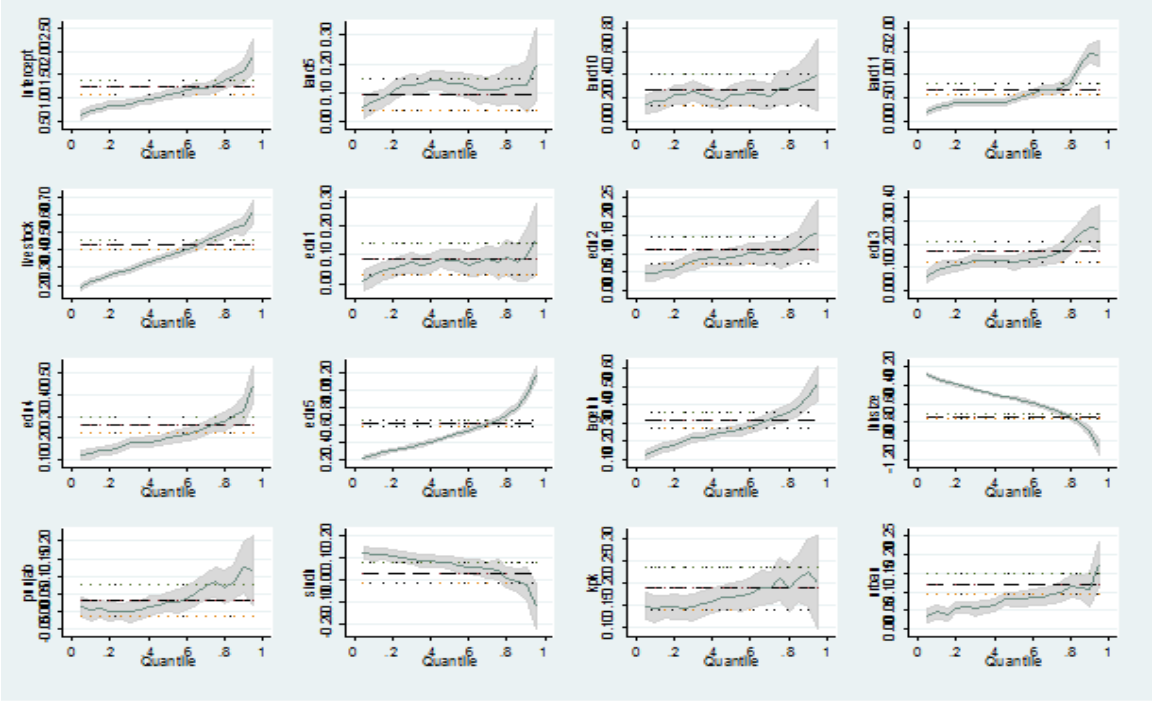
All of the control variables and regional dummies have expected signs. Education has positive effects on food security. The findings of the following research are compatible with the findings of De Marco and Thorburn (2008); (Olabiyi and McIntyre, 2014; Regmi and Paudel, 2017; Woertz, 2017). The family head's age also has a positive and significant

effect on the security of food. The findings are in line with those of Arene and Anyaeji (2010); Bashir et al. (2012); Cheema and Abbas (2016); Zhou et al. (2017) and contrast with Regmi and Paudel (2017) who concluded that a reduction in family heads' age will boost family food security. In the population they investigated, the family head worked as a farmer or laborer. Because they were uneducated, their ages did not improve their work experience, which may cause a greater food security issue. Food security suffers as a result of the consequences of family growth. These findings are congruent with the findings of the following research (Cheema and Abbas, 2016).

The heteroscedasticity test, especially the Breusch-Pagan test, shows that there is heteroscedasticity in the data. The presence of heteroscedasticity violates a few of the underlying principles of the OLS Regression analysis, which is that the residuals are uniformly scattered. As a result, the OLS regression coefficients are inefficient. Furthermore, for the estimation of the coefficients, The QR does not imply that errors be uniformly distributed and permits them to differ for different subgroups of the dataset. Data with endogeneity may not accurately reflect the behavior of households experiencing various degrees of food security. When compared to OLS regression, quantile estimates enhance estimator efficiency and allow for the analysis of independently different families.

Table 3 presents that there are disparities in family behavior that might not have been seen if researchers merely looked at the OLS regression findings. Agricultural land ownership has statistically significantly favorably effects on the security of food. Furthermore, as with the number of acres held rises, so do the magnitudes of the coefficients. One notable finding in the variations of the coefficients of different numbers of acres is that the magnitudes of the coefficients of 11 and more acres of land continue to rise as the percentile increases. When compared to not owning property, this number of acres affects the lowest quantile by 0.29 units and the highest quantile by 1.46 units. This demonstrates that a bigger number of acres have a greater impact on households with a greater rate of food security than on families with lower levels of food security Likewise, for all quantiles except the 50th to 80th, the coefficients diverge appreciably from the OLS parameter estimates.

Figure-2



The 95 percent confidence range for QR calculations is depicted in Figure 2 for the 10th to 40th quantiles is lower than OLS regression coefficients, whereas the confidence zone for quantile coefficients for the 80th and higher quantiles is higher than the OLS regression estimates. In terms of the difference in the magnitudes of the coefficients of 11 or more acres of land, When the gap between quantiles is 30 (that is, between the 30th -60th quantiles, and so on), or greater, it is economically meaningful see table 4.

Table 4: Role of Ownership of Agricultural Land and Livestock on Food Insecurity

	.10 - .20	.20 - .30	.30 - .40	.40 - .50	.50 - .60	.60 - .70	.70 - .80	.80 - .90	.10-.90	.20-.40	.40-.60	.60-.80	.20-.80	.30-.60	.60-.90	.30-.90
land5	0.037	0.022	0.013	-0.006	-0.010	-0.016	0.014	0.001	0.055	0.034	-0.016	-0.002	0.017	-0.003	-0.001	-0.004
	(2.16)*	(1.42)	(0.98)	(0.49)	(0.79)	(0.92)	(0.57)	(0.03)	(1.09)	(1.79)	(0.94)	(0.06)	(0.43)	(0.16)	(0.01)	(0.08)
land10	0.068	0.024	-0.051	0.015	0.020	-0.031	0.068	0.069	0.182	-0.027	0.035	0.037	0.045	-0.016	0.106	0.090
	(1.45)	(0.62)	(1.64)	(0.34)	(0.47)	(0.52)	(0.88)	(0.53)	(1.08)	(0.58)	(0.74)	(0.41)	(0.39)	(0.30)	(0.71)	(0.55)
land11	0.122	-0.000	-0.015	0.087	0.112	0.070	0.176	0.621	1.172	-0.016	0.200	0.246	0.430	0.184	0.867	1.051
	(1.92)	(0.01)	(0.44)	(1.53)	(1.89)	(1.10)	(0.90)	(2.77)**	(4.40)**	(0.29)	(2.65)**	(1.16)	(1.75)	(2.18)*	(3.97)**	(4.36)**
livestock	0.037	0.028	0.042	0.040	0.037	0.048	0.045	0.037	0.313	0.070	0.077	0.092	0.239	0.119	0.129	0.248
	(4.35)**	(4.20)**	(6.64)**	(6.28)**	(4.82)**	(5.13)**	(3.59)**	(2.01)*	(12.47)**	(8.13)**	(7.87)**	(6.27)**	(13.20)**	(10.95)**	(6.13)**	(10.57)**

edu1	0.025	0.019	-0.003	0.013	-0.017	0.023	0.004	0.006	0.069	0.016	-0.004	0.027	0.039	-0.007	0.032	0.025
	(1.53)	(1.45)	(0.28)	(1.22)	(1.36)	(1.58)	(0.20)	(0.17)	(1.69)	(0.98)	(0.27)	(1.15)	(1.29)	(0.41)	(0.88)	(0.63)
edu2	0.007	0.026	0.008	0.002	0.011	0.001	0.006	0.038	0.099	0.034	0.013	0.008	0.054	0.020	0.046	0.066
	(0.85)	(3.47)**	(1.13)	(0.33)	(1.32)	(0.14)	(0.49)	(1.83)	(3.34)**	(3.78)**	(1.19)	(0.48)	(2.84)**	(1.72)	(1.73)	(2.49)*
edu3	0.015	0.021	-0.001	-0.006	0.016	0.016	0.052	0.068	0.180	0.020	0.009	0.068	0.097	0.008	0.136	0.144
	(1.49)	(2.54)*	(0.16)	(0.73)	(1.44)	(1.33)	(2.77)**	(2.07)*	(4.10)**	(1.95)	(0.73)	(3.18)**	(3.60)**	(0.51)	(3.28)**	(3.41)**
edu4	0.014	0.037	0.004	0.016	0.020	0.027	0.029	0.050	0.197	0.041	0.036	0.056	0.133	0.040	0.106	0.146
	(1.33)	(4.46)**	(0.45)	(1.90)	(2.19)*	(2.26)*	(1.78)	(1.99)*	(5.95)**	(3.88)**	(3.21)**	(2.93)**	(5.48)**	(3.02)**	(3.51)**	(4.48)**
edu5	0.062	0.044	0.055	0.063	0.066	0.075	0.108	0.233	0.705	0.098	0.129	0.183	0.410	0.183	0.416	0.599
	(5.14)**	(4.42)**	(5.40)**	(5.99)**	(5.76)**	(5.95)**	(4.13)**	(5.08)**	(11.63)**	(7.50)**	(8.96)**	(6.22)**	(11.54)**	(11.50)**	(7.69)**	(9.96)**
lageh	0.029	0.038	0.023	0.014	0.025	0.049	0.030	0.091	0.299	0.060	0.038	0.080	0.178	0.061	0.171	0.232
h	(2.68)**	(4.29)**	(2.63)**	(1.51)	(2.57)*	(4.41)**	(1.72)	(3.91)**	(9.31)**	(5.19)**	(3.05)**	(3.74)**	(7.03)**	(4.56)**	(6.24)**	(7.73)**
lhhsi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ze	0.054	0.052	0.056	0.037	0.056	0.066	0.084	0.148	0.553	0.108	0.092	0.150	0.351	0.148	0.298	0.447
	(6.82)**	(7.55)**	(8.93)**	(5.68)**	(8.43)**	(8.48)**	(8.39)**	(8.30)**	(22.58)**	(13.55)**	(10.51)**	(12.23)**	(21.17)**	(13.99)**	(13.58)**	(18.85)**
punja	-	-	0.017	0.011	0.010	0.034	-0.002	0.056	0.122	0.014	0.021	0.032	0.068	0.038	0.088	0.127
b	0.001	0.003														
	(0.13)	(0.34)	(2.22)*	(1.22)	(1.04)	(3.25)**	(0.10)	(2.07)*	(3.50)**	(1.42)	(1.80)	(1.63)	(2.75)**	(2.80)**	(2.86)**	(3.70)**
sindh	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0.002	0.014	0.011	0.008	0.019	0.012	0.036	0.031	0.133	0.024	0.026	0.049	0.099	0.037	0.080	0.117
	(0.21)	(1.63)	(1.34)	(0.85)	(2.06)*	(1.32)	(2.23)*	(1.48)	(4.69)**	(2.28)*	(2.32)*	(2.47)*	(4.40)**	(2.80)**	(3.46)**	(4.62)**
kpk	0.003	-0.001	0.014	0.010	0.008	0.013	0.001	0.034	0.082	0.013	0.017	0.013	0.044	0.032	0.047	0.079
	(0.30)	(0.11)	(1.65)	(1.05)	(0.77)	(1.15)	(0.04)	(1.38)	(2.62)**	(1.16)	(1.37)	(0.62)	(1.70)	(2.21)*	(1.70)	(2.63)**
urban	0.012	-0.003	0.009	0.016	0.005	0.007	0.024	-0.012	0.059	0.007	0.021	0.031	0.058	0.030	0.019	0.049
	(1.76)	(0.46)	(1.73)	(2.77)**	(0.69)	(0.92)	(2.03)*	(0.54)	(2.16)*	(0.89)	(2.50)*	(2.38)*	(3.44)**	(3.08)**	(0.74)	(1.82)

Constant	0.096 (2.36)*	0.040 (1.23)	0.092 (2.84)**	0.091 (2.75)**	0.106 (2.94)**	0.033 (0.79)	0.192 (3.17)**	0.169 (1.95)	0.818 (6.98)**	0.132 (3.10)**	0.197 (4.21)**	0.224 (3.08)**	0.554 (6.34)**	0.290 (5.65)**	0.393 (3.85)**	0.683 (6.21)**
Observations	17985	17985	17985	17985	17985	17985	17985	17985	17985	17985	17985	17985	17985	17985	17985	17985

t statistics in parentheses
* significant at 5%; ** significant at 1%

When it comes to livestock, its coefficient varies depending on the quantile. Its magnitude grows as we progress from the lowest to the greatest quantile. It has a 0.22-unit effect on the lowest quantile and a 0.53-unit effect on the highest quantile when compared to individuals who do not have it. This demonstrates that its impact is greater for people experiencing greater amounts of security of food than those with lower stages of food stability Likewise, apart from the 5th and 70th quantiles, the estimates for all quantiles deviate from the OLS model coefficients. Figure 2 demonstrates that the 95 percent confidence zone for QR results in the 10th to 40th quantiles is lower than the OLS regression estimates, while the confidence interval for quantile estimators in the 80th and 90th quantiles is greater, however the confidence margin for quantile findings for the 80th and 90th Q is wider than the OLS analysis values. In terms of the orders of the intensity of the livestock coefficients, It is statistically meaningful across all Qs whether the gap is 10 (between the 10th -20th Qs and so on), 20 (between the 20th -40th Qs, and so on), 30 (between both the 30th-60th Qs and so on), or wider (between the 10th-80th quantiles, 20th -80th Qs, see table 4.

As far as the control variables (like level of education, age, and household size) are concerned, they are also having their slope coefficients different across the quantiles. The age and education are affecting the food insecurity favorable, whereas the household size adversely. In terms of the magnitude differences of the coefficients of all three variables, they are significant statistically mutually constitutive quantiles, yet if the gap is 10 (between the 10th and 20th Qs, for example), 20 (between the 20th and 40th Qs, and so on), or 30 (between the 30th and 60th Qs, and likewise) (that is, 10th- 80th Quantiles, 20th -80th quantiles, or 30th -90th Qs) (in this way, 10th- 80th Quantiles, 20th -80th Qs, or 30th -90th Qs).

This study also finds the role of the above variables on food security using the Calorie Intake approach. The results remain intact. In a nutshell, we may establish that our findings are robust and not compromised by the food insecurity estimating approach. The results are available on request.

CONCLUSION AND POLICY IMPLICATIONS

This research utilized QR analysis to examine the Food security ratio heterogeneity, demonstrating that projection of OLS analysis is not an effective method for determining the factors impacting food security. OLS analysis results understate/exaggerate the influence of predictor variables on food security far beyond QR estimates. Ownership of agricultural land and animals has an economically significant beneficial influence on food security across all quantiles, however, the richer quantiles influence food security larger

than that of poorer quantiles. As a result, this study shows that owning agricultural property, particularly 11 acres or more, is an effective tool for overcoming food poverty. In terms of animal ownership, it has statistically substantial beneficial effects on food security. Our findings are reliable and unaffected by food security measurement techniques (i.e., Food Expenditure and Calorie intake). This research recommends that government should implement land reforms in letter and spirit and at least five acres of land necessary to allocate among the families who are not having land ownership. Livestock should be arranged for poor families.

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