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Original article

Impact of Parental Education and Employment on Households' Food Security in Pakistan: Application of Bayesian Logistic Framework

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Abstract. This study evaluates the role of some important socioeconomic factors including parental education and employment on households' food security in Pakistan using Bayesian logit model. Cross sectional data of 14948 households from national surveys, i.e. HIES 2013-14 (Prior information) and HIICS 2015-16 (Current data), are extracted. Food security status is determined by calculating difference between daily per adult capita calories consumption and requirement for each household. Sample data shows that 58% of the households are food insecure which reveals the worst situation of food security in Pakistan. The model is estimated using Bayesian logistic framework. The study concludes that maternal and paternal paid employment and other parental employment are effective to improve food security status in Pakistan. Adverse impact of dependency ratio also induces creation of employment opportunities, especially for lower class families. However, couple employment shows insignificant impact on food security due to probably time constraints. Agricultural employment seems to be the most effective factor to fulfill calories requirement at household level. Insignificance of maternal as well paternal primary and middle education where as significant positive role of high parental education is observed which may be attributed to awareness of food security through education. It induces policy steps to raise level of education rather than literacy rate. Moreover, the analysis shows that the rural areas compared to urban areas and Baluchistan compared to other provinces are facing the worst conditions of food insecurity. Development of agricultural sector, creation of employment opportunities to control unemployment, raising level of parental education rather than literacy rate and introduction of developmental and social welfare schemes for backward areas are some important guidelines for food security policy of Pakistan in order to chase the Vision 2050 of UNO.

Key words: Households Food Security, Parental employment, Parental education, Bayesian analysis, Pakistan

1. Introduction

Food security is one of the most important agenda points of Millennium Development Goals. The concept of "food security" was introduced in the 1940s and is now widely used in designing humanitarian emergency and development programs. Today, the universal definition of "food security" describes it as a situation where "all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (World Food Security 2012 as per the FAO (1996) [1] . Hence, the core concept of food security means that no individual should be hungry [2-3]. It implies that household acts as a basic economic unit which determines individuals' food consumption. Hence, household, as a basic unit of analysis, may be considered more important than larger

units of analysis. Therefore, the debate around food security issues has evolved from global to national and at household level. Food insecurity is a problem with multiple manifestations and, therefore, the analysis is conducted to determine causes and consequences of food insecurity and the effects of socio-economic and environmental factors. Moreover, sustainable economic development is considered as the base of food safety [4-7]. Food insecurity is directly linked up with health, learning, individual productivity and economic development [8]. Consequently, FAO (2014) [9] emphasizes the need to place food security issues at the top of the political and international research agenda.

Despite efforts to fight poverty and hunger, there are still unacceptable numbers of people having insufficient food needed for an active and healthy life [10-11]. Recent estimates show that about 795 million people in the world (about 10% of the global population) are malnourished. Among these people, 780 million of the malnourished are living in developing countries [10]. About 294.7 million people are food insecure only in South Asia, i.e. 35% of the total undernourished world population [12]. Pakistan, having 210 million population, is facing severe problem of food insecurity as shown by Global Hunger Index 2017 which ranks Pakistan 106 out of 119 countries. World Food Program statistics show that 60% of the population in Pakistan is food insecure. This situation needs to take steps for improving food security at household level. Hence, determination of the factors affecting households' food security may provide an insight into causes and cures for food insecurity issue in Pakistan. Literature contains a number of studies that have analysed the determinants of food security at household level for different regions and countries including Pakistan. These include Feleke *et al.* (2005) for Southern Ethiopia [13]; Omonona *et al.* (2007) for Nigeria [14]; Wangthamrong (2010) for Thailand [15]; Obayelu (2012) for Nigeria [16]; Harris-Fry *et al.* (2015) for Bangladesh [17]; Jodlowski *et al.* (2016) for Zambia [18]; Pauze et al. (2016) for Haiti [19]; and Ogunndari, K. (2017) for Nigeria [20] etc. These and many other studies have documented various socioeconomic and demographic determinants of households' food security for many countries and regions. Most of the studies have documented employment and education of households' head as the important determinants of household food security status.

For the case of Pakistan, most of the published studies regarding food security present analysis of food security at national level by using time series data, e.g. [21-27]. However, some studies contains analysis of the factors affecting households' food security but those studies use data of only some parts of Pakistan see e.g., Farkhanda, et al. (2009) for Faisalabad [28]. Khan *et al.* (2012) for rural households [29], Bashir *et al.* (2012) for rural Punjab [30]; Hussain et al. (2016) for Hindu-Kush region of Pakistan [31]; Amir *et al.* (2013) for northern areas [32] and Zhou *et al.* (2017) for northern areas [33]. To the best of authors' knowledge, only Sultana and Kiani (2011) [34] determines the factors affecting households' food security in Pakistan using PSLM 2007-08 survey data. However, this study did not take into account a number of important factors affecting household food security. Two among the most important such factors are employment and education with paternal and maternal dimensions which are closely linked up with access and utilization dimensions of food security. Moreover, both of these variables may be divided into various categories for more detailed analysis.

Hence, major objective of this study is set to evaluate the impact of some important socioeconomic and demographic factors, especially employment and education with maternal and paternal dimensions, on households' food security in Pakistan. Moreover, most of the econometric studies related to households' food security use logistic regression under classical framework. Bayesian inference is considered an alternative to classical inference. Bayesian inferential approach estimates parameters on the basis of current as well as prior information while assuming parameters of the model as random variables. Hence, another distinct feature of the study compared to the previous studies of food security is the application of Bayesian logistic framework. Rest of the study consists of material and methodology, results and discussion, and policy implications.

2. Material and Methods

To achieve the objectives, material and methodology is explained in the following three sub-sections.

2.1. Theoretical framework and model specification

Specification of model is the first step of an econometric analysis which requires theoretical framework. Households' utility model is taken as the base of theoretical framework for analyzing households' food security on the basis of consumer demand and production theories. Following the pattern of [20, 35,36] general household level reduced form equation for food demand (assuming that households desire to maximize utility) is given as follows.

$$FC_i = FC(P, w, I_i^*(w, L_i^0, K_i^0, N), F_i^O)$$

Here FC_i stands for household level food consumption, P stands for food price as well as non-food items prices. w I_i^*, L_i^0, K_i^0, and represent wages, income of household, fixed land, human and physical capital, and non-labor income respectively. F_i^O represents other factors that are not related to prices but they affect supply and demand of food items at household level [37]. The empirical model is defined within the framework of Eq. 1. Since, the study is conducted using cross-sectional data and, therefore, price vector may be omitted. The reduced-form equation for food security is formulated by considering the following socio-economic and demographic variables as explanatory variables. These explanatory variables include household's income, education, employment, agricultural employment including agricultural land, ethnicity and culture, and some other household characteristics. Income is considered as the major determinant of physical and economic access dimension of food security at household level. Paternal and maternal educational levels (Primary, middle, High) are taken as proxy for human capital [36,38]. Employment determines resources but it may also limit time and, therefore, a number of dummies representing employment including maternal paid employment, paternal paid employment, couple paid employment, other employment and agricultural employment are considered here. Three dummies representing four provinces and the fourth dummy for rural versus urban residence are taken to represent demographic and cultural factors affecting food security. Some households' characteristics such as age, gender, marital status of household head, family size and dependency ratio are included as control variables. Hence, the empirical specification of the reduced form of Eq. 1 without prices vector is given as eq. (2)

$$Y = X\beta + \mu$$

Here Y represents Food security status of the household, 'X' is the vector which contains 20 explanatory variables (X1","X2" , "X3","X4", "X5","X6",……,X20) explained in Table 1. 'β' is the vector of parameters and 'μ' is the error term of the model. Table 1 presents description of all the variables included in the model.

2.2. Data and Construction of variables

Data of all the variables are taken from Households Integrated Income and Consumption Survey (HIICS-2015-16), i.e. a national level household's survey data collected and published by Pakistan Bureau of Statistics, Government of Pakistan. The Survey was conducted by employing two stage stratified sampling scheme where 1668 representative sample blocks were selected from all over Pakistan at first stage. At the second stage, 16 households were selected at random from each block and hence, 24238 households were finally interviewed. However, sample size of the data used by the study is limited to 14948 households due to missing data figures. The survey contains data of 172 food items consumed by the households during the last 30 days. Using Food consumption table for Pakistan [39], per adult capita daily caloric intake and per adult capita daily caloric requirement for each of the household is calculated. Difference of caloric requirement and caloric intake is used to decide food security status of each household. If caloric intake is greater or equal to caloric requirement, then the household is considered as food secure otherwise the household is declared as food insecure. Hence, the dependent variable is binary categorical variable where 57.91% of the sampled households are food insecure.

Table 1. Variables Descriptions

Variables' abbreviation	Variables' Description
Y_i	Food Security status of households as secure=1 and zero otherwise
$X1_i$	Paternal paid employment=1 and zero otherwise, where paternal unemployment is the base category
$X2_i$	Couple paid employment=1 and zero otherwise
$X3_i$	Maternal Paid employment=1 and zero otherwise, where maternal unemployment is the base category
$X4_i$	Other employment (including business) of father or mother or both=1 and zero otherwise where paternal and maternal unemployment is the base category
$X5_i$	Agricultural employment where household having agricultural income=1 and zero otherwise
$X6_i$	Paternal primary education =1 and zero otherwise, where uneducated father is the base category
$X7_i$	Paternal middle education =1 and zero otherwise, where uneducated father is the base category
$X8_i$	Paternal high education =1 and zero otherwise, where uneducated father is the base category
$X9_i$	Maternal primary education =1 and zero otherwise, where uneducated mother is the base category
$X10_i$	Maternal middle education =1 and zero otherwise, where uneducated mother is the base category
$X11_i$	Maternal High education =1 and zero otherwise, where uneducated mother is the base category
$X12_i$	Natural log of Household total income as continuous variable
$X13_i$	Dummy variable representing household' belonging to Punjab province=1 and zero otherwise where province Baluchistan is the base category
$X14_i$	Dummy variable representing household' belonging to Sindh province=1 and zero otherwise where province Baluchistan is the base category
$X15_i$	Dummy variable representing household' belonging to KPK province=1 and zero otherwise where province Baluchistan is the base category
$X16_i$	Residential Status where Urban=1 and Rural=0
$X17_i$	Marital Status of household head where Married=1 and Zero otherwise
$X18_i$	Household Head age in years
$X19_i$	Household size
$X20_i$	Dependency Ratio

2.3. Methodology of analysis

The response variable of the specified model is categorical and, therefore, the model cannot be treated as classical linear regression model. The reason is that error term does not follow normal distribution in the case of binary choice dependent variable. However, cumulative distribution function (c.d.f.) of logistic distribution can be used to get parameters' estimates and probability of the dependent variable by employing maximum likelihood estimation method. Since Y is binary variable and therefore, probabilities of Y under logistic c.d.f. is represented as follows.

In the first step, Likelihood function is derived. Likelihood function for n observations using c.d.f. of logistic distribution is given as follows.

Under classical inferential approach, maximum Likelihood method is employed to get parameters' estimates from the above equation. However, Bayesian inferential approach is the alternative to classical inferential approach in econometrics. Bayesian statistical inference is derived from the Bayes Theorem published

by Thomas Bayes in 1763. Properties of Bayesian procedures in both large and small samples have been developed [40-42]. However, Bayesian econometrics is a later developed branch of econometrics [43-44]. Bayesian estimates bases on the idea that model's parameters are random variables and hence, their posterior distribution is derived by merging prior knowledge about parameters with the information contained in the sample data. The posterior distribution is then used for statistical inference. Details of Bayesian logistic framework [45]

Bayesian inference requires derivation of likelihood and prior densities for parameters to derive posterior distribution of the parameters. Likelihood function for Bayesian logistic regression is given as Equation (5). Choice of the prior distribution for Bayesian analysis depends upon the nature and the range of the parameter(s) in model. In Bayesian econometrics, normal prior for unknown parameters of the regression model is extensively used and normal distribution has strong theoretical grounds to be used as Prior in Bayesian Econometric Models. Hence, it is assumed that each of the parameter of the specified model is independently normally distributed with its

$$P(Y = 1/X) = P = F(X\beta) = \frac{e^Y}{1+e^Y} = \frac{e^{X\beta}}{1+e^{X\beta}}$$

$$P(Y = 0/X) = 1 - P = 1 - F(X\beta) = 1 - \frac{e^Y}{1+e^Y} = 1 - \frac{e^{X\beta}}{1+e^{X\beta}}$$

own prior mean and prior variance. i.e.

Then the Joint Posterior Distribution is defined as:

$$L(\beta/Y) = \Pi_{i=1}^{n}\left[\left(\frac{(e^{X\beta})}{(1+e^{X\beta})}\right)^{Y_i} \times \left(1 - \frac{(e^{X\beta})}{(1+e^{X\beta})}\right)^{1-Y_i}\right]$$

Hence, Posterior distribution is derived by multiplying the likelihood function with prior density. In the case of logit model, normal priors are not conjugate priors [47] and, hence, the Joint Posterior Distribution for all the parameters is given below:

3. Results and Discussion

The specified model as equation (2) is estimated as a logit model using Bayesian econometric approach. The posterior density derived as equation (8) using independent normal priors for parameters is used to get posterior estimates. In the first step, we require parameters' estimates of prior density. Data of HIES 2013-14 is considered as the prior information. Data of all the variables considered by the study are extracted from HIES 2013-14 to be used as prior information and the specified model is estimated as logit model by employing maximum likelihood method under classical framework to the likelihood function derived as equation (5). From the estimated model, significant mean estimates along with their estimated variances are taken as the prior estimates of the parameters. We assume that the insignificant parameters of the estimated model have no prior information and hence are assumed to follow standard normal distribution with zero means and unit variances. All the prior estimates are given in Table 2. Using these prior estimates, MCMC simulations using Gibbs sampling algorithm are conducted to the posterior density de-

$$p(\beta_j) = \left[\prod_{i=1}^{n} \frac{1}{\sqrt{2\pi}\delta_j} e - 1/2\left(\frac{\beta_j - \mu_j}{\delta_j}\right)\right] ; j = 0,1,2,3, \ldots \ldots, 20$$

rived as equation (8) to get Bayesian estimates. For this purpose, R2Winbugs package is run in R and

$$p(\beta \setminus Y, X) \propto L(\beta/Y) \times p(\beta)$$

Winbugs together where 100000 MCMC simulations with 20000 initial burn periods and 5 thinning intervals are conducted. Posterior mean estimates of the parameters along with their standard deviations, Highest Posterior Density intervals and odds ratios are taken which are given in Table 2. Various diagnostic tests are

$$p(\beta \setminus Y, X) = \prod_{i}^{n}\left[\left(\frac{(e^{X\beta})}{(1+e^{X\beta})}\right)^{Y_i} \times \left(1 - \frac{(e^{X\beta})}{(1+e^{X\beta})}\right)^{1-Y_i}\right] \times \left[\prod_{i=1}^{n} \frac{1}{\sqrt{2\pi}\delta_j} e - 1/2\left(\frac{\beta_j - \mu_j}{\delta_j}\right)\right]$$

employed to establish validity of the estimated model. Trace plots presented as Figure 1 show convergence of all estimates. Autocorrelation plots in Figure 2 show independence of the MCMC samples of all parameters and there is no problem of autocorrelation. All density plots presented as Figure 3 show normality of the parameters. Some other diagnostic tests are presented in Table 3. Null hypotheses of stationarity under Heidelberger-Welch test statistic are accepted on the basis of P values given in Table 3. It also establishes

convergence of all the parameters under the chain. All estimates of Raftery-Lewis test statistics are greater than '1' which implies that the Markov Chain sample is sufficient to achieve the desired accuracy. Geweke Z scores for all the parameters lies within the interval (-19.6, +19.6). It may be concluded that all diagnostic tests establish validity of the posterior mean estimates and hence, the estimated model may be used to evaluate the phenomenon under consideration. Significant positive coefficient estimates and odds ratios greater than one indicate that the household is likely to lie in food secure category than food insecure category.

Results given in Table 2 shows that coefficient estimate of income is significant with positive sign which indicates that rising income improves households' food security. Odds ratio of income is 1.22 which shows that 1% increase of income raises 0.22 probability of a household to be lying in food secure category. Literature supports close positive link between income and food security because rising income of households improves food security by raising their resources for food expenditure. Hence, any step that leads to a rise in households' income makes improvement in food security. Parental employment generate income which is expected to improve food security at household level. However, the impact may varies due to different types of employment. The results show that paternal and maternal paid employment are playing significant positive role to improve food security at household level and hence, households with paternal or maternal paid employment are more likely to be food secure than the households with unemployed parents. However, coefficient estimate of couple employment is insignificant due to the reason that it carries adverse impact of limiting time for women. Other parental employment is significant with positive impact which shows that the households with employed parents are more likely to be food secure compared to the households with unemployed parents. Agricultural sector is the most important sector for improving food security by improving physical and economic access dimensions. Estimate of households' with agricultural employment indicates strong positive impact on food security. Odds ratios show that a household involve in agricultural activities

Table 2. Estimation Results of logit Regression Models

Variables	**Parameters' Description**	**Prior Mean Estimates and [variance]**	**Posterior mean Estimates [S.D]**	**Odds Ratio**	**(95% HPD Interval)**
Intercept	a	0 [1]	-2.081 [0.328059]	0.12481	(1.434; 2.726)
Paternal paid Employment	b_1	0 [1]	0.093 [0.042906]	1.09746	(0.00944; 0.1784)
Couple paid employment	b_2	-0.1316 [0.001165]	0.07080 [0.117846]	1.07337	(-0.15060; 0.30210)
Maternal paid employment	b_3	0.11390 [0.000594]	0.1077 [0.096752]	1.12064	(0.07596; 0.30110)
Other employment	b_4	0 [1]	0.004353 [0.062690]	1.00436	(0.11670;0.12820)
Agricultural employment	b_5	0.5203 [0.000565]	0.48870 [0.074556]	1.63020	(0.34090; 0.63500)
Paternal primary education	b_6	0 [1]	0.03422 [0.067774]	1.03481	(-0.098; 0.16630)

(continued)

Paternal middle education	b_7	0.2104 [0.00142]	0.08370 [0.068507]	1.08730	(-0.05010; 0.21990)
Paternal high education	b_8	0.1608 [0.000859]	0.35220 [0.116947]	1.42219	(0.1240; 0.5818)
Maternal primary education	b_9	0.1735 [0.001504]	-0.07283 [0.047007]	0.92976	(-0.1643; 0.02123)
Maternal middle education	b_{10}	0.2058 [0.001205]	0.02059 [0.050922]	1.02080	(-0.07809; 0.1220)
Maternal High education	b_{11}	0.1734 [0.000453]	0.20940 [0.141973]	1.23294	(0.06842; 0.4905)
Household total income	b_{12}	0.283 [0.000961]	0.20110 [0.065108]	1.22275	(0.07127; 0.3287)
household' belonging to Punjab	b_{13}	0 [1]	0.67670 [0.069495]	1.96737	(0.5447; 0.8146)
household' belonging to Sind	b_{14}	0 [1]	0.31430 [0.072136]	1.36930	(0.1749; 0.4579)
household' belonging to KPK	b_{15}	0 [1]	0.72520 [0.073539]	2.06514	(0.5830; 0.8709)
Residential Status	b_{16}	0.321 [0.000961]	0.84130 [0.043887]	2.31938	(0.7555; 0.9279)
Marital Status of Head	b_{17}	0 [1]	-0.14140 [0.064044]	0.86814	(-0.2654; 0.01765)
Household Head age	b_{18}	0.0029 [0.0000018]	0.00187 [0.001650]	1.00187	(-0.0014; 0.005079)
Household size	b_{19}	0 [1]	-0.00628 [0.007012]	0.99374	(-0.02008; 0.00760)
Dependency Ratio	b_{20}	0 [1]	-0.22910 [0.089430]	0.79525	(-0.5574; -0.4026)
Deviance Goodness of Fit		3896.499 (0.1526)	19480		(19470; 19490)

compared to other households is 1.63 times likely to lie in food secure category. It indicates that agricultural employment is playing vital role for achieving food security at household level in Pakistan because it carries two types of beneficial effects for food security i.e. direct source of food items and indirect source of income for households. The households operating agricultural land or having livestock utilize their livestock and crops to increase calories that lead them to food secure category. Hence, growth of agricultural sector may be considered as a vital factor for improving food security in Pakistan.

Human capital represented by parental education is considered an important factor for achieving SDG's

Table 3. Results of Diagnostic Tests of Bayesian logit Regression estimates

Parameters' Description	Raftery-Lewis Diagnostics	Geweke Z Score	Heidelberger Welch test (P Value)
a	17.300	-0.75932	(0.1694)
b1	1.010	0.97724	(0.2095)
b2	1.030	0.29727	(0.4763)
b3	1.000	0.02491	(0.3196)
b4	1.080	1.43434	(0.5116)
b5	1.001	-0.55814	(0.8107)
b6	1.150	0.48108	(0.2829)
b7	1.200	-0.79243	(0.1663)
b8	1.110	-1.41983	(0.1491)
b9	1.010	0.18011	(0.9315)
b10	1.004	-0.81817	(0.5116)
b11	1.001	-0.28514	(0.1672)
b12	2.750	0.80244	(0.3652)
b13	2.070	-0.02998	(0.9006)
b14	1.170	0.27970	(0.9238)
b15	1.200	0.17602	(0.9710)
b16	1.020	1.34884	(0.1029)
b17	1.290	-0.17992	(0.8592)
b18	1.590	-0.77338	(0.2005)
b19	1.100	1.23232	(0.1798)
b20	1.080	0.41648	(0.1594)

including food safety. Table 2 shows that coefficients' estimates of maternal as well as paternal primary and middle education are insignificant but the estimates of parental higher education are significant. Odds ratios show that a household with higher educated father compared to uneducated father is 1.42 times more likely to lie in food secure category where as a household with higher educated mother compared to uneducated mother is 1.22 times more likely to lie in food secure category. It indicates that higher education is playing significant positive role for improving food security at household level in Pakistan. It is because parental higher level of education is helpful to improve allocation and distribution of resources which raises marginal productivity [46]. Parental level of education is directly related to awareness which positively affects food security of households. It induces that raising level of parental education may be helpful to improve households' food security by improving access and utilization dimensions.

Significant and positive coefficient estimates of the three demographic and cultural dummies representing provinces i.e. Punjab, Sind and KPK reveal that households residing in the three provinces are likely to be

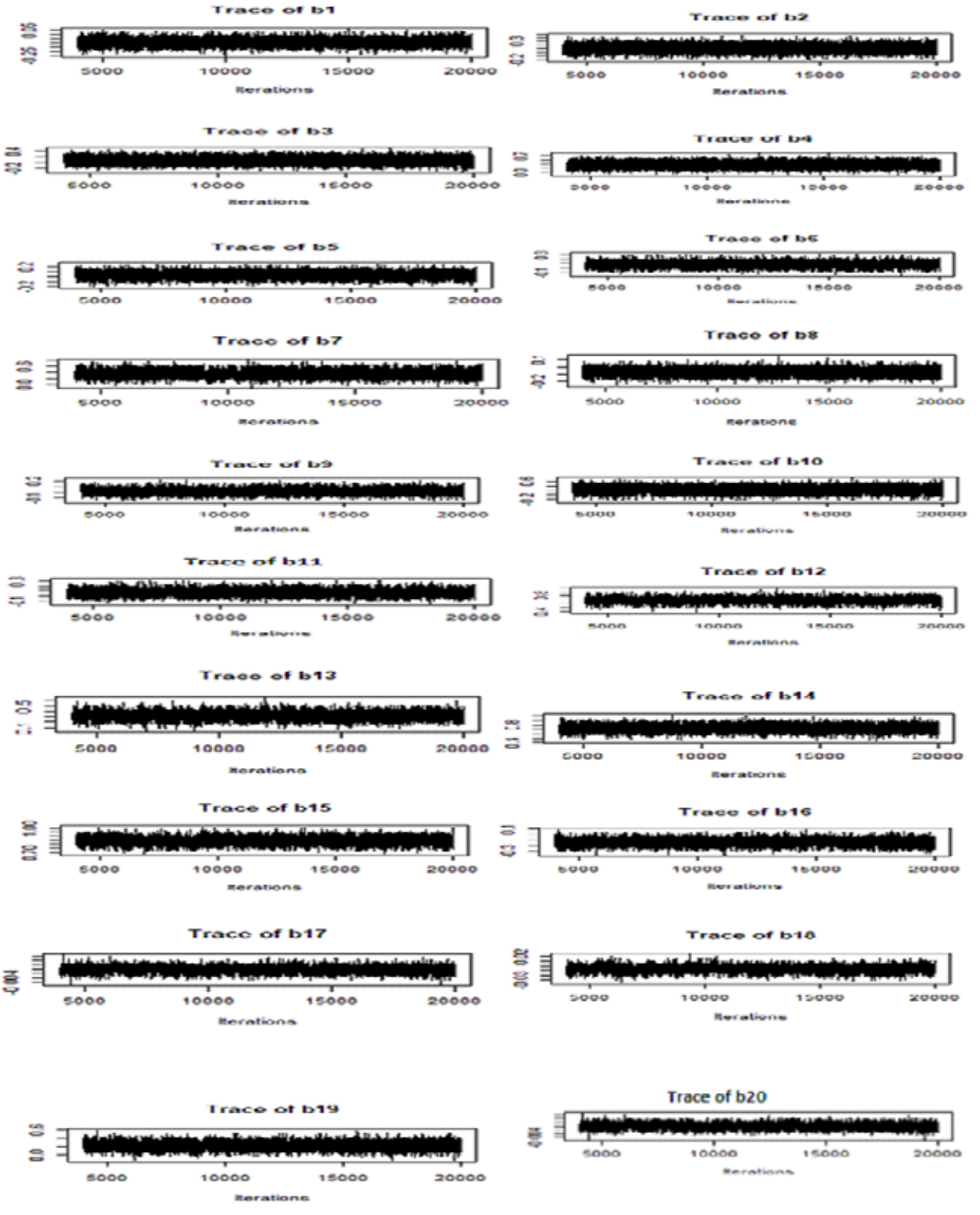

Figure 1. Trace Plots of Parameters

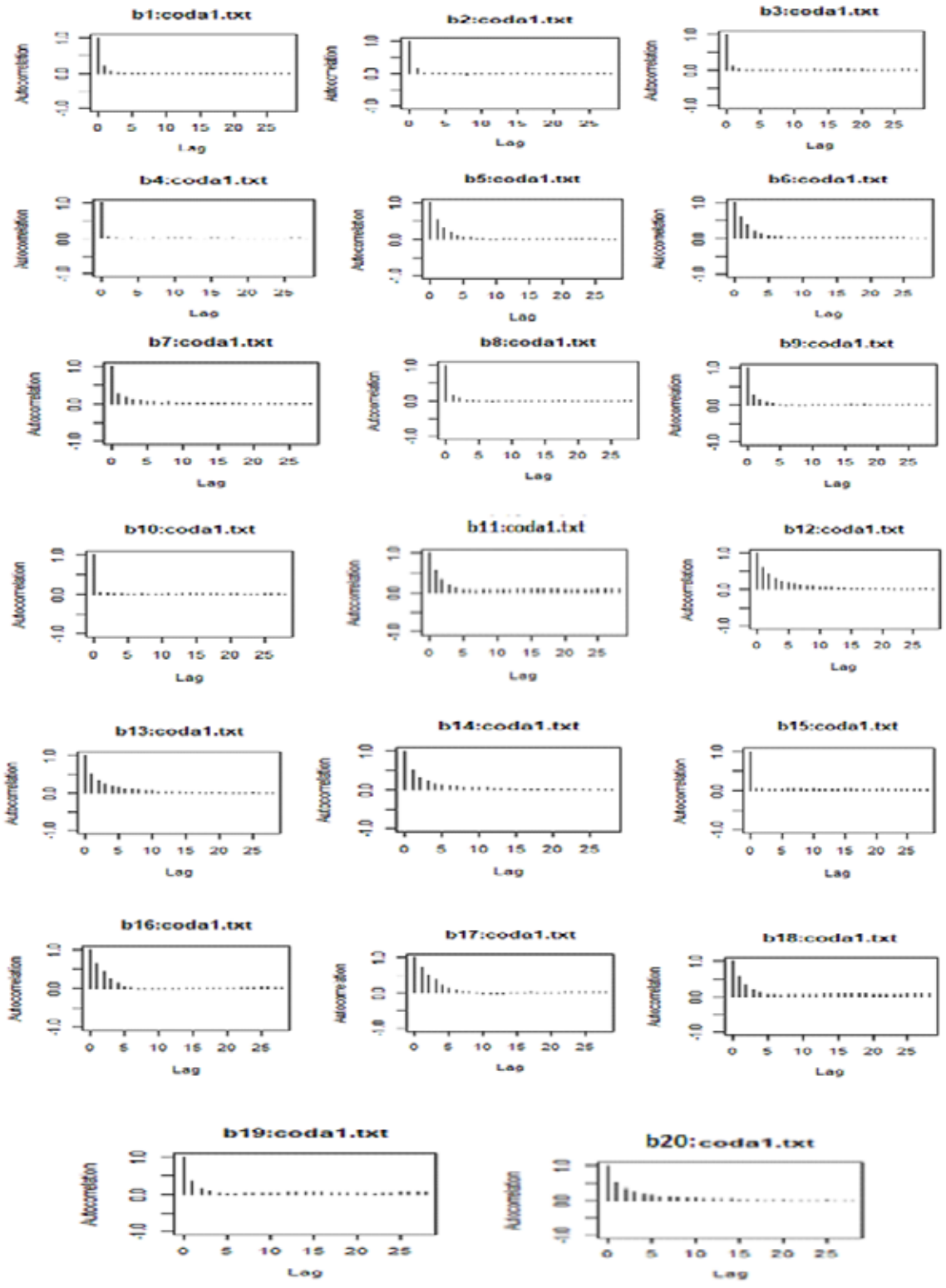

Figure 2. Autocor- relation plots of Parameters

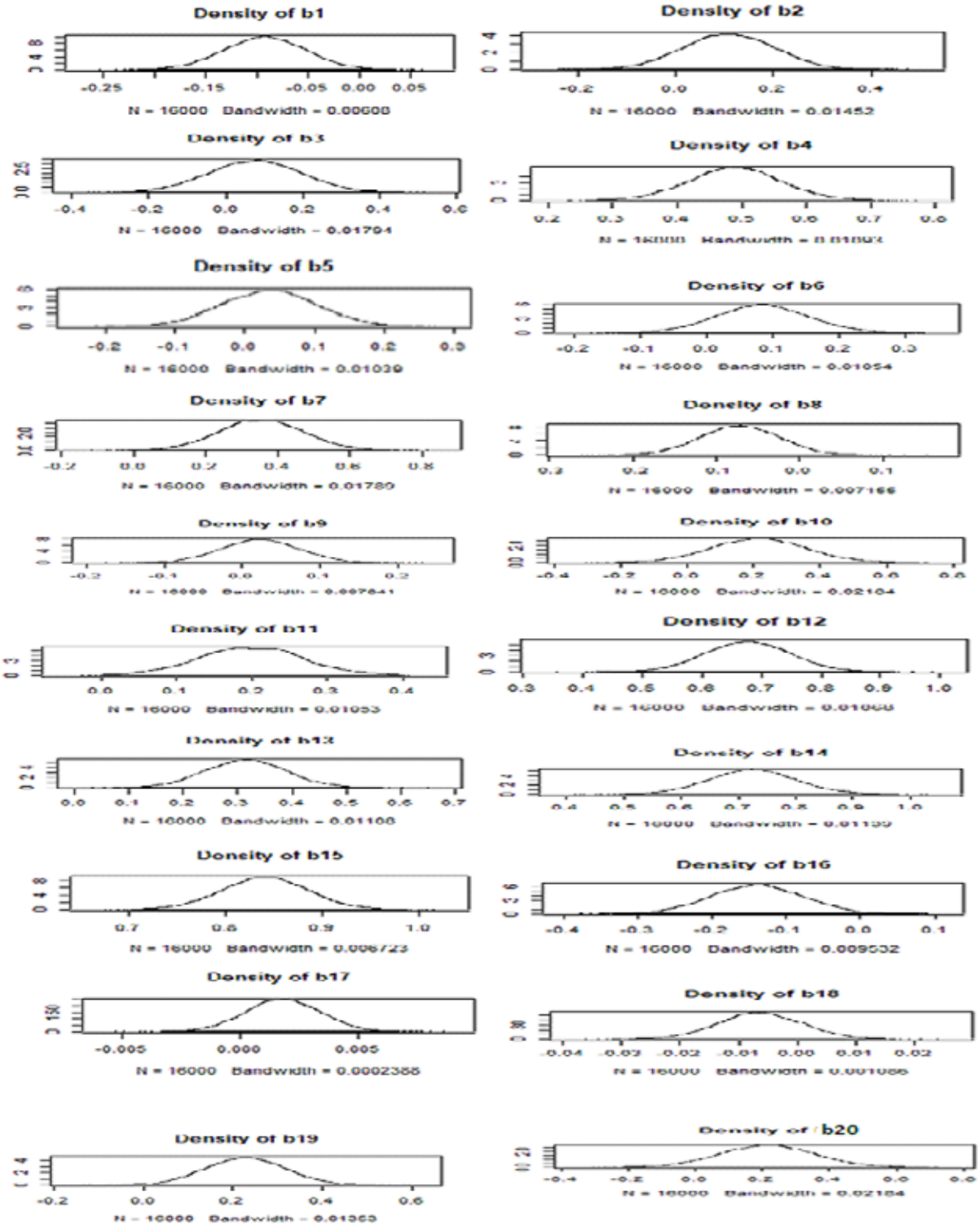

Figure 3. Density plots of Parameters

food secure than the households of Baluchistan. Odds ratios of KPK, Punjab and Sind versus Baluchistan are 2.06, 1.97 and 1.37 which indicate that the households in KPK and Punjab are almost 2 times more likely to be food secure than the households belongs to Baluchistan. Hence, Baluchistan compared to other regions is facing severe crisis of food insecurity. As far as rural versus urban residential status is concerned, its coefficient estimate is significant with positive sign. It implies that urban households are likely to be food secure compared to rural households. It is because urban areas contains more opportunities of earnings than rural areas and literacy rate is high in urban areas. Moreover, urban households compared to rural households have easy access to markets. Hence, households residing in urban areas are more likely to be food secure than rural areas. HH Age and marital status show insignificant impact on households' food security status. Estimates of household size is insignificant but the estimate of dependency ratio is significant with negative sign. It implies that a household is likely to lie in food insecure categories when dependency ratio increases rather than increase in family size.

4. Conclusions and policy implications

This study evaluates the role of some important socioeconomic and demographic factors with special focus on parental employment and education for improving households' food security in Pakistan. Most of the econometric studies analyzing determinants of food security use classical logistic regression framework. This study uses Bayesian logistic framework which utilize current as well as prior information. Literature reveals that Pakistan is facing worst situation of food insecurity as shown World Food Program statistics and Global Hunger Index 2017. These statistics are confirmed by the sample data used in this study which indicate that 58% of the sampled households are lying in food insecure category. Hence, determination of the important parental factors affecting food security at household level may be helpful for devising effective policies to improve food security in Pakistan. To achieve the objectives, data of all the variables for 14948 households are taken from Households Integrated Income and Consumption Survey (HIICS-2015-16), i.e. a national level household's survey data. Food security status of each household is determined by calculating difference between per adult capita daily caloric intake and per adult capita daily caloric requirement in each case. Hence, the dependent variable is binary categorical variable. Using the data of the same variables taken from HIES 2013-14 as the prior information, Bayesian logit model is estimated. Important conclusions and policy implications are as follows.

Significant positive impact of households' income is observed which implies that rising income improves economic and physical access to food and hence can be considered as the most effective determinant of households' food safety. Hence, policy steps for raising per capita income, e.g. education, employment, infrastructure development etc., would be helpful to achieve food security in Pakistan. Role of different levels of education and different types of employment with paternal and maternal dimension are evaluated in this study. The results show that primary and middle level of parental education have no significant contribution for improving food security. However, significant positive role of paternal and maternal higher education level for improving food security is observed. It is because higher education level directly affects present and future income and awareness which are closely linked up with access and utilization dimensions of food security. Hence, policy steps for providing higher education without gender discrimination are recommended as an effective instrument to achieve food security in Pakistan. Maternal paid employment, paternal paid employment and other employment show significant positive role in improving households' food security status in Pakistan. It is because employment is a major source of income in Pakistan. Moreover, paid employment carries two types of positive impact, i.e. income effect and education effect, as most of the paid employees are educated. However, estimate of couple employment is insignificant due to time constraints. It may be concluded that employment generation will be effective for improving food security. Role of agricultural employment for improving households' food security is highly significant and positive. It is because agricultural activities directly provide food items to the

agriculturist families. Moreover, agricultural income makes easy economic access to food market by raising purchasing power. Hence, development of agricultural sector is imperative to tackle the problem of food insecurity in Pakistan. Insignificance of family size but significant negative impact of dependency ratio implies that unemployment is badly affecting food security and hence, creation of employment, especially for lower class families where population growth is high but income is low, must be focused as a policy step in order to improve food security situation in Pakistan. Results of geographical and cultural dummies show that rural households compared to urban households and Baluchistan compared to the other three provinces are facing worst conditions of food insecurity. It induces that these areas need to focus by effective developmental policies, e.g. infrastructure development, policies for growth of agricultural activities and introduction of social welfare schemes to overcome food insecurity.

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Conflict of Interest: The authors declare that they have no conflict of interest.

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