Pakistan Economic Review
4:2 (Winter 2021), PP. 1-27

GENDER IN FOOD PURCHASING DECISIONS AND HOUSEHOLD FOOD INSECURITY BASED ON DIETARY ENERGY DEFICIENCY: AN APPLICATION OF OAXACA AND BLINDER DECOMPOSITION

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Abstract

Existing literature shows that women empowerment reduces the risk of households' food insecurity. Therefore, households with male and female food purchase decision makers are likely to have food insecurity differences as well. For designing food security policy, it is important to understand the extent and underlying causes of the food insecurity differences between the households. Whether the difference in food insecurity status between the households with female and male food decision-makers arises from the differences in households' characteristics like income, education, residential location, demography, etc., or from the different ways two categories of households react to changes in these characteristics, have gained little attention. To fill this literature gap, we first explore if the gender of food purchase decision maker has any impact on the households' probability of being food insecure after controlling for income and other important determinants of food insecurity. We estimate logistic regression using microdata obtained from *Household Integrated Economic Survey* of Pakistan. Then using Oaxaca-Blinder decomposition, we decompose group difference in food insecurity prevalence between the two categories of households into the differences in their observed characteristics and behavioral responses. We find that households with female food purchase decision makers have lesser probability of being food insecure and prevalence of food insecurity is 4% less is this group compared to households where males decide food purchases. From alternative generalizations of decomposition equation, we find that 55%-66% food insecurity gap is explained by differences in observed households' characteristics and 34%-45% by behavioral differences. Income status, education, household size, and age of household head are significant predictors of food insecurity and food insecurity gap between the two populations. From these findings, we imply that policies which strengthens females' voices in household decision making and build their capacity to make better choices, should be promoted to improve households' food security situation. We also found significant contribution of behavioral differences in explaining food insecurity group difference. Therefore, we imply that group specific policies should be designed to reduce food insecurity in the two populations.

Keywords: Food insecurity gap, Characteristics, Differences, Decomposition

JEL; D12, D13, I3, J16, R29

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1. INTRODUCTION:

Pakistan has shown progress in improving the state of food security (access) at national level during 2006-2019 with some fluctuations in between FAO et al. (2019). This national trend emerges from an equitable progress across all population groups or not, is unclear. It is a very relevant question for food security (FS) policy design in presence of socioeconomic inequalities across population groups. The prevalence and severity of food insecurity (FI) varies across population groups classified based on income, socio-demographic characteristics, and geography (Gundersen & Ziliak, 2018). This is so because the socioeconomic determinants of food insecurity (FI) and their relevance, varies across distinct population groups. Unfortunately, disaggregated analysis presenting FI differences across groups of households and its determinants has not gained much attention in Pakistan. This study attempts to enrich empirical evidence into this direction. For such an analysis, households can be grouped based on characteristics which impact their FI status like income, region of residence, education, age and gender of household head and gender of resource allocator specifically the one deciding food purchases etc.

A recent publication by World Economic Forum shows that Pakistan has alarming level of gender inequality in terms of intra-household decision making (Crotti et al., 2020), which may often translate into relatively higher food insecurity in households impacted by it. Studies conducted for developing countries like Pakistan (Aziz et al., 2020; Aziz et al., 2021; Naz et al., 2021) Bangladesh (Sraboni et al., 2014), Nepal (Malapit et al., 2015) and Ethiopia (Sariyev, Loos, & Zeller, 2020) found that gender-equity in intra-household decision-making and access to productive resources, can improve households' food security and health outcomes and vise-versa. Prominent reasons underlying the positive association between women-empowerment and FS are greater tendency of females to spend on family health and education (Sraboni et al., 2014) and invest in strategies that assure household food security like investment in agricultural products among farming households (De Schutter, 2013). Therefore, high gender inequality can impede Pakistan's progress towards achievement of Zero-Hunger target by 2030.

Few recent studies (Aziz et al., 2020; Aziz et al., 2021; Naz et al., 2021) have explored the association between women empowerment and FS based on data collected from field surveys implemented in selected regions of Pakistan (sample of 600 rural women of Azad Jammu and Kashmir in Aziz et al. (2020) and Aziz et al. (2021), and of 420 rural household of three districts of the Punjab province in Naz et al. (2021)). These studies found significant role of women empowerment in determining women' own and their households' FS status. However, we could not find evidence which uses nationally representative dataset and is sufficient to draw inference at national level for Pakistan. The existing evidence explains the differential impact that different domains of gender empowerment may have on households' FS status. It does not explain well how specifically women control over food purchases (most important aspect of women empowerment for assuring household FS) create difference in the prevalence of food insecurity between the households. Is it the difference in behaviors or observed characteristics between the households with female and male food purchase decision-makers that explains different rates of FI prevalence among them, is not explored in the literature. We planned this study to fill this literature gap.

The first objective of this study is to explore if the prevalence and risk of FI is different between the households with female and male food purchase decision-makers. The second objective is to investigate whether the difference in FI prevalence between the two categories of households arises from the differences in their observed characteristics like income, education, residential location, demography, etc. or from the way two categories of households react differently to changes in these characteristics. Using microdata from nationally representative *Household Integrated Economic Survey of Pakistan* (*HIES*) 2018-19 and 2005-06, we study how gender of the food purchase decision maker impacts FI status of the households using logit regression model. And then using Oaxaca-Blinder decomposition, we decompose the gap in prevalence of FI into differences in observed characteristics and behaviors/coefficients between the two groups of households.

We find that female food purchasing decisions significantly reduce the risk and prevalence of FI. On average, 4% lower FI prevalence is noted among households where female make food purchase decisions compared to those where male dominates these decisions. Education of household head and mother, poverty-status, household size, age of household head and residential area are other significant determinants of FI difference across the two categories of households. In what follows, section 2 presents the existing developments in the food security literature with gender focus. Next, the theoretical framework, methodology, results of empirical analyses and conclusion of the study follow in sections 3, 4, 5 and 6 respectively.

2. Literature Review

Gender differences in preferences and decisions have implications for households' FS status. Women compared to men, spend more on family health and education (Schmidt, 2012; Sraboni et al., 2014). Share of food expenditures in households' budget is found to be positively associated with women's share of cash income in Cote d'Ivoire (Udry & Duflo, 2004) and with their share of assets in Ghana (Doss, 2006). In a sample of less-industrialized countries it is observed that improvement in gender related development indices reduces child hunger and mortality (Scanlan, 2004). From these and similar studies, it appears that empowering women is a sound strategy to improve household food and nutrition security (Sariyev, Loos, & Zeller, 2020).

The status of women in the household is one of the main determinants of household FS. Studies conducted for Latin America, Sub-Saharan Africa and South Asia (Sariyev, Loos, Zeller, et al., 2020), and a set of developing countries (Smith et al., 2003) including Pakistan (Aziz et al., 2020; Aziz et al., 2021; Naz et al., 2021) provide empirical support for this argument by reporting positive association between women empowerment and food and nutrition security. Contributions for Bhutan (Sariyev, Loos, Zeller, et al., 2020), South Africa (Chitja & Murugani, 2018), and Ethiopia (Sariyev, Loos, & Zeller, 2020) that report women empowerment improves individual and household dietary diversity provide further support for this argument. Udry and Duflo (2004) and Sraboni et al. (2014) also show that gender of the earner and resource allocator in the household have serious implications for household FS status. Qualitative analysis conducted for Cote d'Ivoire draws similar conclusion that increased cooperation between men and women in household decision making and women empowerment lessens households vulnerability to FI even in lean season (Kiewisch, 2015).

To study the association between FS and women empowerment, common practice in the literature, specifically, in the studies cited above, is either control for gender of household head or create some index of women empowerment (women empowerment in agriculture index, gender development index etc) and include it as a regressor in regression analysis. Such analyses report net effect of an improvement in women status or gender of head on household or individual FS. These analyses do not explain if the difference in FI prevalence between households with different levels of women empowerment (specifically in terms of women control over food purchases) is entirely due to women empowerment or partially because of their structural and behavioral differences. Structural differences in terms of socioeconomic characteristics like income, education, resource ownership, income generating opportunities and residential location partially explain the difference in FI prevalence among male and female headed households (Azeem et al., 2016)[2]. Thus, controlling for gender of household head or including an index of women empowerment as a regressor in a regression equation, is insufficient to explain the FI gap between households where women have a say in decision making and where they do not. A better way to study the problem is to answer the question that whether FI difference arises from the differences in observed characteristics or from the behavioral differences of men and women i.e., the way in which two groups of households respond to a change in characteristics.

Gender based behavioral differences are observed and reported in the literature. For instance, evidence for Sudan (Ibnouf, 2009) and Philippines (De Schutter, 2013) shows that women compared to men have more innovative approach in diversifying food production and preservation methods. This increases availability of diverse foods in the farming households with female decision makers and assure food and nutrition security. Another evidence on how behavioral differences between men and women impact FS is presented in Sraboni et al. (2014). They note that positive association between women empowerment and FS varies by household wealth. It is stronger in poor compared to non-poor households. This indicates that how a change in household characteristics like income will affect household FS, is not independent of the gender of the decision maker in the household. FI may be higher among the households where decision makers are female due to low income, but these households may be better able to manage their food budget because of the greater emphasis of women on food and health. So, there is a need to isolate the impact of differences in characteristics from that of behavioral differences when explaining the FI gap between households categorized by gender of food purchase decision maker. FS Policies that increase access to food as well as communicate or put in place mechanisms to promote required behavioral changes, would be more effective in addressing FS issues (Turk et al., 2021).

Unfortunately, ordinary linear regression-based analyses presented in most of the studies cited above, fail to explain whether the gap in FI prevalence is due to group differences in observed characteristics or behaviors (coefficients) between households with female and male decision makers. Simple regression analysis captures the net effect of gender on FI only. A better way to address the question is to resort to Oaxaca-Blinder

[2] Generally head is decision maker in the household so this kind of analyses also provide insights to study gender based FI differences and its causes

decomposition, something not available in existing literature. This study attempts to fill this gap in literature by first estimating difference in prevalence of FI between the households with male and female food purchase decision makers and then by decomposing this group difference into household characteristics and behavioral components using Oaxaca-Blinder decomposition technique.

Another methodological issue is that most of the factors that empower women like their income/wealth status, education, decision making power, cultural norms of household and societies where they live, also affect FS status of households. It might create endogeneity problem in simple linear regression analysis which makes estimates questionable (Sraboni et al., 2014). Thus, the methodological improvement proposed in this paper will produce more reliable estimates compared to those produced from simple regression-based analysis.

3. THEORETICAL FRAMEWORK

We explain FI within the context of consumer demand theory. Individuals derive utility from consumption of food and non-food goods/services as well as leisure time. The demand for food is derived demand because it is taste and nutrient value of meals which an individual requires to get utility. Therefore, let individual's utility (3.1) depend on vectors of taste-components (T), nutrients (N) available in meals, consumption goods other than food (Y_O) and leisure (T_l).

$$U = u(T, N, Y_O, T_l) \qquad (3.1)$$

The amount of nutrients (N) available to individuals for consumption is determined from their home production function presented in equation 3.2.

$$N = n\left(X_f, T_f, K, C\right) \qquad (3.2)$$

Home production function for nutrients shows that meal preparation and hence, nutrient availability in the household depends on market-purchased and/or homegrown[3] food items (X_f), food shopping and cooking time (T_f), capital (K) both physical; home appliances, as well as human; cooking skills and nutrition knowledge and household demography (C). Therefore, to develop theoretical model for determinants of nutrients' demand and hence, FI, one needs to combine households' demand for food characteristics (Lancaster, 1966) with household production theory (Becker, 1965). Thus, we assume that households maximize

[3] We consider home grown food as self-purchased

utility subject to their home production function, income, and time constraints as reflected in their budget constraint in equation 3.3.

$$P_f X_f + P_O Y_O = I + w\left(T_t - T_f - T_l\right) \qquad (3.3)$$

Where 'P_f' and 'P_O' denote price vectors for food and nonfood goods respectively. Left side of equation 3.3 equals households' expenditures and right-side equals their total income, which is a summation of wage (w) and non-wage income (I). Maximum time a household can work for wages equals total available time (T_t) minus time spent in food shopping, cooking and leisure. The solution of this optimization problem gives us reduced form nutrient demand function as presented in equation 3.4. Here, the nutrient demand depends upon prices of food and nonfood goods and services that household pays, its total income, capital stock and demographic characteristics. Similarly, we can derive demand functions for other arguments in utility function (T, Y_O, T_l). However, this is beyond the scope of present study.

$$N = n^*\left(P_f, P_O, I, w\ K, C\ \right) \qquad (3.4)$$

Though FS is a dynamic concept, the nature of proposed theoretical framework is static because data availability limits our analysis to cross-sectional modeling of only extreme form of FI which is hunger i.e., inadequate dietary energy consumption. Thus, we consider equation 3.4 as household's demand function for dietary energy and define FI indicator (Y_i) in equation (3.5) as a binary variable which equals one if a household's daily per-capita dietary energy consumption (N) is below its minimum requirement (N_{min}) and zero otherwise.

$$\begin{aligned} Y_i &= 1, && \text{if N} < N_{min} \\ Y_i &= 0, && \text{otherwise,} \end{aligned} \qquad (3.5)$$

Here, dietary energy intake is a function of prices, income, household characteristics and capital. Whereas dietary energy requirement is determined by age, sex, height, and weight of each household member.

So far, we have discussed the factors that directly affect caloric intake and hence, determine households FS status. There are many other factors including education, empowerment, norms/beliefs, disasters, food preferences and behaviors that indirectly influence household's food consumption pattern and hence have implications for their state of FS (Burchi & De Muro, 2016). Therefore, while analyzing the determinants of household

FS, it is important to consider both direct and indirect drivers of FS. This way we can detect whether FI is a problem of limited financial resources or lack of capabilities like education and empowerment which influence resource allocation and create behavioral differences across individuals, something we intend to explore in this study. We present the theoretical model of household FS status in equation (3.6). It is worked out by adding some controls for indirect drivers of FS to the nutrient demand function (equation 3.4).

$$Y_i = \begin{pmatrix} Prices, Income, wages, capital\ stock, household\ size, age, gender\ and \\ agriculture\ engagement\ of\ household\ head, external\ factors \end{pmatrix} \quad (3.6)$$

We assume that FS status (Y_i) of each household is determined by prices of food and non-food items, income and/or wages, human and physical capital stock and household demography and external factors like disasters and shocks that impact households purchasing power. Due to data unavailability, we cannot directly control for external factors like disasters etc. Though it is possible to calculate unit values from HIES data and use them as prices, we have avoided to do so given the criticism (Deaton, 1997) on this approach to estimate market prices. Main reason is that the cross-sectional variation that we observe in household surveys can be due to quality differences. So, following Burchi and De Muro (2016), we proxy these variables by residential locational (province and region) based on the assumption that households living in same area face similar prices and external factors like disasters. Income (earned from wage or non-wage sources like wealth) data often suffer from reporting biases (Deaton, 1997). So, we use household expenditures as indicator of economic status indicator (income) as suggested by Deaton (1997) because expenditures are strongly correlated with income. Then we classify households into poor and nonpoor by comparing their monthly per adult equivalent expenditures to national poverty line. We do so because after a threshold income variation becomes irrelevant for caloric intake or there is a maximum limit for caloric intake for each age-sex group. Also, the poverty line calculated using cost of basic needs approach includes allowance for meeting average dietary energy recommendation plus additional amount for other necessities. Thus, we assume that anyone above poverty line can afford to meet its minimum caloric requirements. Due to data unavailability, we proxy human capital and/or nutrition knowledge of the household by education of household head and mother. Details of variables' construction is provided in Table 4.1. Given above considerations, the theoretical model to be estimated is following:

$$Y_i = f\begin{pmatrix} education\ of\ household\ head\ and\ mother, poverty\ status, age\ of\ head, \\ household\ size, agriculture\ employment\ of\ head, residential\ area \end{pmatrix} \quad (3.7)$$

Studies that report resource allocation differs by gender of resource allocator and the ones which conclude women empowerment reduces risk of FI in household, suggest that the nutrient demand function is sensitive to gender of decision maker in the household. Therefore, separate demand functions are needed for the households with male (hereafter male group) and female (hereafter female group) decision makers regarding food purchases when the objective is to analyze the group difference and its determinants across these two categories of households.

4. EMPIRICAL MODEL AND DATA

We first calculate mean difference in the prevalence of FI and households' characteristics between the two groups of households and evaluate its statistical significance using t-test. Then to find out the determinants of FI, we estimate equation 3.7 using logit regression model proposed in (4.1) because our indicator of FI is a binary variable. We will estimate empirical model (4.1) for the two population groups and overall sample separately.

$$\Pr(Y_i = 1) = \frac{\exp(X_i'\beta_i + \varepsilon_i)}{1 + \exp(X_i'\beta_i + \varepsilon_i)}$$

(4.1)

Where, $'Y_i'$ is FI status of 'ith' household and 'X_i' is vector of independent variables, 'β_i' vector of respective parameters and $'\varepsilon_i'$ is the error term. After estimating the determinants of FI status for the two population groups, next step is to explore, what determines group difference in prevalence of FI in the two categories of households. Thus, we use regression-based decomposition technique, Oaxaca-Blinder decomposition, which decomposes mean outcome difference between two groups into different components. Linear regression based standard Oaxaca-Blinder decomposition of the male/female gap in the mean value of FI prevalence (Y) can be written as:

$$\bar{Y}_A - \bar{Y}_B = (\bar{X}_A - \bar{X}_B)\hat{\beta}_A + \bar{X}_B\left(\hat{\beta}_A - \hat{\beta}_B\right) \quad (4.2)$$

Where subscript A and B represent the male and female group respectively, $\bar{X}$ is a row of average values of regressors and $\hat{\beta}$ represents vector of coefficient estimates. Left side of equation 4.2 shows average outcome differential across the two groups and first term on right side measures the gap attributable to group differences in observed characteristics also called explained or the composition gap and second term measures the gap attributable to group differences in coefficients (unexplained gap). Equation 4.2 is written treating group A as reference group, and it can be written alternatively considering group B as reference group as follows:

$$\bar{Y}_A - \bar{Y}_B = (\bar{X}_A - \bar{X}_B)\hat{\beta}_B + \bar{X}_A(\hat{\beta}_A - \hat{\beta}_B) \quad (4.3)$$

Bauer and Sinning (2008) highlight that the conditional expectation $E(Y_i | X_i)$ in non-linear models like logit is not the same as linear predictions $X_i\hat{\beta}_B$. So, they propose to rewrite equation 4.2 as follows to adjust non-linear models.

$$\bar{Y}_A - \bar{Y}_B = [E_{\hat{\beta}_A}(Y_A | X_A) - E_{\hat{\beta}_A}(Y_B | X_B)] + [E_{\hat{\beta}_A}(Y_B | X_B) - E_{\hat{\beta}_B}(Y_B | X_B)] \quad (4.4)$$

As our regression model is logit, $(\bar{Y}_A - \bar{Y}_B)$ in 4.4 represents the difference in average predicted probabilities of being FI between two population groups. $E_{\hat{\beta}_A}(Y_B | X_B)$ represents the counterfactual part of the decomposition equation which assigns A group's parameters to B group's characteristics to evaluate how the FI gap between two groups responds if (1) they have same characteristics and/or (2) same behavioral responses (coefficients). In 4.4, A group is treated as reference group. Alternate expression for the decomposition is presented in 4.5 using B group's coefficient estimates as reference.

$$\bar{Y}_A - \bar{Y}_B = (E_{\hat{\beta}_B}(Y_A | X_A) - E_{\hat{\beta}_B}(Y_B | X_B)) + (E_{\hat{\beta}_A}(Y_A | X_A) - E_{\hat{\beta}_B}(Y_A | X_A)) \quad (4.5)$$

A renowned problem with Oaxaca Blinder decomposition is index number problem which states that decomposition results are sensitive to the choice of reference group. Thus, the decomposition results produced by estimating equation 4.4 and 4.5 will be different because the vector of coefficient estimates chosen as non-discriminatory basis is different in the two generalizations of decomposition equation. To overcome index number problem, different researchers have proposed different weighting schemes for estimating the vector of unknown nondiscriminatory coefficients. Equation 4.6 defines nondiscriminatory coefficients as a weighted average of the two groups' coefficient estimates.

$$\beta^* = \Omega\,\hat{\beta}_A + (I - \Omega)\hat{\beta}_B \qquad (4.6)$$

Where Ω is a weighting matrix and I is an identity matrix. Decomposition equations presented in Blinder (1973) and Oaxaca (1973) assume ($\Omega = 0$) or ($\Omega = 1$). Reimers (1983) suggested assigning equal weights ($\Omega = 0.5$) to both groups' coefficients. Whereas Cotton (1988) proposes weighting each group's coefficients by respective sample size. However, Neumark (1988) and Oaxaca and Ransom (1994) approach is to estimate pooled model for overall sample to estimate β^*. We present result for $\Omega = 0;$ female group is reference group, $\Omega = 1;$ male group is reference group in main text and for $\Omega = 0.5;$ β^*= average of $\hat{\beta}_A$ *and* $\hat{\beta}_B$, and β^*= Pooled model's coefficients in appendix Table A4. However, we will explain only extreme cases $\Omega = 0$ or 1.

The detailed decomposition can tell us the contribution of each characteristic in explaining the FI gap between two groups. Below equation 4.7 and 4.8 present linear detailed decomposition for explained (E) and unexplained (C) part of 4.2 respectively.

$$E = \sum_{k=1}^{K} (\bar{X}_{Ak} - \bar{X}_{Bk})\hat{\beta}_{Ak} \qquad (4.7)$$

$$C = (\hat{\beta}_{Ao} - \hat{\beta}_{Bo}) + \sum_{k=1}^{K} \bar{X}_{Bk}(\hat{\beta}_{Ak} - \hat{\beta}_{Bk}) \qquad (4.8)$$

Here, subscript k represents the k^{th} regressor. However, detailed decomposition in non-linear models is not straightforward. As explained above in non-linear models the conditional expectations are different from linear prediction. Thus, the detailed decomposition of the explained and unexplained part into the contribution of each regressor may not add up to the total. If linear method of detailed decomposition is applied to nonlinear decomposition models, the results are sensitive to the choice of omitted category in case of categorical regressors (identification problem) and to the order in which variables enter decomposition equation (path dependency). Different non-linear decomposition methods are proposed to handle these problems. For example, Yun (2005) proposed computing normalized effects for categorical predictors. Fairlie (2005) suggests performing replications of decomposition by randomizing the order of variables in which they enter decomposition equation and switching the coefficient values to base group's values in replications. Average of estimates produced in series of replications in Fairlie (2005) is used as final estimates. The limitation of Fairlie (2005) is that it only focuses explained part of the distribution. We follow Powers et al.

(2011) who incorporate latest developments to overcome path dependency and identification problem and propose using weights in the nonlinear detailed decomposition as follows:

$$\bar{Y}_A - \bar{Y}_B = \sum_{k=1}^{K} W_{\Delta x_k} E + \sum_{k=1}^{K} W_{\Delta \beta_k} C = \sum_{k=1}^{K} E_k + \sum_{k=1}^{K} C_k \qquad (4.9)$$

Where $\sum_{k=1}^{K} W_{\Delta x_k} = \sum_{k=1}^{K} W_{\Delta \beta_k} = 1$ and the contribution of each regressor to explained/characteristics gap is ($E_k = W_{\Delta x_k} E$) and to unexplained/coefficients gap is ($C_k = W_{\Delta \beta_k} C$). Positive sign of E_k and C_k denotes a decrease in raw differential and negative sign shows an increase. Weights represent the relative share of each regressor in explaining the respective part of group difference in outcome and they are assigned following Powers et al. (2011). The composition weight (4.10) is the difference in average values of the regressor, weighted by its coefficient estimate in group A. Whereas, the coefficient weights (4.11) equal the group difference in the coefficient estimates weighted by the mean values of the regressor in group B.

$$Composition\ weights = W_{\Delta x_k} = \frac{\hat{\beta}_{Ak}(\bar{X}_{Ak} - \bar{X}_{Bk})}{\sum_{k=1}^{K} \hat{\beta}_{Ak}(\bar{X}_{Ak} - \bar{X}_{Bk})} \qquad (4.10)$$

$$Coefficient\ weights = W_{\Delta \beta_k} = \frac{\bar{X}_{Bk}(\beta_{Ak} - \beta_{Bk})}{\sum_{k=1}^{K} \bar{X}_{Bk}\left(\hat{\beta}_{Ak} - \hat{\beta}_{Bk}\right)} \qquad (4.11)$$

The unexplained group difference can result from factors like unobservable/unmeasurable characteristics, omitted variables, behavioral differences, or some sort of discrimination. Therefore, interpretation of this part is too complex and decomposing unexplained gap into contribution of individual regressors doesn’t offer considerable insight in nonlinear models. Thus, in detailed decomposition, we mainly focus FI gap created by differences in observed characteristics.

4.1 **DATA AND VARIABLES**

We pooled microdata from two rounds (2005/06 and 2018/19) of HIES of Pakistan to have a sufficiently large sample size. Sample size in each of these rounds equals 15453 and 24809 households respectively. HIES is conducted by Pakistan Bureau of Statistics. It provides household level data on income and consumption expenditures as well as other socio-economic characteristics, representative at national, rural/urban and province level. Table 4.1 presents detailed construction of the variables and their expected signs.

Table 4.1: Determinants of Household Food Insecurity and Their Expected Signs

Dependent variable	
Food Insecurity status of household (Y)	Y = 1; Food insecure if daily per-capita dietary energy consumption is less than minimum requirement of the household. Y = 0; otherwise (Food secure)
Independent variables (Expected sign)	***Description***
Gender of Food purchase decision maker (+/—)	Equals '1' if females take food purchase decision and '0' if male take food purchase decision in the household.
Household head's education (—)	Equals '1' if household head has completed 12 or greater years of education and '0' otherwise
Mother's education (—)	Equals '1' if household mother has completed 12 or greater years of education and '0' otherwise
Poor (—)	Equals '1' if Poor and '0' if Non-Poor (base); household is poor if its per adult equivalent monthly expenditures are below national poverty-line (Rs.1277.74 and 3250.28 per adult-equivalent/month in 2005-06 and 2015-16 respectively (GoP, 2016).
Household head age (+/—)	Equals '1' if household head's age is 30 years or above and '0' otherwise
Household size (+/—)	Equals '1' if household size is 5 or greater and '0' otherwise
Household head employed in agriculture (—)	Equals '1' if employed in agriculture (crop production or livestock) and '0' for non-agriculture employment
Region (+/—)	Equals '1' if urban area resident and '0' otherwise
Province (+/—)	Punjab (base), Sindh, KPK, Baluchistan; (yes=1) binary variables
Survey year (+/—)	Equals '1' if survey year (2018-19) and '0' if 2005-06

Note: All variables are binary with zero representing base category of each regressor. Households' daily per-capita dietary-energy consumption (N) and minimum dietary-energy requirements (Nmin) are calculated following (FAO et al., 2019). Caloric values for each food item reported in *HIES* are obtained from Food Composition Table of Pakistan (2001).

The relevance of most of the variables is already explained in section 3 except for 'survey year' which is an additional variable in Table 4.1. This is included to control for the time effect as socioeconomic indicators like poverty, literacy, and undernourishment etc., changed significantly between 2005-2019. Nationwide social protection program, Benazir Income Support Program was also implemented between this period. These external factors which are not directly controlled for in this analysis might affect the association between FI and household characteristics in the two HIES rounds.

5. Results and Discussion

We first present descriptive statistics in Table 5.1 to shed light on compositional differences in the two groups of households. t-test results show significant differences in food insecurity and household characteristics exist between the two groups.

Table 5.1: Distribution of Sample by Household Characteristics

Variable	*Male*	*Female*	*Difference*
Observations	10467	10623	
Food Insecurity Prevalence	***0.204***	***0.166***	***0.039******
Head Education 12 years or above	0.075	0.072	0.003
Mother Education 12 years or above	0.026	0.056	-0.03***
Poverty	0.422	0.239	0.183***
Age of head (30 years or above)	0.782	0.81	-0.028***
Household size	0.872	0.762	0.11***
Head employed in Agriculture	0.301	0.224	0.077***
Residential Location			
Urban	0.328	0.394	-0.067***
Punjab	0.171	0.693	-0.521***
Sindh	0.285	0.135	0.15***
KPK	0.336	0.131	0.205***
Baluchistan	0.208	0.041	0.167***

Source: Author's calculation. Note: Cell values are sample proportions. Last column presents difference of male female group proportions and t-test results with "***" p-value<0.01, "**" p-value<0.05, "*" p-value<0.10

Male group has significantly higher (4%) prevalence of FI compared to female group. Female group has relative advantage in maternal education, age of household head (higher proportion in middle age and above), smaller household size and lesser poverty. Compared to male group, it has smaller proportion of households whose heads are involved in agriculture sector for livelihood. The female group is mostly concentrated in Punjab and urban areas which are relatively developed areas. These significant food insecurity and characteristics differences makes this sample a suitable case for the application of Oaxaca Blinder decomposition. We estimated pairwise correlation coefficients for all regressors, and the results (see Table A1 in Appendix) show that chances of multicollinearity among regressors are slim.

First step in Oaxaca Blinder decomposition is estimating separate regressions for the two groups. Therefore, Table 5.2 presents the logit regression results (marginal effects at mean values) of male and female groups subsamples. Logit regression output for the pooled sample is presented in Appendix Table A2 because the only objective to estimate pooled model is to evaluate if the gender of food purchase decision maker have any significant impact on household status or not while controlling for other important determinants of FI.

We tested different specifications of logit regression (controlling for different set of covariates). However, we report regression results for the model specifications (Model 1-4) with minimum AIC, BIC and maximum count R^2 values. Count R^2 values show that all these model specifications predicted probability of being food insecure in more than 80% cases correctly. Apart from the control variables included in model 1, model 2 includes maternal education, model 3 poverty status and model 4 both maternal education and poverty status among list of regressors. We are not keen in the magnitudes of coefficients (marginal effects) because unlike linear regression, in nonlinear models like logit, it depends on the level of the covariate. Predicting marginal effects at means present hypothetical case for an average individual in the sample with all covariate values equals sample average. Thus, in table 5.2 we focus only direction of the association and significance levels for the four specifications in each sample. Results for most of the regressors remain consistent across model 1-4. Given the model diagnostics, Model 4 specification is a better and robust choice to estimate determinants of FI. Therefore, in what follows, all results will be discussed for Model-4 only.

In all the model specification, keeping other factors constant, households with female food purchasing decision makers have significantly lesser chances of being food insecure compared to male group (see Table A2 in appendix). This finding holds even after controlling for maternal education and poverty status of households (model 2-4) and is consistent with the literature (Burroway, 2016; De Schutter, 2013; Sariyev, Loos, Zeller, et al., 2020; Scanlan, 2004; Sraboni et al., 2014). This is so because female's contribution to the household economy and her participation in the household decision-making is positively associated with prioritizing food consumption in household budget, while male tends to dedicate higher income to non-food spending and other activities (AFZAL & AHSAN, 2021; Aziz et al., 2021; Naz et al., 2021). Both higher education of household head and mother reduces chances of FI compared to lower levels of education holding other factors constant. This is because education plays an important role in shaping individuals' decisions. Therefore, it is very likely that food choices made by well-educated individuals will reduce household level risk of FI (Burroway, 2016; Sraboni et al., 2014). Education improves households' capabilities of being food secure by broadening their set of employment opportunities and introducing them to better ways of resource management (Aziz et al., 2021; Naz et al., 2021; Turk et al., 2021).

Poverty, larger household size (5 or greater), and residence in urban areas compared to rural areas increases probability of FI in all samples ceteris paribus. These results are consistent with Azeem et al. (2016), Sraboni et al. (2014) and Naz et al. (2021). Higher incomes and the possibility of food consumption out of own production in rural areas increase households' access to food and thus, reduces their vulnerability to FI. Our result for agricultural engagement of heads also matches with Sraboni et al. (2014) who found that caloric availability is higher among households whose heads are farmers. This is more common in rural areas and thus it partly explains the rural-urban difference in risk of being food insecure.

Households with older (30 years or above) heads have higher probability of being FI compared to those with young household heads in female sample other things remaining the same. However, in males sample the positive association between FI and household head age does not exist. Sraboni et al. (2014) found positive association of caloric availability in the household with linear term of household head's age and negative with its quadratic term. This indicates aging of heads adversely affects households' FS status. One reason could be that households headed by a person aged less than 30 years are likely newly married couples with smaller household size and expenses. Larger household-size burdens food consumption expenditures and therefore, increases risk of FI compared to smaller family-size. The negative association between family size and FS becomes stronger among household with higher dependency ratio (Drammeh et al., 2019).

We find that keeping all other factors constant, probability of being food insecure for households living in Sindh, KPK and Baluchistan is lesser than those living in Punjab. One potential reason could be that the relative importance as well as share of food in the expenditure basket of poor households is mostly higher than other goods. Therefore, residents of underdeveloped provinces are likely more conscious about their food than those residing in Punjab which is comparatively developed province and have lower poverty. Negative significant marginal effects for survey year (base 2006) show that FI has significantly declined between 2006 and 2019 and it is consistent with the findings reported in FAO et al. (2019).

Table 5.2: Logit Regression Output for Male and Female Sub-samples

Variables	**Male Sample**				**Female Sample**			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Constant	-1.5396*** (0.0000)	-1.5131*** (0.0000)	-2.7770*** (0.0000)	-2.7488*** (0.0000)	-2.3099*** (0.0000)	-2.2975*** (0.0000)	-3.8473*** (0.0000)	-3.8147*** (0.0000)
Head Education 12 years or above	-1.7174*** (0.0000)	-1.5902*** (0.0000)	-0.9639*** (0.0000)	-0.8722*** (0.0000)	-1.9396*** (0.0000)	-1.5617*** (0.0000)	-1.3633*** (0.0000)	-1.0518*** (0.0000)
Mother Education 12 years or above		-1.5055*** (0.0000)		-1.0612*** (0.0009)		-1.8830*** (0.0000)		-1.4468*** (0.0000)
Poverty			2.6057*** (0.0000)	2.5884*** (0.0000)			2.7788*** (0.0000)	2.7436*** (0.0000)
Age of head (30 years or above)	0.0545 (0.4073)	0.0414 (0.5310)	0.1058 (0.1451)	0.0964 (0.1853)	0.1708** (0.0229)	0.1441* (0.0562)	0.2732*** (0.0012)	0.2549*** (0.0026)
Household size	1.1992*** (0.0000)	1.2100*** (0.0000)	0.6645*** (0.0000)	0.6733*** (0.0000)	1.3632*** (0.0000)	1.3809*** (0.0000)	0.8469*** (0.0000)	0.8615*** (0.0000)
Head employed in Agriculture	-0.3470*** (0.0000)	-0.3498*** (0.0000)	-0.2515*** (0.0003)	-0.2521*** (0.0003)	-0.4608*** (0.0000)	-0.4645*** (0.0000)	-0.2387*** (0.0058)	-0.2427*** (0.0050)
Urban	0.5811*** (0.0000)	0.6116*** (0.0000)	1.2938*** (0.0000)	1.3110*** (0.0000)	0.5686*** (0.0000)	0.6280*** (0.0000)	1.5226*** (0.0000)	1.5538*** (0.0000)
Sindh	-0.2881*** (0.0002)	-0.3170*** (0.0000)	-0.6823*** (0.0000)	-0.6980*** (0.0000)	0.0077 (0.9208)	-0.0084 (0.9138)	-0.1394 (0.1089)	-0.1528* (0.0795)
KPK	-1.1347*** (0.0000)	-1.1598*** (0.0000)	-1.6754*** (0.0000)	-1.6914*** (0.0000)	-1.2375*** (0.0000)	-1.2599*** (0.0000)	-1.6501*** (0.0000)	-1.6641*** (0.0000)
Baluchistan	-0.0387 (0.6157)	-0.0717 (0.3548)	-0.6841*** (0.0000)	-0.7013*** (0.0000)	0.0774 (0.5608)	0.0477 (0.7209)	-0.5886*** (0.0001)	-0.6022*** (0.0000)
Survey year (2018/19 equal 1)	-1.5007*** (0.0000)	-1.4933*** (0.0000)	-0.9413*** (0.0000)	-0.9386*** (0.0000)	-0.9434*** (0.0000)	-0.9251*** (0.0000)	-0.2877*** (0.0000)	-0.2791*** (0.0000)
Observations	10467	10467	10467	10467	10623	10623	10623	10623
Count R^2	0.81	0.81	0.83	0.83	0.83	0.83	0.86	0.86
AIC	9069.58	9035.87	7534.71	7523.15	8473.26	8389.53	6828.46	6789.47
BIC	9142.14	9115.69	7614.53	7610.23	8545.97	8469.51	6908.44	6876.72

Source: Author's calculation; cell values are marginal effects at means (p-values), "***" p-value<0.01, “**” p-value<0.05, “*” p-value<0.10

Given significant differences in household characteristics (Table 5.1) and significant differential impact of the gender of food purchase decision maker on households' FS status (Appendix Table A2), we decompose differences in prevalence of FI between the two groups into different components and present result in Table 5.3.

Table 5.3: Oaxaca Blinder Decomposition for Logit regression

	Male	*Female*
Overall Decomposition		
Due to Characteristics (Explained)	58.05***	55.09***
Due to Coefficients (Unexplained)	41.95***	44.91**
Detailed Decomposition		
Due to Characteristics		
Head Education 12 years or above	-2.39*	-1.78***
Mother Education 12 years or above	31.13*	26.22***
Poverty	464.28**	304.04***
Age of head (30 years or above)	-2.63	-4.3**
Household size	72.63**	57.41***
Head employed in Agriculture	-18.93*	-11.26**
Urban	-85.64**	-62.7***
Punjab	-394.96*	-190.98***
Sindh	10.94	40.93***
KPK	-184.6*	-131.5***
Baluchistan	11.69	0.26
Survey year (2018/19 equal 1)	156.53**	28.76***
Due to Coefficients		
Head Education 12 years or above	2.95	3.97
Mother Education 12 years or above	4.93	2.97
Poverty	-8.45*	-19.32*
Age of head (30 years or above)	-29.29	-36.6
Household size	-32.7	-48.43
Head employed in Agriculture	-0.48	-0.83
Urban	-21.84***	-23.49**
Punjab	26.54	8.5
Sindh	-11.62***	-31.69***
KPK	4.19	13.93
Baluchistan	0.65	4.23
Survey year (2018/19 equal 1)	-97.74***	-93.36***
Constant	204.82***	265.03***

Source: Author's calculation. Cell values are percentages of overall group difference which adds up to 100. "***" p-value<0.01, "**" p-value<0.05, "*" p-value<0.10

We present results for two types of Oaxaca Blinder decomposition in Table 5.3. First decomposition results using male group as reference group and using its coefficients (omega=1) as non-discriminatory/reference coefficients. This addresses the question, what would the prevalence of FI be in male group if they are assigned female group's characteristics (characteristics effect) and what would the prevalence of FI in female group be if female group were to have the same set of coefficients as estimated for male group (coefficients effect)? These two components of the decomposition (characteristics and coefficients effect) are estimated for each regressor to find out their contribution in explaining the gap in FI prevalence between the two groups. Second case presents decomposition results using female coefficients. Results using average of male and female coefficients, and pooled regression coefficients as reference coefficients are presented in Appendix Table A3.

Results are consistent across all variants of the Blinder and Oaxaca decomposition. Though there are differences in magnitude of overall results and for each regressor in different versions of decomposition, the direction (sign) and relative order of the impact of each regressor on FI difference is similar in all cases. Results show that difference in characteristics explain larger percentage of the overall FI group differential between two populations. Table 5.1 shows that female group has relative advantage in most of the characteristics that reduces household's risk of being FI. So, we interpret results for first case which shows if male group's characteristics profiles are upgraded to female group level, how prevalence of FI will change in male group. As explained in section 3, we will mainly interpret detailed decomposition results for the explained part. The unexplained part contains the effects of omitted variables and other unobservable factors like cultural differences etc., and hence, it is too challenging to be fully interpreted here.

Overall decomposition results show that characteristics differences explain 58% and coefficients or behavioral differences 42% of the total difference in prevalence of FI between the two groups. However, with female group as reference the contribution of characteristics is slightly lower (55%) and of coefficients is slightly higher (45%). When we assign both group's coefficients equal weightage (average), the results, as expected lie between these two extremes (56% explained and 44% unexplained; see Appendix Table A3). However, when reference coefficients are set equal to pooled model's estimates, the contribution of explained part increases considerably (66% explained and 34% unexplained; see Appendix Table A3). In all cases results are statistically significant. These results confirm that although independent impact of characteristics explain the FI gap between groups yet understanding and measuring behavioral differences is important. Due to part of FI differential explained by difference in behavioral responses, one policy may not fit all population groups when it comes to reducing FI.

The detailed decomposition results show that difference in education of household head increases the gap in FI prevalence. Table 5.1 shows that though insignificant, the difference in proportion of household heads who have completed more than 12 years of education is slightly higher (0.3%) in male sample. Since, education reduces the chances of household FI (negative marginal effects in Table 5.2), if male group is assigned female group's education of household head, prevalence of FI might increase in male group from its current level which is already higher than female group. Therefore, the FI gap would further increase (2.39%) between the two groups. However, FI gap would decrease by 2.95% if heads' education impacts FI status of households in female group the same way as it does in male group. If we look at Table 5.2, marginal effect of heads' education is weaker in male sample (0.87) compared to female sample (1.05). Results for other characteristics can be interpreted in the same way while looking the sample proportions and coefficients estimates for male and female samples.

Results show that reducing group differences in maternal education, poverty status and household size, reduces FI gap between the two groups by 31.13%, 464.28% and 72.63% respectively. Descriptive statistics tell us that female group has advantage in these characteristics with regards to their impact on FI. Thus, if male groups characteristics profiles for these variables are upgraded to female levels, FI prevalence will reduce in male group, and this will reduce the FI group difference. Similarly, switching male group's characteristics like age, and agricultural employment of household head with female group levels, will deteriorate male groups' characteristics profiles for these variables and hence it will face higher prevalence of FI compared to existing level. Therefore, reducing group difference in age, and agricultural employment of household head stretches the FI group difference by 2.63%, 18.93%, respectively.

In unexplained part we find that if characteristics are fixed at female group's level, a reduction in group difference in coefficients for maternal and household head's education will reduce FI-gap between groups by 2.95% and 4.93% respectively. Though the differential negative impact of these variables on FI is smaller in male sample, increase in their sample proportions would lower FI in male group and result in narrowing down FI difference across group. Further, results show that reducing the gap in differential impact of characteristics like poverty, aging of household head and his/her employment in agriculture, household size and urban area residence, widens FI gap between the two groups. If we look at regression results (Table 5.2), poverty, age of head, household size coefficients are smaller in male group compared to female group, meaning the adverse impact of poverty, aging of heads and larger household-size is lesser in male sample. Therefore, when male coefficients are assigned to female group for these characteristics, FI in female group will increase by lesser amount, compared to a situation when its own estimates are used to predict prevalence of FI. Similarly, employment in agriculture of household head protects household slightly more in male group and assigning same coefficient to female group would mean protecting female group more against FI. Thus, female group already have lower prevalence of FI and any further reduction in it, will widen the FI gap between the groups. The contribution of differences in unobservable characteristics and/or omitted variables is largest in unexplained part of the decomposition. This calls for further exploration into behavioral differences, its causes, and other relevant determinants of FI which this study could not capture for any reason.

These results provide support to argument that when studying prevalence of FI, it is necessary to consider group differences in characteristics and behavioral responses across different population groups. Homogenous solution, for example increasing incomes, may not be equally effective for all population groups. Qualitative studies like Turk et al. (2021) that digs deeper into issues like what kind of behavioral differences between men and women can be relevant for household FS status at national scale would be very useful.

6. **CONCLUSION**

Using microdata from HIES, this study examines the factors that affect FI status of households with male and female food purchase decision makers. Afterwards, it estimates the difference in prevalence of FI in the two populations and decomposes it into an explained and an unexplained part using Oaxaca Blinder decomposition. It is first attempt to explain, whether the difference in FI prevalence between the two categories of households mentioned above, arises from the group differences in observed characteristics like income, education, residential location, demography, etc., or from the way the two categories of households react differently to changes in these characteristics.

Descriptive statistics show that female group has better characteristics profiles in the context of FI. They are more literate, have smaller families, less poverty, and mostly urban areas residents that has diverse employment opportunities. Regression results show that though different characteristics affect FI status of households almost the same way (same signs of coefficients), their contribution (size of marginal effects) to increasing or decreasing risk of FI is different in the two populations. The risk of FI is lower among households where women decide food purchases compared to households where food purchases are made by men. Poverty, illiteracy, larger family size, aging of household head and his/her disengagement with agriculture sector increases chances of FI in both populations. Decomposition results show that if male groups' characteristics profiles are improved in a way that they reach at least to female groups level, more than half of FI gap (58.05%) between two categories of households would reduce. So, we conclude that if the group difference in higher education attainment, poverty, household size, agricultural employment of household head and region-specific factors like prices is reduced, FI gap would shrink between the two population groups. Detailed decomposition results show that upgrading male group's characteristics profiles for these characteristics will reduce FI prevalence in this group. Though it is difficult to fully comprehend the impact of behavioral differences between two groups of households, they explain significant part of FI gap between these populations.

Our analysis show, that both the differences in observed characteristics and behavioral responses/differential impacts of characteristics in the two populations offer useful insights to explain group difference in FI. Therefore, in designing FS policies, group specific incentive structure might produce better results compared to homogenous incentives for both groups. Overall, we observed that female participation in food purchase decisions is higher in households with better socioeconomic profiles. Promoting female participation in decision making among households that have relatively lower socioeconomic profiles, could be useful to reduce their vulnerability to FI. At the same time, it is important to assure that women in these households are well equipped to make right choices. Otherwise, they must be educated about family health and food choices. Significant portion of group difference which is attributed to unexplained part particularly intercepts, calls for further exploration into omitted variables and factors that are unobservable but relevant for FI status of household.

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Appendix

Table A1: Pairwise correlation between explanatory variables

	Head Education 12 years or above	Mother Education 12 years or above	Poverty	Age of head (30 years or above)	Household size	Head employed in Agriculture	Urban	Punjab	Sindh	KPK
Head Education 12 years or above	1.00									
Mother Education 12 years or above	0.33	1.00								
Poverty	-0.15	-0.13	1.00							
Age of head (30 years or above)	0.04	-0.01	-0.01	1.00						
Household size	-0.01	-0.03	0.20	0.13	1.00					
Head employed in Agriculture	-0.10	-0.08	0.04	0.01	0.08	1.00				
Urban	0.17	0.17	-0.17	0.04	-0.01	-0.35	1.00			
Punjab	-0.04	0.07	-0.17	0.02	-0.11	0.00	0.00	1.00		
Sindh	0.05	-0.01	0.01	-0.01	-0.02	0.02	0.05	-0.45	1.00	
KPK	0.01	-0.03	0.04	-0.02	0.11	0.00	-0.02	-0.48	-0.28	1.00
Baluchistan	0.00	-0.05	0.19	0.01	0.05	-0.03	-0.03	-0.33	-0.19	-0.21
Source: Author’s Calculations										

Table A2: Logit Regression Output for Total Sample

	Model 1	Model 2	Model 3	Model 4
Constant	-1.7089*** (0.0000)	-1.6925*** (0.0000)	-3.1424*** (0.0000)	-3.1123*** (0.0000)
Female Food purchase decision maker	**-0.4901*** (0.0000)**	**-0.4871*** (0.0000)**	**-0.4035*** (0.0000)**	**-0.4031*** (0.0000)**
Head Education 12 years or above	-1.8143*** (0.0000)	-1.5873*** (0.0000)	-1.1437*** (0.0000)	-0.9520*** (0.0000)
Mother Education 12 years or above		-1.7219*** (0.0000)		-1.3044*** (0.0000)
Poverty			2.6730*** (0.0000)	2.6462*** (0.0000)
Age of head (30 years or above)	0.1064** (0.0312)	0.0873* (0.0783)	0.1794*** (0.0011)	0.1663*** (0.0025)
Household size	1.2934*** (0.0000)	1.3075*** (0.0000)	0.7723*** (0.0000)	0.7831*** (0.0000)
Head employed in Agriculture	-0.4007*** (0.0000)	-0.4027*** (0.0000)	-0.2612*** (0.0000)	-0.2617*** (0.0000)
Urban	0.5869*** (0.0000)	0.6327*** (0.0000)	1.4080*** (0.0000)	1.4338*** (0.0000)
Sindh	-0.1513*** (0.0048)	-0.1729*** (0.0014)	-0.4206*** (0.0000)	-0.4337*** (0.0000)
KPK	-1.1141*** (0.0000)	-1.1364*** (0.0000)	-1.5828*** (0.0000)	-1.5971*** (0.0000)
Baluchistan	0.0225 (0.7179)	-0.0070 (0.9106)	-0.5627*** (0.0000)	-0.5776*** (0.0000)
Survey year (2018/19 equal 1)	-1.5187*** (0.0000)	-1.5102*** (0.0000)	-0.9633*** (0.0000)	-0.9603*** (0.0000)
Observations	21090	21090	21090	21090
Pseudo R^2	0.13	0.14	0.29	0.29
Count R^2	0.82	0.82	0.84	0.84
AIC	17541.45	17423.44	14379.53	14326.69
BIC	17636.93	17526.88	14482.97	14438.08

Source: Author's calculation; cell value are marginal effects at means (p-values), "***" p-value<0.01, "**" p-value<0.05, "*" p-value<0.10

Table A3: Oaxaca Blinder Decomposition for Logit regression

	Average	***Pooled***
Overall Decomposition		
Due to Characteristics (Explained)	56***	66.38***
Due to Coefficients (Unexplained)	44***	33.62**
Detailed Decomposition		
Due to Characteristics		
Head Education 12 years or above	-3***	-1.67
Mother Education 12 years or above	28***	24.55***
Poverty	385***	305.04***
Age of head (30 years or above)	-3**	-3**
Household size	64***	54.46***
Head employed in Agriculture	-15**	-12.72***
Urban	-74***	-60.17***
Punjab	2*	-214.69***
Sindh	-59*	16.84***
KPK	-274***	-120.02***
Baluchistan	-87**	10.21**
Survey year (2018/19 equal 1)	92**	67.53***
Due to Coefficients		
Head Education 12 years or above	3	3.2
Mother Education 12 years or above	5	3.54
Poverty	-13**	-11.09*
Age of head (30 years or above)	-33*	-30.74
Household size	-41*	-37.79
Head employed in Agriculture	0	-0.32
Urban	-23***	-21.41**
Punjab	-1	12.84
Sindh	-31***	-16.16***
KPK	-3	4.81
Baluchistan	-3	-0.34
Survey year (2018/19 equal 1)	-95***	-91.36***
Constant	279***	2.18***

Source: Author's calculation. Cell values are percentages of overall group difference which adds up to 100. "***" p-value<0.01, "**" p-value<0.05, "*" p-value<0.10