Research Article

Determinants of Livestock Farm Household's Welfare with Main Focus on Women's Involvement in Livestock Production in Rural Areas of District Mardan Khyber Pakhtunkhwa, Pakistan

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Abstract | This study was carried out in district Mardan of Khyber Pakhtunkhwa to investigate determinants of welfare of livestock farm households with special reference to women's participation in livestock farming. A multistage sampling technique was used to collect a sample of 274 livestock farm households from six union councils of district Mardan. Data were collected through face to face interviews from female members of the selected livestock farm households in 2015-16. Data were analyzed by ordered logit model to determine factors affecting households welfare, measured as daily per capita income level. Variables, such as income generating individuals, milking animals, women participation in livestock farming, education level of the head, age of the head and agricultural land holding of the household, were used as explanatory variables in the model. Results of ordered logit model showed that education level of the head, numbers of income generating individuals, land holding, number of milking animals, women involvement in livestock farming, access to agricultural credit had positive significant effects on household's probability to be in the upper income category. Based on the findings, study recommends that the significance of women participation for growth in livestock industry should be recognized in government plans and policies. Non-government organization, working for rural development, should be involved in provision of credit and livestock training facilities to rural women and encourage them to participate in livestock production and management. Access to credit will empower women in making pertinent livestock management decisions. Success of livestock venture will support rural economy and improve overall well being of everyone involved.

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Introduction

According to (Hashmi et al., 2007) crops and livestock were the main source of income for rural household because it adds a share of 69 percent to their monthly income. Women are involved in livestock farming and contribute to their family income (Aujla and Hussain, 2015; Khan and Khan, 2015; Borkar et al., 2017). Increase involvement of women in livestock activities not only increased income from livestock operations but also helps to reduce poverty. A comparison of low and high income farmers revealed that besides crop production, maintaining livestock was the key to reduce poverty.

Livestock is a dependable source of food as well as steady income. Reasonably sized livestock operations provide employment opportunities in rural areas where such opportunities are scarce and support local and national economy. Successful livestock operations are

a reliable source of foreign exchange. For low income farmers, livestock offer a number of benefits such as liquid cash, means of transportation, and organic matter for crops. Farmers utilize livestock to plough fields and use manure to improve soil fertility. Dried manure is used as a source of energy for burning to cook meals and keep warm. Farmers use milk and milk derived products from their livestock, eat their meat, and sell cow hides for cash are among many other benefits farmers take advantage of by maintaining a healthy livestock. Rural women participate in livestock management by performing tasks such as cutting fodder, cleaning barns, and milking. Such tasks are considered extra work for women besides other routine chores. (Garcia et al., 2003).

The affluence and development of a nation depends on the position and development of its females, as women not only represent nearly half of its population but also positively influence the expansion of remain half of the population. Women in rural areas play significant role in various farming activities in many countries of the world. Women perform approximately all types of tasks in agriculture and livestock sector in rural areas. They also face many constraints while performing these tasks because they are also having to perform regular household activities. In Pakistan, majority of population live in the rural areas where major source of income depends directly or indirectly on crop production and livestock management. Rural women in Pakistan are among the millions of landless small farmers (Zahoor et al., 2009).

The purpose of this study is to investigate determinants of welfare of livestock farm households with special reference to women's participation in livestock farming.

Limited literature was available on livestock farming in district Mardan, a relatively detail baseline survey was carried out in Mardan, and the data was collected to find out and to investigate livestock farm household welfare from the sample data of 274 farmers.

Materials and Methods

Study area and sampling technique

A multistage sampling technique was used for selecting the sample. In the first stage two tehsils namely Mardan and Katlang of district Mardan were selected for having maximum number of livestock farms. Each tehsil was further divided into urban and rural union councils (UCs) and three rural UCs were randomly selected from each. In the final stage, households in each selected union council were divided into livestock farmers and others. Households from livestock farming were selected randomly. A total of 274 households were selected, and number of households from each union council was selected based on Yamane's formula (Yamane, 1967).

$$S = N/(1 + N(e^2) \ldots\ldots (1)$$

Where;
S= Sample size; N= Total number of livestock farm households in selected UCs; e= Precision which is set at 6% (0.06).

Data collection

A well-designed questionnaire was used to collect data from the selected farmers using face to face interview. Efforts were made to keep it simple and explicable so as to capture all the essential information.

Data analysis

Determinants of livestock farm household's welfare: To measure livestock household's welfare and analyze the effect of different policy tools on household's welfare, economists use utilitarian approach. Utilitarian approach uses indirect/ maximum utility function for measuring changes in household's welfare/ satisfaction from the direct or indirect consumption of goods and services or changes in income (Nicholson and Snyder, 2012; Hal and Varian, 2005).

Any change in household's income changes their welfare (measured with indirect/ maximum utility function v(P,Y). Mathematically.

$$\Delta U = v(PY_1) - v(P, Y_0)$$

Where;
ΔU = change in household's welfare; V = is the household's indirect/ maximum utility function; Y0 = is the initial income level; Y1 = is the new income level; P = price vector for goods and services consumed by the household.

Welfare theory reports direct relationship between household's welfare and their income level (Nicholson and Snyder, 2012; Hal and Varian, 2005). Any increase

in household's income leads to rise in their welfare. This positive relationship allows economists to use household's income level as a proxy variable for their welfare (Slesnick and Daniel (1998)).

In this study income was taken as proxy variable of welfare status of the livestock farm household. Livestock are known to play important role in the welfare of rural families by providing food, income, and materials to use as bio fuel. Based on poverty line, used by the United Nation and the World Bank, livestock farm households were divided into the following four categories.

Following studies conducted by Samman and Santos (2013) and Geda et al. (2005) an ordered logistic regression model was used to identify important determinants of livestock farm household's welfare. Income categories were used as dependent variable to investigate the effect of the following important explanatory variables (X).

Table 1: *Income categories of household.*

Income category	Daily per-capita income (Pak. Rupees)	Daily per capita income (US dollars)
1	= < Rs.100	= < $1.00
2	Rs.101 - Rs.200	$1.10 - $2.00
3	Rs.201 - Rs.300	$2.10 - $3.00
4	> Rs.300	> $3.00

Source: *Survey data (2015-2016)*

Income generating individuals (numbers); Agricultural land holding (in acres); Milking animals (numbers); Women participation in livestock (time given to the livestock activities); Credit access (dummy 1 = Yes, 0 = No); Household head status (education and age in years).

In ordered logit, an underlying score is estimated as a linear function of the independent variables and a set of cut points. The probability of observing outcome i corresponds to the probability that the estimated linear function, plus random error, is within the range of the cut points estimated for the outcome:

$$\text{"}Pr(outcomej = i) = Pr(Ki{-}1 < x\beta + u \leq Ki) = (1 / (1 + exp(-K_i + x\beta))) - (1 /(1 + exp(-K_{i-1} + x\beta)))\text{"}$$

u_j is assumed to be logistically distributed in ordered logit; In either case, we estimate the coefficients β_s together with the cut points K_1, K_2, ..., K_{k-1}; where, k is the number of possible outcomes. K0 is taken as $-\infty$, and K_k is taken as $+\infty$. The model was estimated using maximum likelihood estimation approach.

Binary and Interval regression models were also used to double check for important determinants of households' welfare determinants (for more details see Green, 2010). Both models were estimated using maxi category. The coefficient value mum likelihood estimation method.

Results and Discussion

Estimated ordered logistic model results

In the ordered logistic regression analysis, households monthly income order (1,2,3,4) was used as dependent variable and income generating individuals (IGI), milking animals (MA), women involvement in livestock production (WI), education level of the head (HEDU), age of the head (HAGE), and agricultural land (AL) of the household were used as independent explanatory variables. Results from maximum likelihood estimation are given in Table 2. Details on the estimated coefficients and their significance are discussed below.

Table 2: *Estimated determinants of welfare through ordered logistic model.*

Variables	Ordered logit model	
	Coefficients	Z value
Income generating individuals	0.618	5.120
Milking animals	0.226	2.650
Women's participation	0.148	2.360
Land holding	0.066	3.860
Access to credit	1.231	3.340
Head education	0.015	0.630
Head age	-0.001	-0.060
Constant		
LR chi2(7)		92.660
Prob> chi2		0.000
Pseudo R2		0.127
/cut1	1.516	
/cut2	3.572	
/cut3	4.903	

Income generating individuals (IGI): Result showed that IGI had a positive and significant that households having more working individuals were more likely to be in high income category. This was

consistent with prior expectation.

Milking animals (MA): As expected MA had positive significant effect on household's income. Greater the numbers of milking animals will yield in greater total income. The coefficient value indicates an increase in milking animals by one would rise the logit in favor of the high income by 0.21while the other variables in the model are held constant.

Women involvement in livestock production (WI): The coefficient value for women participation was positive and significant. This result implies that WI had positive and significant effect on household's probability for high income category. The coefficient value obtained means that an increase in women participation by one hour would raise the ordered logit of being in higher income category by 0.15, holding other variables constant.

Agricultural land (AL): As expected, AL had a positive and statistically significant coefficient. Households having more agricultural land are likely to be in high income category. This was consistent with prior expectation.

Access to credit (CA): CA has a positive and significant coefficient, indicating that households having access to agricultural credit were likely to be in high income category. This was consistent with prior expectation.

Education of the head (HE): Education of the head is another important determinant of household's income. The positive coefficient of 0.01 indicates that a one unit increase in head education level would result the order logit in favour of high income category by 0.01 while the other variables in the model were held constant.

Head age (HA): The estimated coefficient was positive but statistically insignificant.

Explanatory variables such as income generating individuals, milking animals, women participation, agricultural land holding and access to agricultural credit had positive significant effects on household's welfare. These results were consistent with ordered model results. The estimated probability was 0.38 means that the probability of households to be in upper welfare category (having more than Rs. 200 daily per capita income) is 38 percent.

LR test

LR test was used to measure the goodness of fit for binary logit, ordered logistic model, and interval regression model. The estimated likelihood ratio test statistics were statistically significant with P-values of 0.00, for all the three models, suggesting strong explanatory power of these models.

Prediction with ordered logit model

Prediction with cut values: To find out the income (welfare) category of a household the data on the explanatory variables are placed in the estimated model and the outcome was compressed with cut values given at the bottom of the Table 2.

Cut1: is the estimated cut point on the latent variable used to differentiate the first income category from the other three categories. A value of 1.54 or less on the underlying latent variable that gave rise to income variable would be classified first income category.

Cut2: is the estimated cut point on the latent variable used to differentiate second category of income from 1st, 3rd and 4th categories when values of the predictor variables are evaluated at zero.

Cut3: This is the estimated cut point on the latent variable used to differentiate third category of income from 1st, 2rd and 4th categories.

Estimated probabilities

Table 3 shows the predicted probability for livestock farm household for each category of income. Results show that the most likely income categories are 2nd and 1st with probabilities of 0.38 and 0.24. These estimated results were consistent with percentages of households in different income categories given in Table 1.

Table 3: *Predicted probabilities of ordered logit model.*

S.No	Probability	Value
1	P1 (= < $1.00)	0.24
2	P2 ($1.01 - $2.00)	0.38
3	P3 ($2.01 - $3.00)	0.19
4	P4 (> $3.01)	0.17

Conclusions

Based on ordered logit model it was concluded that head education level, number of income generating individuals, number of milking animals, access to credit and more women involvement in livestock

have positive significant effects on farm household's income (welfare).

Recommendations

Based on results it is recommended that provision of low interest agricultural credit for adoption of more productive buffalo and cow breeds should be insured. Significance of women participation in livestock industry growth should be recognized. Government should develop plans and policies to encourage women develop women roles in livestock management operations.

Author's Contribution

Neelum Andaleeb: Conducted the research as part of Ph.D.
Munir Khan: Supervisor of first author's Ph.D.
Syed Attaullah Shah: Helped in data analysis
Rahmat Ullah: Helps in data collection and composing.

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