Research Article

Role of Child Labor in Agriculture Sector of District Mardan (Pakistan): A Multinomial Logistic Regression Analysis

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Abstract | This study investigated child work in the agricultural sector of district Mardan, Pakistan. Data collected from a sample of 275 farm households, and the involvement level of their children in agriculture was quantified over three points Likert scale (*Never involved*, *Part-time involved* and *Full-time involved*). Data analysis revealed that 34.7 percent of children of the sampled farm households were full-time involved and 41.9 percent were part-time involved in different agricultural activities. The most frequent of them were animals grazing, fodder cutting and carrying, crops weeding, harvesting and firewood collection. Multinomial Logistic analysis revealed that a child's age, gender(male) and school distance (more than walking distance) were found positively associated with a child's involvement in agriculture. Household characteristics, such as head's education, monthly income and ownership of agricultural land were important negatively affecting the determinants of child involvement in agriculture. The study recommended forceful control of child labour in agriculture and ensuring their access to free education through an increasing number of government schools in rural areas. Traditional agriculture is labour intensive, provision of interest-free formal credit for the adoption of modern technologies could reduce demand for labour.

Introduction

Children are the future of a nation and humankind. Their protection from mental, social and physical hazards is very important for the prosperity and progress of a nation. Unfortunately, a large number of children all over the world are forced to work and exploited as cheap commodities when it is the time for them to acquire knowledge, skills, personal worth and values to become good citizens.

Throughout the world, about 218 million children of age 5-17 years are engaged in employment (excluding children involvement in domestic activities) and almost 73 million works in hazardous conditions.

Around 152 million are victims of child labour, out of the 88 million are boys and 64 million are girls and 42 million (28%) are 12-14 years old (ILO, 2012-2016). In the agriculture sector, 98 million (60 %) children are employed in livestock, farming, fishing, forestry and aquaculture throughout the world.

In agriculture, children involvement is a serious issue that is harming this sector by perpetuating rural poverty and also forces children to work hard for long hours thereby limiting their ability to develop skills and attend a school which later on deprive them of productive employment opportunities (ILO, 2017). Farmers mostly employ children due to shortage of capital intensive technology and usage of labour-

intensive technology or due to a shortage of adult labour on peak season.

Pakistan being a feudal country, a large number of children are compelled by their parents to work for money, or they work to pay off the debts of their parents. They also work on family farms as non-wage earners. They are engaged mostly in cleaning, cooking, rearing livestock, taking care of younger siblings, fetching water from far sources and gathering wood for cooking. However, a large number of children work for wages which is the worst form of children employment.

The GoP (2007-08) reported that 21 million children are involved in child labour in Pakistan in which 73% are boys, and 27 % are girls. GoP (2014-015) shows that more than 12.5 million children of age 10-14 years are involved in different working activities in which 61% are boys. Seventy percent of children are found unpaid family workers, 23 percent of employees and 7 percent are self-employed (Jillani and Jillani, 2000).

To address the issue of working children in Pakistan, several initiatives and legal framework have been created which includes (1) The Employment of Children Act, 1991 (2) The Bonded Labor System Abolition Act, 1992. (3) The Factory Act, 1934 (4) Mines Act, 1935. Under the Benazir Income Support Program, the GoP (2007) provided the framework for cash transfers. In selected districts, Pakistan Bait-ul-Maal has initiated child cash transfer program to poorest families. Article 11, section 3 of the constitution states "No child below the age of fourteen years shall be engaged in any factory, or mine, or any hazardous employment.

This study is carried out with the objective to investigate children involvement in agriculture and identify its determinants in Khyber Pakhtunkhwa province of Pakistan. Only a few studies have investigated this problem. Review of relevant studies in other developing countries reveals that the use of traditional production technology in agriculture is labour intensive. Therefore, to produce at low cost, farmers engage their family members and children. Rodgers and Standing (1981) and Majumdar et al. (2001) reported that children participation would be common in those economies where production techniques are labour intensive as compared to

economies having capital intensive production techniques. Fafchamps and Wahba (2006) examined children involved in the agricultural sector in Nepal with special emphasis on urban proximity. They found that children who reside in or near urban areas are more likely to attend school. Urban proximity is positively associated with parents' education, local wage rate and returns from agriculture which influence children involved in the agricultural sector. Kruger et al. (2007) found that higher school attendance and lower child work are associated with household wealth and high wages of parents. Kang (2012), Kotb et al. (2011), Lange (2009) and Owusu and Kwarteye (2008) found that age and gender of child and education of parents as significant determinants of children involved in agriculture.

Materials and Methods

Study area
The study was conducted in the Mardan district of Central Khyber Pakhtunkhwa. District Mardan was purposively selected because of a large number of rural households (252486 households reported in 2017 Census) and farmers in the region.

Geographically, the district is bounded by district Buner and Malakand Agency in the north, district Swabi in the east, district Charsadda in the west and district Nowshehra in the south. The whole district can be divided into two zones, i.e. south-western plain and north-eastern Hilly zones. The south-western plain area is the most fertile area of the province which is more suitable for farming. The total geographic area of the district is 398766 acres in which 249942 acres are cultivated, and 52822 acres are uncultivated (GoKP, 2013-14).

Sampling
There are three tehsils in Mardan district-Katlang, Takhtbhai and Mardan. Out of them, tehsil Mardan is purposively selected for having a maximum number of farm households. The selected tehsil is divided into rural and urban Union Councils (UCs), and four rural UCs were randomly selected. A random sampling technique was used to select a sample of 275 rural households from selected UCs.

Data collection and analysis
A well-structured questionnaire was used to collect data from selected households in summer 2018.

Households were interviewed face to face for data collection.

Descriptive statistics, such as mean, percentage and frequency were estimated over the data set (Tables 2 and 3).

A Multinomial Logistic model was used to estimate child involvement is agriculture and identify its determinants. The model estimated the child involvement level (Y: a categorical variable) as a function of household-specific, child-specific and area-specific characteristics (X).

$$Y = f(X)$$

Child involvement in agriculture can be categorized into the following three levels:
1. Never involved (y = 1)
2. Part-time involved (y = 2)
3. Full-time involved (y = 3)

For this setup, the multinomial logistic model corresponding to each outcome is:

$$\Pr(y = 1) = \frac{e^{X\beta^{(1)}}}{e^{X\beta^{(1)}} + e^{X\beta^{(2)}} + e^{X\beta^{(3)}}}$$

$$\Pr(y = 2) = \frac{e^{X\beta^{(2)}}}{e^{X\beta^{(1)}} + e^{X\beta^{(2)}} + e^{X\beta^{(3)}}}$$

$$\Pr(y = 3) = \frac{e^{X\beta^{(3)}}}{e^{X\beta^{(1)}} + e^{X\beta^{(2)}} + e^{X\beta^{(3)}}}$$

Where Pr is the probability of involvement in a given category; X is a vector of variables affecting probability and e is the natural base of logarithms. The model consists of 3 sets of coefficients, $\beta^{(1)}$, $\beta^{(2)}$, and $\beta^{(3)}$. To estimate the model, one category is selected as a reference category, and the coefficients for other categories are estimated in reference to the coefficients for base categories which are assumed zero (= 0). That is, if set $\beta^{(1)} = 0$, the remaining sets of coefficients, $\beta^{(2)}$ and $\beta^{(3)}$, measure the change relative to the y = 1 group. We assumed $\beta^{(1)} = 0$; thus the given equations become

$$\Pr(y = 1) = \frac{1}{1 + e^{X\beta^{(2)}} + e^{X\beta^{(3)}}}$$

$$\Pr(y = 2) = \frac{e^{X\beta^{(2)}}}{1 + e^{X\beta^{(2)}} + e^{X\beta^{(3)}}}$$

$$\Pr(y = 3) = \frac{e^{X\beta^{(3)}}}{1 + e^{X\beta^{(2)}} + e^{X\beta^{(3)}}}$$

The relative probability of y = 2 to the base outcome is

$$\frac{\Pr(y = 2)}{\Pr(y = 1)} = e^{X\beta^{(2)}}$$

Results and Discussion

Socio-economic characteristics of the households
Summary statics for the socioeconomic characteristics of the sampled households are given in Table 2. The household size was on average, six individuals, and they were headed mostly by male individuals. Statistics for heads characteristics reveals that they were on average, 46.69 years old, and most of them were uneducated. Their mean education was around the primary level (5 years). Agriculture was the main source of income for 82 percent of the households. Their total household income was on average, 24167 Pakistani rupees (PKR) per month.

Table 1: *Total population and sampled households.*

Tehsil	Union council	Total farm households	Sampled farm households
Mardan	Bakhshali	6511	67
	Gujrat	5439	56
	Gujar Garhi	7009	73
	Rustam	7613	79
Total	4UCs	26572	275

Data source: *Government of Khyber Pakhtunkhwa 2016-2017; Yamane's (1967) formula was used to decide the sample size of 275 from selected UCs; Proportional Allocation Sampling technique was employed to select farm households from each UC.*

Table 2: *Household characteristics.*

Variable	Mean	Std. Dev.	Min	Max
Head's age (years)	46.69	6.59	30	66
Head's occupation as agriculture	82 %	38.5	0 %	100 %
Head's education (years)	4.64	4.27	0	14
Total monthly income (PKR)	24167	19446.32	7000	140,000
Household size (Individuals)	5.98	1.53	3	11

Source: *Survey data (2017-2018).*

Children characteristics
Out of the total interviewed children (510), around 63.53 percent were male, and 36.47 percent were female. They were in the range 5-14 years old; however, most of them (67.65 percent) were 10-14 years of age.

Table 3: *Children characteristics.*

Characteristic	Specification	Frequency	Percent
Gender	Male	324	63.53
	Female	186	36.47
Age group	5-10 years	165	32.35
	10-14 years	345	67.65
Educational status	Enrolled	303	59.41
	Dropped Out	130	25.49
	No Admission	77	15.10
School distance	Less than 5 km	320	62.75
	More than 5 km	190	37.25

Source: *Survey data (2017–2018).*

Table 3 shows that 59.41 percent of the surveyed children were enrolled in school 25.49 percent were dropped out, and only 15.10 percent were not admitted. In addition to this, 62.75 percent of children had their schools located within 5 km of their homes. Distance to school is considered an important factor affecting a child enrolment in school, especially for the female in rural areas.

Involvement in agricultural activities

On the basis of discussion with sampled households, different activities were identified in which they involved their children. They included: grazing of animals, fodder cutting and carrying, feeding, harvesting, ploughing, weeding and firewood collection. To find out children' involvement in these activities, three points Likert scale was used (1 for never involved; 2 for part-time involved; and 3 for the full time involved). Simple descriptive statistics were calculated to analyze the data. Results reveal that children of the sampled households were mostly involved in firewood collection, fodder cutting, feeding and grazing of their livestock.

Multinomial logistic regression analysis

As recommended by Long and Freese (2006), MLM was used. To estimate the multinomial logistic regression for children involved in agriculture, the never involved category was taken as a base category, and the coefficients for other categories were estimated by using statistical analytical software, STATA.

Post estimation tests

Model's prediction power: Pseudo R^2 showed that the explanatory variables explain 68 percent variation in the dependent variable. However, it is not considered a good indicator of the prediction power of the model.

The goodness of fit test

Likelihood Ratio Test (LR test) was used to test the goodness of fit for the estimated model. The estimated Chi^2 value is 749.45, and the associated p-value is 0.000, indicating that the combined effect of all the independent variables is statistically significant in explaining children involvement in agriculture.

Multicollinearity test

Correlation matrix was constructed for all the explanatory variables used in the model. The estimated correlation values between the explanatory variables are less than 0.8, which shows that there is no association among the explanatory variables.

Correlation matrix

Child Gender	| 1.0000
Distance to School	| 0.0119 1.0000
Child's age group	| 0.1896 0.5155 1.0000
Farming Occupation	| -0.0116 0.2138 0.1552 1.0000
Head's Education	| -0.0807 -0.5645 -0.4443 -0.4064 1.0000
Land Ownership	| 0.0564 0.1350 0.0752 0.4504 -0.1926 1.0000
Income	| -0.1580 -0.3236 -0.3989 -0.1656 0.3938 -0.0948 1.0000

Determinants of child involvement in agriculture

The estimated coefficients for child gender are positive and statistically significant. As child gender is a dummy variable (1 for male and 0 for female), these results confirm that male children of farm households, as compared to female, are likely to be involved in full-time and part-time agricultural activities with reference to base category of never involved. This is consistent with prior expectation as female are mostly involved in household chores. In district Mardan, social and cultural boundaries are defined for girls beyond which they are not allowed to work.

Boys work outside and meet the basic needs of the family, whereas girls are bound to household duties. Similar results were reported by Lange (2009), Adeoti et al. (2013), Kotb et al. (2011) and Adisa (2016) where male children participation was more in agricultural activities.

Distance to nearby school is another dummy variable (1 if more than 5 kilometers, 0 otherwise). Its estimated

coefficients for 'full-time' and 'part-time' involvement in agriculture, with reference to the base category of 'never involved', are positive and significant. These positive and significant associations reveal that a child involved in agriculture increases if his distance to a nearby school is high (more than 5 kilometers). This is consistent with prior expectation as children do not attend school when there is a large distance between the school and home. As children get older and complete a certain level at one school, they cannot access another grade level at other schools due to a large distance. Therefore, they are compelled to leave school prematurely and engage in other activities. Moreover, religious schools where children study the Quran in the house of a neighbour are the only form of education for girls in remote rural areas. Fafchamps and Wahba (2006) also reported that children whore side in or near urban areas, and there is less distance from school; their probability is less to be involved in agricultural activities.

Head's education level (schooling years) is an important determinant having a negative association with a child involvement in 'full-time' and 'part-time' agricultural activities, as indicated by its negative and significant coefficients. As education of a household head increases, their children involved in agricultural activities reduces because more educated household heads want their children to go school and get an education to earn higher grades, have better social skills and improved behaviour and play an important role in prosperity and progress of a nation. These results are consistent with the researcher's prior expectation and with the findings of Ofuoku *et al.* (2014) and Abou (2014).

The estimated negative and significant coefficients for farmland ownership categorical dummy variable (1 if the owner of the farmland, 0 otherwise) indicates that children of farmland owners are less involved in agriculture as compared to others. In other words, tenant farmers have high chances of their children involvement in 'full-time' and 'part-time' agricultural activities. These results are similar to findings of Cingo and Rosati (2006), who reported that households' ownership of land is considered as a proxy of income, thereby reduces children participation in agricultural activities.

Farm household's income level is a categorical variable differentiating farm households into lower-income, average income and high-income categories. The estimated coefficients for a high-income category are consistently negative and statistically significant for full-time and part-time involvement which reveals that farm household children in this category don't participate in agriculture as compared to those in average and low-income categories. Households having a low income cannot afford the cost of schooling, i.e. yearly admission fee and uniform cost although books are provided free by the government. This is consistent with prior expectations as the income of a household increases, their children's involvement in agriculture activities reduces. These results are similar to the studies conducted by Ofuoku *et al.* (2014), Edet and Etim (2014) and Abou (2014).

Child's Age Level (1 if child's age is above 10, otherwise 0) has a significant positive effect on a child's part time involvement in agriculture as compared to the reference category of never involved. Farmers' children above ten years of age are most likely involved in part time agriculture, and this is consistent with findings of Fasina and Adekoya (2010), investigated the association between child's age and his labour work.

Age of the head and farm household size has no significant effect on their children involved in agriculture. This is consistent with the study conducted by Friedrich and Huebler (2008). Farming occupation also has no significant effect on children involved in agriculture.

Table 4: *Children involved in different agricultural activities.*

Activity	Total children	Children Involved		Involvement level	
		Frequency	Probability	Part-time	Full time
Wood collection	510	357	70.0 %	48.6 %	21.4 %
Fodder	510	257	50.4 %	31.8 %	18.6 %
Feeding	510	251	49.2 %	27.8 %	21.4 %
Grazing	510	249	48.8 %	32.0 %	16.9 %
Weeding	510	153	30.0 %	18.8 %	11.2 %
Ploughing	510	138	27.1 %	16.7 %	10.4 %
Harvesting	510	137	26.9 %	13.1 %	13.7 %

Source: *Survey data.*

Predicted probabilities
Table 5 shows the predicted probabilities for a child's involvement in agriculture at three different levels. These probabilities were predicted using the estimated

multinomial logistic model and values of all the explanatory variables at an average level. On average, the highest probability was predicted for the part-time involved category, which was 0.419. It reveals that in the study area, the probability of involvement for a farm household's child in part-time agriculture is 41.9 percent. In other words, 41.9 percent of the children in farm households in the study area were involved in part-time agriculture.

Table 5: *Multinomial logistic regression results.*

Categories	Variables	Coef.	Std.Err	Z	P>Z
Full-Time	Gender of Child	2.348	0.626	3.75	0.00
	School Distance	5.443	1.177	4.62	0.00
	Age Group	18.129	682.288	0.03	0.98
	Age of Respondent	0.005	0.050	0.10	0.92
	Farming Occupation	0.906	0.898	1.01	0.31
	Education	-0.823	0.099	-8.33	0.00
	Household Size	0.100	0.211	0.48	0.63
	Land Tenancy Status	-1.772	0.737	-2.40	0.02
	Income Level (Average)	-0.501	0.791	-0.63	0.53
	Income Level (High)	-4.656	1.029	-4.52	0.00
	Constant	-15.194	682.294	-0.02	0.98
Part-Time	Gender of Child	1.734	0.383	4.53	0.00
	School Distance	1.169	1.066	1.10	0.27
	Age Group	2.310	0.408	5.66	0.00
	Age of Respondent	-0.038	0.030	-1.26	0.21
	Farming Occupation	0.823	0.524	1.57	0.12
	Education	-0.298	0.056	-5.33	0.00
	Household Size	-0.051	0.122	-0.42	0.68
	Land Tenancy Status	-0.982	0.481	-2.04	0.04
	Income Level (Average)	-1.659	0.466	-3.56	0.00
	Income Level (High)	-2.502	0.435	-5.75	0.00
	Constant	4.132	1.767	2.34	0.02

LR Chi² = 749.45; Prob>Chi² = 0.000; Pseudo R² = 0.686

Similarly, the predicted probability of involvement for a farm household's child in full-time agriculture is 34.7 percent. It means 34.7 percent of the children in farm households in the study area were involved in full-time agriculture. The aggregation of these two categories indicates that 76.6 percent of the children in farm households were involved in agriculture, and this portrays a shocking situation in the study area.

Marginal effects

Child's gender: A child's gender has a significant effect on his probability of involvement in agriculture

at different levels. As indicated by the estimated results, its marginal effects are statistically significant for a child's probability of involvement in 'never' and 'part-time' categories. As Child gender was used as a dummy variable (1 if male, otherwise 0), the negative marginal effects for 'never' and 'part-time' involved indicate that the probability for a male child's involvement in any of these categories is less by the respective estimated value as compared to a female child. The ME for the full-time involved category is positive but statistically insignificant.

Table 6: *Predicted probabilities for child involvement in agriculture.*

Child involvement	Mean estimated probability	Std. Dev.	Min	Max
Never Involved	0.233 (23.3%)	0.345	0.000	0.989
Part Time	0.419 (41.9%)	0.381	0.001	0.981
Full Time	0.347 (34.7%)	0.432	0.000	0.999

Table 7: *Marginal effects for children's involvement in agriculture.*

Coefficients	Never involved		Part-time		Full-time	
	ME	P > |z|	ME	P > |z|	ME	P > |z|
Child's gender	-.104	0.000	.078	0.006	.026	0.188
Distance to nearby school	-.073	0.236	-.100	0.108	.174	0.000
Child's age group	-.150	0.778	-.492	0.986	.644	0.981
Head's age	.002	0.211	-.004	0.099	.001	0.292
Farming occupation	-.049	0.111	.045	0.290	.004	0.893
Head's education	.018	0.000	.003	0.394	-.021	0.000
Household size	.003	0.688	-.009	0.396	.006	0.385
Land tenancy status	.059	0.035	-.026	0.458	-.032	0.149
Average income household	.123	0.000	-.171	0.000	.047	0.081
High income household	.202	0.000	-.095	0.141	-.107	0.049

Distance to nearby school: The effect of distance to a nearby school on a child's probability of involvement for the 'never involved' and 'part-time involved' categories are statistically insignificant, whereas for the 'full-time involved' category, its value is positive (0.174) and statistically significant. The estimated ME of 0.174 reveals that a child's probability of involvement in full-time agricultural activities raises by 17.4 percent if his distance to nearby school is greater than 5 kilometers.

Head's education: The estimated ME for head's education is negative (-0.021) and statistically significant for full-time involvement in agriculture. It reveals that an increase in the head's education level by one year decreases his children's probability for full-time involvement in agriculture by 0.021. For 'never involved' category, the estimated ME is positive and statistically significant, which indicates that the head's education level and children's probability for never involved in agriculture are positively associated. More specifically, an increase in head's education by one year may increase children's probability for never involvement in agriculture by 0.018. For part-time involved, the estimated ME is statistically insignificant.

Land tenancy status: Farmland ownership has a positive and significant effect on children's probability of never involvement in agriculture. The probability of 'never involved' in agriculture for children of a farmland owner is high by 5.9 percent as compared to that for a tenant or owner-cum tenant.

Income category: As income was used as a categorical variable (low, average and high-income farm households), its positive and significant marginal effects for 'never' involved in agriculture reveals that increase in a household's income increases their children's probability for never involved in agriculture. In other words, the probabilities of 'never involved' in agriculture for children on average and high-income households, as compared to low-income households, are high by 12.3 percent and 20.2 percent, respectively.

For part-time and full-time categories, the estimated MEs are negative, and most of them are statistically significant. These results are consistent with the researcher's prior expectations and with findings of other research studies.

Conclusions and Recommendations

The study concludes that 76.6 percent of the farm children were involved in different Agricultural practices at different levels. Out of the children reported involved in agriculture, 34.7 percent are the full time involved, while 41.9 percent are the part-time involved. Mostly they are involved in grazing of animals, feeding, watering, milking, harvesting, threshing, weeding, ploughing, storage, firewood collection and spraying fertilizer. Regression analysis shows that child's age, gender and school distance are the most important determinants of their involvement in agriculture. Similarly, household characteristics such as education, income and land tenancy status are affecting children involvement in agriculture. Around 37% of children have limited access to nearby schools. This could be the main factor of children involved in the study area.

The well-being of a nation depends on children who are valuable human resources, and it is the responsibility of each individual to report anyone employing a child in the agriculture sector.

Agriculture is one of the dangerous sectors in terms of high risks and hazards. Tasks that do not age-appropriate and include high risk can harm health, education and personal development of a child. Furthermore, it was concluded that poverty is the root cause of children involved in agriculture. Low income and education of household head compel a child to engage in agriculture activities.

Based on findings from data analysis, the study recommends an increase in numbers of government schools in rural areas to ensure children access to free and quality education; provision of interest-free formal credit to the tenant and small farmers for adoption of labour efficient modern production technologies to indirectly reduce their children involvement in agriculture; and provide technical training on additional income-generating activities to cope with poverty.

Novelty Statement

Novelty of this research is the reduction and elimination of child labour specifically in agriculture sector. Further, this research study has given road map to policy makers to stop forceful control of child labour in agriculture and ensuring their access to free education through an increasing number of government schools in rural areas.

Author's Contribution

Sana: Principal author and Ph. D. scholar who conducted the research, collected and interpreted the data
Abbas Ullah Jan: Major superviser and provided technical guideline throughout the research.

Conflict of interest

The authors have declared no conflict of interest.

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