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Land Tenure System And Farm Productivity In Central Khyber Pakhtunkhwa, Pakistan

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Abstract: This research study attempted to investigate the impact of land tenure on sugarcane productivity between owner and tenant cultivators. A multi-stage sampling technique was employed in selecting the 250 (150 owners and 100 tenants) sugarcane cultivators. Data collections were by face-to-face interview schedules and data analysis involved, log-log regression Model as well as Chow test to estimate sugarcane productivity and differences in the production functions between owner and tenant cultivators. The findings revealed that sugarcane productivity is more prominent (10%) with the owner cultivators. The significant factors influencing the sugarcane productivity level of the owner cultivators were education (1%), fertilizers (5%), land size (5%), farm labor (5%), and irrigation (1%). while for the tenant cultivator, household size (5%), fertilizers (5%), land size (5%), farm labor (5%), and irrigation (1%) were the significant factors influencing productivity level. The dummy variable signifying farmer's tenancy status were the significant factors influencing productivity level. The Chow test confirmed differences in sugarcane productivity between owner and tenant cultivators. The Chow test confirmed differences in risk attitude between farmers with insurance and farmers without insurance.

Keywords: land tenure, Sugarcane productivity, Multistage sampling, Log-log Regression Model, Chow test

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1. INTRODUCTION

Land is the basis for physical development and constitutes the primary medium for food production, for the provision of shelter, and for the establishment of institutions to support the basic need of modern communities (Lasun, 2006). Land is the key factor for the economic growth, development of every nation, and source of livelihood in rural areas (Ukaejiofo, 2009). Land is a scarce resource and its distribution, as well as tenure arrangements, are observed as important issues in a nation's developmental strategy. Secure tenancy arrangement encourages the farmer to undertake productivity-enhancing investments. Pakistan has a long history of discriminatory access to land. Land tenure structures affect agricultural productivity by inducing the efficient use of inputs and application of modern technology.

In the present farming system of Pakistan, tenancy systems occupy a considerable percentage of socio-economic reasons which turn a farmer to be a tenant (Khan, 2008). According to Otsuka (2007) stated that household farming or owner cultivation is the optimum form of production organization in agriculture in the context of Asian countries. In contrast, tenant cultivation is widely believed to be inefficient because of the adverse effect of tenure insecurity on long-term investments as well as the disincentive effect of output sharing on work effort.

Although empirical literature on the effects of' land tenancy on agriculture productivity, the evidence remains different (Deininger et al., 2009; Otsuka and Hayami, 1988). For example, Shaban (1987) reported that tenant farmers decrease input use by about 32% and productivity by about 16%. Feder (1985) explored the influence of land ownership on farm productivity in Thailand, also found that farm productivity is significantly affected by the tenancy status of the farmers. Li et al. (1998) reported that the right to use the land for long periods reassures the use of land-saving investments in China. Banerjee & Ghatak (2004) indicated that tenancy laws that lead to better crop shares and higher security of tenure exercise positive effects on productivity. On the other hand, Arcand et al. (2007) found no significant difference in productivity between owner and tenant cultivators. Kassie and Holden (2007) show in their study on Ethiopia that tenant farmers may even be more productive than owner-cultivator because of potential exclusion threats by landlords. In their recent study on Pakistan, Jacoby and Mansuri (2009), show that trained tenants are more significantly productive than untrained ones, signifying the role of tenancy by observing the productivity differences between tenants and owners. This research study adds to the discussion on farmer's tenancy status and agriculture productivity, by investigating how different land tenure systems affect sugarcane productivity in central Khyber-Pakhtunkhwa, Pakistan.

2. OBJECTIVE OF THE STUDY

(i) To analyze the influence of land tenure on sugarcane productivity
(ii) To analyze the difference in production function between owner cultivators and tenants
iv) To analyze the difference in sugarcane productivity between owner cultivators and tenants

3. HYPOTHESES OF THE STUDY

H_1 : Land tenure system has a significant impact on sugarcane productivity
H_2 : There is a significant difference in production function between owner cultivators and tenants

H_2 : There is a significant difference in sugarcane productivity between owner cultivators and tenants

3. METHODOLOGY

3.1 Area of the study

Ecologically Khyber Pakhtunkhwa (KP) is divided into three regions namely Northern, central, and southern regions. The climate in the north is normal, moderate in the center while severe in the south region (Samreen & Amin, 2012). Charsadda and Mardan from the Central region constitute the study area for this research. These two districts have access to canal irrigation water channels and the soil is famous for sugarcane production.

3.2 Sampling and data collection

This study was based on primary data, collected from sugarcane growers in KP during crop season 2019, through face-to-face interviews with those farmers who were engaged in sugarcane production. The data was collected in the local language Pashto to understand the important factors. Therefore, the author visited every field and home of the households. In the survey, numeric data about tenancy status and socio-economic characteristics of the sugarcane growers were focused. For the present study, households were taken as a unit of analysis data and were collected at the household level from the head of farm households. A 20% sample was fixed due to human and financial constraints (Ali & Shafi, 2016). The study followed a multi-stage random sampling technique. In the first stage, the two districts namely Charsadda and Mardan were selected purposively from five districts. In the second stage, a random sampling technique was used to select three villages namely Aspandehri, Kamran Kalay, and Abazai from Charsadda and Saro shah, Mia Issa, and Pir saddi from district Mardan. Thus, the survey covered six villages. In the final stage, a sample of 250 sugarcane growers consisting of 150 owner cultivators and 100 tenant cultivators were properly divided into the above-mentioned villages through the proportional allocation method (Cochran (1977). shown in the following table I

Table 1: Village wise distribution of sampled sugarcane growers in the study area

Districts	Villages	Owner cultivators	Tenant cultivators	Both farms(20%)
Charsadda	Aspandehri	21	16	37
	Kamran Kalay	24	14	38
	Abazai	25	17	42
Mardan	Saro shah	29	18	47
	Mia Issa	26	19	45
	Pir saddi	25	16	41
Total		**150**	**100**	**250**

3.3 MODEL SPECIFICATION

To examine the impact of farmer's tenancy status and socio-economic characteristics on sugarcane productivity, the following log-log model was estimated by employing the ordinary least square method, separately for owner cultivators, tenant cultivators, pooled data, and pooled data with dummy variable (Ali et al., 2020b; Hussain, 2013).

$$\text{Log } Q=\log\beta_0+ \beta_1 D +\beta_2 \log FE+ \beta_3 \log HHS+ \beta_4 \log EXP+ \beta_5 \log FERT+ \beta_6 \log LS+ \beta_7 \log FL+ \beta_8 \log IRRI+ \epsilon \text{----------1}$$

Where Q = Sugarcane productivity (rupees/per acre), D = Dummy variable (1= owners and 0 = tenants), FE = farmers education (schooling years), HHS = Household Size (numbers), EXP = Experience (years), FERT = Fertilizes (amout of money spent in rupees per acre), LS = Land Size (acre), FL=Farm labour (manday/acre), IRRI= Irrigation (numbers), β_i =regression coefficient/ output elasticities of explanatory variables, β_0= constant/intercept and ϵ = error/disturbance term

3.4 Chow test for structural changes

The effect of farmers' tenancy status on the sugarcane productivity or differences in the production function between owners and tenant sugarcane cultivators was done by employing Chow's test**.** Following Ali et *al* (2020b), Sial *et al.*, (2012), who employed this model to examine the impact of a factor on two different categories of respondents, the Chow's test is given as follows:

a) Test for farmer's tenancy effect/difference in production function

$$F_C = \frac{(\sum E_3^2 - \sum E_2^2 - \sum E_1^2)/(K_3 - K_1 - K_2)}{(\sum E_1^2 + \sum E_2^2)/(K_1 + K_2)} \text{-------2}$$

Where:

$\sum E_1^2$ = Error sum of square for owner cultivators' production function;

$\sum E_2^2$ = Error sum of square for tenants' production function;

$\sum E_3^2$, = Error sum of square for the pooled data without a dummy variable;

K_1 = Degree of freedom for the owner cultivators' regression;
K_2 = Degree of freedom for the tenants regression;
K_3 = Degree of freedom for pooled data;
This statistics is compared against the tabulated F-values, $F_{tab}= F_{0.95(,V1, V2)}$ if Fcal > Ftab., it means that farmers tenancy status had an impact on the sugarcane productivity or there is a significant difference in structural parameters (slopes and intercepts) of the production functions between owner cultivators and tenants

b) **Test for homogeneity of slopes**

$$\boldsymbol{F = \frac{(\sum E_4^2 - \sum E_2^2 - \sum E_1^2)/(K_4 - K_1 - K_2\ )}{\sum E_1^2 + \sum E_2^2)/(\ \ K_1 + K_2\ \ \ )} - - - - - - - \mathbf{3}}$$

where
$\sum E_4^2$ and $\mathbf{K_4}$ are Error sum of square and Degree of freedom respectively for the pooled data
with a dummy variable of value one (1) for owner cultivators and zero (0) for tenants' Other variables are as earlier defined.
This statistics is also compared against the tabulated F-value,$F_{tab} = F_{0.95(,V1, V2)}$. if Fcal > Ftab , reject the null hypothesis of no difference in the slope parameters

(c) Test for differences in intercepts

This test is of particular relevance to an examination of significant differences of any Total Factor Productivity change reflected in the parameter associated with the intercept shifter variable. The test statistics is calculated as follows:

$$\boldsymbol{F = \frac{(\sum E_3^2 - \sum E_4^2)/(K_3 - K_4)}{\sum E_4^2)/\ K_4} - - - - - - - \mathbf{4}}$$

All variables are earlier defined. This statistics is also compared against the tabulated F-value, $F_{tab} = F_{0.95(,V1, V2)}$. if Fcal > Ftab , we reject the null hypothesis of no difference in total factors' productivity of the two categories of farms

5. RESULTS AND DISCUSSION

5.1 Influence of Socioeconomic Factors on Wheat Productivity

The main objective of the study is to examine the impact of farmers' tenancy status on sugarcane productivity, it is equally important to investigate the influence of socio-economic factors that the farmers are exposed to in the production process. Therefore, our analysis included seven other variables considered important in ascertaining the sugarcane productivity of the farmer. The results are presented in Table II

All the four models had a comparatively high explanatory power showing that most of the socio-economic variables that affect the sugarcane productivity had been captured by the models. The model for tenant cultivators had the lowest explanatory power (62%) while the pooled data with intercept dummy had a high explanatory power of almost 67% when considering the value of adjusted R-square. The models estimated were a true reflection of the equations as all the models had highly significant F-values. Higher levels of education have generally been associated positively with sugarcane productivity. The years of schooling of the respondent had a positive and significant influence on the sugarcane productivity of the farmers. Education increased farm productivity in the model for owner cultivators, tenants. Similar results were found by Ali et al.(2020). It is assumed center paribus that low family size farmers tend to lower productivity than high family size farmers. While some studies have found that agriculture productivity decrease with family size (Bagal et al., 2018; Hashmi et al., 2015), others have not found a significant effect for the household size on agriculture productivity (Hossseini et al., 2015). However, this study confirmed that farmers having large family sizes are more productive in tenant cultivators as compared to owner cultivators. Naturally, it is expected that experienced farmers will be more productive than less-experienced farmers but the result of the study is to the contrary. Here, experience decreases sugarcane productivity in all the models except in the model of tenant's farmers and pooled data. The result in the table indicates that the sugarcane productivity of owner cultivators increased significantly with an increase in fertilizer application (5%), farm labor (10%), irrigation (1%), and land size (5%), while decrease insignificantly with farming experience. However, the tenant's cultivators' productivity also increased with an increase in fertilizer application, farm labor (10%) and irrigation (1%), while it decreases with land size (5%) and farming experience. This is in line with the report of Gavian, & Fafchamps (1996). the value of the dummy variable, D, is 0.102, and significant at the 0.05 level. This suggests that owner cultivators are nearby 10% more productive than tenant cultivators.

Table II **Influence of Socioeconomic Factors on sugarcane Productivity**

Variables	Owner cultivators		Tenant cultivators		Pooled(combine)		Pooled with dummy	
	β	t-ratio	β	t-ratio	β	t-ratio	β	t-ratio
Intercept	5.023	1.213	6.012	2.468	4.577	1.023	5.948	2,712
Education	1.0178	1.347**	1.098	2.767*	1086	2.489**	1.687	1.504**
Household Size	3.2371	2.345*	5.652	4.023**	4.025	2.564*	5.724	2.324*
Experience	-0.022	-1.412	-1.013	1.991	-0.671	1.045*	-.0213	1.412***
Fertilizers	2.221	3.092**	3.382	2.601	0.391	2.077	0.320	1.623*

Land Size	0.087	1.394**	-0.142	2.460**	0.452	1.373**	0.4349	1.453**
Farm Labour	0.335	1.380**	0.133	1.471***	0.343	1.442*	0.025	1.624*
Irrigation	1.063	2.468***	0.069	4.321***	0.056	3.227*	0.057	2.105**
Dummy								0.102**
Residual SS	65.67		76.03		143.34		153.34	
R^2	0.670		0.631		0.672		0.679	
Adj R^2	0.661		0.620		0.662		0.666	
F-Ratio	211.34**		151.45**		356.25**		345.34***	

Note: *, ** and *** = Significant at 10, 5 and 1 % respectively

5.2 Isolating the Impact of farmers' tenancy status on sugarcane Productivity

The Chow test examines the equality of parameters between two subgroups (Hardy, 1993). The null hypothesis is that the parameters are equal, meaning that all the independent variables have uniform effects for both farmer's groups according to tenancy. Here, tenancy is hypothesized to have no impact on the sugarcane productivity of farmers. The results of the statistical tests for a structural shift in the production function and differences in structural parameters (slopes and intercepts) were presented in Table III. The calculated chow's F statistic for the impact of tenancy on sugarcane productivity was significant at 1 %. The result confirms that there is a significant difference between the sugarcane productivity of owner cultivators and tenant cultivators. The result of the test for homogeneity of slopes shows that the calculated Chow's F statistic is s significant at 5 %. The result confirms heterogeneity of slopes or that farmer's tenancy resulted in differences in sugarcane productivity between two farmers' groups. Heterogeneity of slopes shows that the production functions are factor-biased. The calculated chow's F statistic for the test for differences in intercept is significant at 5 %. This confirms the result of the pooled data with dummy variable representing that owner cultivators are more productive than the tenant cultivators and this may have resulted from the gains from tenancy status which led to increased sugarcane productivity.

Table III **Test for differences in sugarcane productivity**

Farmers Categories	Residual sum of squares	Degree of freedom	F-calculated
Test for tenancy effect			
Owner cultivators	32.45	143	
Tenant cultivators	25.09	93	
Pooled data	51.97	243	95.43***
Tests for homogeneity of slope			
Owner cultivators	32.45	143	
Tenant cultivators	25.09	93	
Pooled data with dummy	42.43	242	92.67**
Test for difference in intercept			
Pooled data	25.637	243	
Pooled data with dummy	43.18	242	76.50**

6. CONCLUSIONS AND RECOMMENDATION

This study explored the influence of tenancy on sugarcane productivity between farmer groups according to tenancy status. Interview methods were employed in data collection and data analyzed using inferential statistics. The influence of socio-economic factors revealed that education, family size, fertilizer, land size, farm labor, and irrigation were significant and positive determinants while the experience was negative and insignificant determinants of sugarcane productivity of owner cultivators. However, the tenant's cultivators' productivity also increased with an increase in fertilizer application farm labor irrigation and experience while it decreases with land size and farming experience. The Chow test confirmed differences in sugarcane productivity between owner cultivators and tenant cultivators.

From the findings of the study, it is recommended that government should increase effort to encourage the tenant cultivators to upturn their production practices. It is also recommended that a credit policy be put in place to empower the small tenant farmers to obtain the necessary production input to increase their output.

7. FUTURE RESEARCH

A comprehensive study might be essential to propose a conclusive recommendation about the impacts of land tenancy as well as land size on farm productivity.

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