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Research Article

Impact of Tenancy Status on Wheat Productivity in Central Khyber Pakhtunkhwa, Pakistan

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Abstract | This study aims to evaluate the impact of farmers' tenancy status on wheat productivity in selected districts of Central Khyber-Pakhtunkhwa. In this context, 350 wheat growers were purposively selected with 150 landowners and 200 tenants in the study area. A multi-stage sampling technique was employed. Furthermore, to estimate wheat productivity, differences in wheat productivity and socio-economic factors between owner and tenant wheat growers, a log-log regression model and an independent unpaired sample t-test was used in conjunction with face-to-face interview schedule. In addition, a dummy variable was added to the production function to analyze the impact of tenancy status on wheat productivity. The results revealed that majority (57.1%) of the wheat growers in the study were rented land for their farming and livelihood. Land preparation, fertilizers, chemicals, and irrigation were significant factors influencing wheat productivity for owner cultivators, whereas age, household size, land preparation, fertilizers, chemicals, and irrigation were significant factors influencing wheat productivity for tenant wheat growers. The statistical value of the dummy variable revealed that the owner wheat growers had higher productivity (almost 10%) than tenant wheat growers. Furthermore, the t-test confirmed the differences in the productivity and socio-economic factors between owner and tenant wheat growers. As a result of the findings, more attention should be paid to tenant wheat growers in central Khyber Pakhtunkhwa, as the majority of tenant have small holdings and lack of access to agricultural inputs, credits, and extension services. Furthermore, the study suggests, policies that should provide tenants with improved access to land and secure tenure be implemented.

Introduction

Land provides the foundation for physical development, serves as the principal medium for food production, shelter, and for the formation of institutions to support the basic need of modern communities (Friesecke and Promoting, 2006). Land, according to (Iheke and Chikezie, 2016), is a natural gift that comprises soil, rivers, and forests. Land is a fixed factor of production that continues to be the

cornerstone of human existence and our food chain. Land is a critical component of economic development, as well as a source of livelihood in rural areas. Land is a limited resource, and its distribution and tenure arrangements are seen as critical factors in a country's development plan (Ahmed *et al.*, 2018). A stable tenancy allows the farmer to make investments that will increase their agricultural production. Land tenure arrangements influence agricultural output by encouraging efficient resource usage and contemporary technology deployment.

Access to land in Pakistan has a long history of discrimination. Tenancy systems account for a significant percentage of socio-economic variables that lead to a farmer becoming a tenant in Pakistan's current farming system (Khan, 2008). According to (Otsuka, 2007), in the context of Asian countries, household farming or owner cultivation is the best kind of agricultural production organization. Tenant cultivation, on the other hand, is usually thought to be inefficient due to the negative impact of tenure uncertainty on long-term investments and the disincentive effect of output sharing on work effort.

Tenancy status of a farmer is one of the important factor affecting farmers' productivity (Deb *et al.*, 2015) noted that positive association exist between land ownership and productivity. Insecurity with respect to ownership of land has a negative impact on productivity (Feder, 1987); (Salas *et al.*, 1970). The insecurity of tenure associated with leasehold or renting land serves as a disincentive to farmers from spending significantly on the land because the land is returned to the owner after the cropping season (Iheke and Echebiri, 2010). As noted by (Macours *et al.*, 2010) insecure property rights over land not only lower the degree of activity on the land, but they also lead to socio-economic matching in the tenancy market, severely limiting access to land for the rural poor. According to (Tenaw *et al.*, 2009) the deployment of technologies for agricultural and natural resource management is influenced by land tenure and property rights. They pointed out that secure property rights provide adequate incentives for farmers to boost their productivity while also ensuring environmental sustainability. Likewise, Ahmed *et al.* (2002) came out with a result from their stochastic frontier production function that land transactions that limit tenants' decision-making, such as sharecropping, are technically inefficient when compared to owner-cultivated or fixed rental tenures.

Farmers will not feel emotional attachment to the land under their cultivation, use inputs efficiently until and unless not giving property rights and protection. Though, (Ghatak and Roy, 2007) noted that tenancy regulation in the form of security of tenure may have the unintended consequence of lowering property owners' incentives to lease out land. (Conning and Robinson, 2007) stated that tenure laws lowered the length of tenancy, and the tenancy law's pressure would be harmful for the land-lease market, but the positive incentive effect on renters might only be partially realized, leaving the overall impact potentially equivocal.

Wheat (*Triticum aestivum L.*) is Pakistan's most important food grain, covering the most land. It is a member of the Poacae family (a significant cereal crop). In many countries, including Pakistan, it plays an imperative role in food and nutritional security as well as in the development of human civilization. It adds 9.1% to agricultural value added and 1.7% to GDP. The total area under wheat in Pakistan is 8825 thousand hectares, with a production of 24946 thousand tonnes in 2019-20. (GoP, 2020).

Wheat is also the main crop in Khyber-Pakhtunkhwa (KP), Pakistan. The KP has become the 3rd largest wheat producing province of Pakistan. The province is third-largest province in terms of area, and the fourth-largest in terms of yield among Pakistan's provinces (FAO, 2018). Wheat is grown on 739570 hectares, with a yield of 1795 kg/hectare and an annual wheat production of 1327580 tonnes. (Crop Statistics KP, 2018-19).

As compared to other regions of development countries, Pakistan's wheat production per hectare is quite low. This study therefore, is focused on analyzing the socio-economic factors and productivity differences between tenant and owner wheat growers in central Khyber-Pakhtunkhwa, Pakistan.

Objective of the study
The specific objectives of the study are:
1. To analyze the difference in the socio-economic factors and productivity between tenant
2. and owner wheat growers.
3. To determine the effect of tenancy status on wheat productivity.
4. To analyze the difference in the production function of tenant and owner cultivators.

Hypotheses of the study

1. H_1: There is no difference in the socio-economic factors and wheat productivity between tenant and owner cultivators.
2. H_2: Tenancy status has no significant impact on wheat productivity.
3. H_2: There is no significant difference in the production function of tenant and owner cultivators.

Materials and Methods

Study area

Khyber Pakhtunkhwa (KP) is divided into three ecological regions: northern, central, and southern. The north has a normal climate, whereas the middle has a moderate climate and the south has a severe climate (Ali *et al.*, 2020). The study area for this research is the districts of Charsadda and Peshawar in the Central region. The land in these two areas famous for agricultural production and has access to canal irrigation water channels. (Figure 1)

Sampling and data collection

Primary data were collected from wheat growers in the selected districts during the crop season in May-June 2021 through face-to-face interviews schedule, who are actively involved in wheat production. To identify the essential elements, the data were collected in the native language (Pashto). As a result, the researchers approached to each household's field. Numeric data on tenancy status and socio-economic characteristics of wheat growers were the primary focus of the survey. Households were used as the unit of analysis in this study, and data were obtained from the heads of agricultural households at the house-

hold level. A multi-stage/stratified random sampling strategy was used in the investigation. The two tehsils (strata) Charsadda and tehsil/town-II were purposively chosen from district Charsadda and Peshawar, respectively. In a very first stage, a consolidated list of all villages and wheat growers has been prepared with the help of Field Assistants, Directorate of Information and Extension Department, which serves as a sampling frame for the selection of sample villages and wheat growers.

It has been assumed that the basic agrarian characteristics within the same climatic region would be homogenous. Similarly, homogeneity was found in the seed rate and seed variety of farm located in the villages within the same tehsil.

A random sampling technique was used in the second stage to select three villages namely Aspandehri, Abazai and Kamran Klay from Charsadda and subsequently Lala Kalay, Khazana, and Nahaqi were selected from district Peshawar. Hence, the survey took place in six villages. In the last stage, by employing Yamani formula (Yamane, 1967), the proportional allocation method was used to divide a sample of 350 wheat growers into the above-mentioned villages, which included 150 owner cultivators and 200 tenant cultivators. (Kotrlik *et al.*, 2001) shown in the following Table 1.

Theoretical and analytical framework

In the literature, two popular and extensively used production functions for measuring agriculture production are Cobb-Douglas production function and Translog production function. Cobb-Douglas is a

Figure 1: *Location of the study area.*
Khyber-Pakhtukhuwa Central Region Study Districts.

Table 1: *Village wise distribution of sampled wheat cultivators in the study area.*

Districts	Villages	Owner cultivators	Tenant cultivators	Total
Charsadda	Aspandehri	21	32	53
	Kamran Kalay	24	28	52
	Abazai	25	34	59
Peshawar	Lala	29	36	65
	Khazana	26	38	64
	Nahaqi	25	32	57
Total		150	200	350

variant of the translog production function in which the squared and interaction terms of translog frontier in put variables are considered to be zero. Translog function is prone to multicollinearityeven if it is more flexible form of production function (Thiam et al., 2001).

The Cobb-Douglas production function is chosen over the translog frontier production function because its coefficients directly express the output elasticities of inputs and are easier to grasp and estimate. (Seyoum et al., 1998). As a result, for the reasons stated above, Cobb-Douglas frontier was chosen in this study. The general form the Cobb-Douglas production form is given by;

$$Q = AL^{\alpha}K^{\beta} \dots\dots\dots 1$$

Where;
Q is the level of output, labor (L) and capital (K) is are inputs and A is the technology used and β are the parameters determined in each case by the data. Both the parameters are the output elasticities of inputs L and K respectively. If the sum of elasticities is unity, there are constant return to scale and if it is greater than unity, the return to scale are increasing and vice versa.

Model specification
To investigate the effect of land tenure on wheat productivity, the following log-log (Cobb-Douglas) model was estimated using the ordinary least square approach, separately for owner cultivators, tenant cultivators and pooled datawith dummy variable, (Ali et al., 2020a; 2020b)

$$LnY = ln\beta_0 + \beta_1 D + \beta_2 lnX_1 + \beta_3 lnX_2 + \beta_4 lnX_3 + \beta_5 lnX_4 + \beta_6 lnX_5 + \beta_7 lnX_6 + \beta_8 lnX_7 + \varepsilon \dots 2$$

Where;
Y= Wheat Productivity per acre, Where D represents dummy variable (1 for owner wheat growers and 0 for tenant wheat growersX_1= Education level of the farmers (years), X_2=Farmers age (years), X_3= Households Size (numbers), X_4 =Land Preparation (value in rupees per acre , X_5 = fertilizer amount per acre (rupees), X_6=Value in rupees, if Insecticides and pesticides used per acre, X_7 =Irrigation (numbers) β_i=coefficients of explanatory variables ε =disturbance term.

Test for statistical difference in wheat productivity and socio-economic factors between owner and tenant cultivators
To test the differences in average wheat productivity and socio-economic factors between two groups, an unpaired t-test was used (Aurangzeb et al.,2007) that is;

$$t = \frac{\overline{(X_1 - X_2)}}{\sqrt{\frac{n_1 S_1^2 + n_2 S_2^2}{n_1 + n_2 - 2}}} \dots\dots\dots 3$$

Where;
X_1 and X_2 are the means of two groups and S^2_1 and S^2_2 are sample variances of owner and tenant wheat growers respectively.

Results and Discussion

Farmers tenancy status
The result showed that majority (57.1%) of the wheat growers in the study area were tenants (Table 2). This is something discouraging for the farmers to make further improvement in the land as they knew about evacuation at the end of the cropping season. (Iheke et al., 2010) stated that the instability of tenure associated with leasehold or rented land discourages farmers from making significant investments on the land because the land is returned to the owner after the cropping season. As aresult, attempts to boost wheat yield should focus on making land available to farmers on a permanent basis rather than on a one-year rental basis, as is the case in the area.

Table 2: *Distribution of farmers according to tenancy status.*

Tenancy status	Frequencies	Percentages	Cum. Percentages
Owners	150	42.9	42.9
Tenants	200	57.1	100
Total	350	100	

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Table 3: *Cobb–Douglas production function estimates.*

Variables	Tenant cultivators			Owner cultivators			Pooled with dummy		
	β	t-ratio	Sig.	β	t-ratio	Sig.	β	t-ratio	Sig.
Intercept	1.977	15.148	.000	2.736	16.293	.000	1.954	19.372	.000
Education	.061	1.541	.125	.109	1.966	.051	.086	3.100	.002
Age	.107	3.097	.002	.037	.718	.474	.090	3.829	.000
HHS	.087	2.471	.014	.065	1.118	.265	.013	.504	.614
Land prep	.118	2.875	.004	.068	1.251	.003	.153	5.155	.000
Fertilizer	.228	4.915	.000	.207	3.716	.000	.276	8.370	.000
Chemicals	.248	4.680	.000	.133	2.044	.043	.193	5.296	.000
Irrigation	.448	12.822	.000	.612	12.701	.000	.435	17.827	.000
Dummy							.098	4.564	.000
Residual SS	0.401			.229			0.616		
R^2	0.808			0.696			0.845		
Adj R^2	0.801			0.681			0.841		
F-Ratio	115.653**			46.390**			283.826***		

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

Table 4: *Test for differences in wheat productivity and socioeconomic characteristics between tenant and owner wheat growers.*

Variables	Farmers tenancy	N	Mean values	Mean diff	t-value	Sig.
Productivity	Tenants	200	1180.2860	452.46733	16.227	.000
	Owners	150	1632.7533			
Education level	Tenants	200	2.1300	0.20333	2.111	.036
	Owners	150	1.9267			
Age	Tenants	200	51.8900	0.99000	1.039	.299
	Owners	150	52.8800			
HHS	Tenants	200	4.0050	0.23833	1.782	.076
	Owners	150	3.7667			
Landprep	Tenants	200	4551.8875	449.78900	3.075	.002
	Owners	150	5001.6765			
Fertilizer	Tenants	200	142.0356	12.31821	2.447	.015
	Owners	150	154.3538			
Chemicals	Tenants	200	1224.7725	202.34083	2.552	.011
	Owners	150	1427.1133		-	
Irrigation	Tenants	200	2.1050	1.86167	9.696	.000
	Owners	150	3.9667			

Impact of tenancy status and socio–economic determinants on wheat productivity

Table 3, based on the magnitude of the coefficient of multiple determination(R^2), the number of significant variables, the conformity of the signs borne by the coefficients of the variables to aprioriexpectation, as well as the significance of the F- ratio. All the model has high explanatory power and indicates that more than half of the variation in the productivity level is due to the socio-economic factors included in the model.

The coefficient of multiple determinations (0.845) for pooled data with dummy variable was higher than the coefficient of multiple determinations for owner and tenant cultivators. This implies that explanatory power of the model increases with farmers' tenancy status. The F-ratio was significant at 1% level of probability, indicating the goodness of fit of the model.

All the coefficients of estimated parameters were highly significant except household size. Resulting

that education, age and household size of tenant cultivators have significant impact on productivity as compared to owner cultivators. While land preparation, fertilizer application, chemicals application and irrigation showed a highly significant impact on wheat productivity for all the three models. The coefficient of tenancy status/dummy variable was significant at 1% level of probability and positively related to productivity. This implies that productivity of owned farms was higher (10%) than the tenant cultivators. The findings are in line with the findings of (Deb *et al.*, 2015) who found a positive association between land ownership and productivity. (Iheke *et al.*, 2010) and (Macours *et al.*, 2010) noted that insecure property rights over land reduce sharply the level of activity on the land as it serves as disincentive to farmers from investing meaningfully on the land since the land goes back to the owner after the cropping season.

Differences in wheat productivity and socioe-conomic characteristics between owners and tenant cultivators
The test for significant differences in wheat productivity and socio-economic characteristics between the owner and tenant wheat growers is presented in the Table 4. The results revealed that there was a significant difference in the means of all variables, including wheat productivity, between owner and tenant wheat growers, with the exception of age and household size. The results show that there was no significant difference between the two farm groups in terms of mean age and household size. Furthermore, a significant difference was found in the means of two farm groups based on fertilizer application, land preparation, insecticides and pesticides, irrigation, and wheat production of the sample families by tenancy. The results were supported by study of (Aurangzeb *et al.*, 2007). This confirms the significant impact of farmers' tenancy on wheat productivity.

Conclusions and Recommendations

This study looked into the impact of land tenure on wheat productivity in different farmer groups between owner and tenant wheat growers. Data were collected using interview methods, and data was analyzed by using both descriptive and inferential statistics. This research suggests that high agricultural output requires tenure security or property rights over land. It is worth to be noted that production of own farms was substantially higher than the rented farms, owing to lower levels of activity on rented farms. The

findings of the t-test showing significant variations in socioeconomic variables and wheat productivity between two farm groups support the impact of tenancy on wheat productivity.

According to the findings of the study, the government should focus for necessary mechanism to encourage tenant cultivators to change and enhance their production practices. A loan and credit programs should be implemented to enable small tenant farmers to get the essential and substantial production inputs to boost their livelihood.

Novelty Statement

This research study estimated wheat productivity for owner and tenant wheat growers separately and investigated the differences in the productivity, parameter estimates and intercepts for the first time in the research area.

Author's Contribution

Sajad Ali: Ph.D candidate, conducted research and wrote 1st draft of the paper.
Naeem ur Rehman Khattak: Supervised the whole study with technical guidelines.
Shahab E Saqib: Refined the draft and helped in analysis.
Saleem ur Rehman: Helped in model selection and sampling.

Conflict of interest
The authors have declared no conflict of interest.

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