Farmers' Perceptions of Agricultural Land Values in Rural Pakistan

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Abstract:

Land is an important social and financial asset in Pakistan. Identifying the determinants of land value is important because these determinants have an impact on the utility of the land. In rural areas, utility can be defined in terms of agriculture productivity. Therefore, the Government of Pakistan will benefit from research which determines what characteristics affect the value of land which will also affect agriculture productivity. This research study will use a hedonic regression model and two-stage least square method to determine what demographic, site, development, or physical characteristics have a correlation with the perceived value per acre of rural agricultural land in Pakistan. Data for this study was obtained from the Pakistan Strategy Support Program's Rural Household Panel Survey (RHPS) conducted in 2012. Results from the survey indicate that there is a high level of inequality in land ownership in Pakistan which can limit opportunities for growth. Regression results indicate that most of the site and physical characteristics are correlated with perceived land value and only a few of the development indicators and none of the demographic variables have a statistical impact. Specifically fertile land, lack of soil erosion, number of canal and ground water irrigations, location of plot at head and middle of watercourse, access to electricity, internal road, cotton grower, sugarcane grower, and average mauza income are positively correlated with perceived land value per acre. Waterlogging, salinity, and distance to nearest city have a negative correlation. These results suggest that the Government of Pakistan should support regional initiatives which improve access to good quality water, improve the condition of land used for agriculture, and provide access to electricity.

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I. Introduction

Pakistan's agriculture sector is crucial because it is responsible for providing food, shelter, and clothing to a massive population of 180 million people which is growing at a rate of 2 percent per annum. Land is a valuable asset and a symbol of prestige for the rural population in Pakistan. According to the recent Pakistan Economic Survey of 2012-13, the agriculture sector contributes around 21% to GDP and provides employment for around 45% of the work force, who are primarily based in rural areas. According to the Agricultural Statistics of Pakistan of 2010-11, the total geographic area of Pakistan is approximately 79.6 million hectares. Around 27.7 percent of Pakistan's land is currently under cultivation and the cultivatable waste lands offer good possibilities for crop production. The total cropped area of Pakistan increased from 21.82 million hectares in 1990-91 to 22.72 million hectares in 2010-11 (Agricultural Statistics of Pakistan 2010-11) and the total population of Pakistan increased from 118 million to 175 million during the same time period. Similarly the tenancy status of land management and land ownership pattern has changed over time. For example, large landowners are shifting their preferences from managing their land on their own towards leasing or sharecropping the land to be managed by others (Agricultural Census 2010).

Land is a difficult resource to exchange because of certain constraints such as the fact that land is immobile and there may be significant differences in the quality of land. Additionally, appropriate institutions may not exist which allow for costless exchange of land. Land is a finite resource and ideally the market with demand and supply forces should be able to determine the equilibrium price. However, this is not the case in Pakistan where land markets mostly don't exist at a formal level and the value of land is being priced arbitrarily and without any scientific backing. In some cases the price of land is being influenced by large landowners. Furthermore, in Pakistan, there is no appropriate or historical collection of data on land buying / selling and land revenue (provincial revenue departments are supposed to maintain records of land ownership, however, this data is usually not publicly available). For example, there is no nationally representative survey on household land purchases and only the recently released Pakistan Agriculture Census of 2010 included some data on change in land ownership patterns.

Lack of a formal land market and sufficient data means it is difficult to identify the determinants of value for land in Pakistan. Determinants of land value have an impact on the utility of land. In rural areas, the utility of land can be determined as the productivity level of agriculture land.

In Pakistan, rural land in the agriculture sector is important because most of Pakistan's land can be classified as rural and is based in the agriculture sector. Since Pakistan is a developing country, the Government is trying to implement policies which promote development and reduce poverty. This can be done by promoting investment and policies which increase agriculture productivity. Yet the same polices and investments which increase agriculture productivity indirectly also increase agricultural land prices (Gardner et al 1979). Previous literature has shown that land ownership and the productivity level of agricultural land are very closely related to poverty and development (Deininger 2004 and Hirshima 2008). Finding out what factors affect land values in rural Pakistan could help the Government of Pakistan decide what to invest in to promote development of rural land. Similarly, proper investment into rural areas can turn them into centers of commerce which will boost productivity and economic growth. In the long run, this will improve competition in the area.

According to the Food and Agriculture Organization (2003), price of land is one of the tools which can be used to manage land resources. Price of land itself is important because it reflects the level of government reforms which are used to support agricultural production. However, studying land itself is difficult because land value has different definitions and land markets in Pakistan do not exist at a formal level. In order to resolve the problem of the definition of land value, we will be using the perceived value of the land by the farmers who manage the land.

Previously, many studies revealed that there is a positive impact of attributes/ characteristics of land on the value of agricultural land (Vasquez *et al.* (2002), Guiling *et al.* (2009), Cavailhès and Wavresky (2003), Peterson (1984 and 1986)). However, no such study exists for Pakistan. Specifically, this research study will look at the relationship between physical and economic characteristics and whether they are correlated with property values in rural Pakistan. Due to a lack of suitable and reliable data, we used perceived value of land per acre as our dependent variable. Specifically, we asked the farmers managing the land what is their perceived value of the land they are managing. The rest of the paper is organized in the following manner; section II gives a literature review on the subject, section III describes the methodology used and Section IV gives data on the sample. Section V describes the model we will be using to examine the relationship and Section VI provides results. Specifically we will be using a hedonic regression model based on the approach originally presented by Bover and Velilla (2002). Section VII is a conclusion along with brief policy recommendations.

II. Literature Review

As mentioned above, land is an important social and financial asset, yet there is a high level of inequality of land ownership in Pakistan. For example, the Household Income and Expenditure Survey of 2001-2002 stated that 43.13% of households in Pakistan were in rural areas. Out of the rural households 24.02% were landless, 42.27% owned less than 5 acres, 22.40% owned 5 to fewer than 12.5 acres, and 11.31% owned 12.5 acres or above. According to Qureshi and Qureshi (2004), the Gini coefficient for land ownership in Pakistan significantly increased from 0.66 in 1972 to 0.75 in 2000. Highest increase in inequality of land ownership is seen in the province of Punjab from 0.63 to 0.71 and KPK (NWFP at the time) from 0.68 to 0.86.

Gini Coefficient is almost the same for Sindh 0.69 to 0.67 and Balochistan 0.69 to 0.68. Similarly, Mumtaz and Noshirwani (2006) performed a mapping exercise in 3 provinces (Punjab, Sindh, and KPK) and found that 40% of rural land is owned by 2.5% of households. They also found that women prioritized inheritance as an issue that bothered them. Women faced issues that they were manipulated out of their inheritance, had to forfeit their share in favor of brother or son, and were unable to pursue inheritance in court.

The Government of Pakistan has tried on three different occasions (1959, 1972, and 1979) to implement land reforms to solve problems with land usage and land development in Pakistan. PANOS (2011) stated that previous attempts at land redistribution have failed because of fragmentation which is hurting agriculture output. Ownership of land is rarely registered (despite law making land ownership registration mandatory) and is passed on through inheritance. An estimated 40% of cases brought before lower level civil courts and high courts are land related disputes (Aftab et. al. 2012). On August 10, 1989 the Supreme Court Shariat Appellate Bench declared that a maximum ceiling for land holding was illegal as per Islamic Law. Therefore, in recent decades, the focus had shifted from land redistribution towards improving records of land ownership.

Hirashima (2008) showed that the price of land in the province of Punjab in Pakistan and India was increasing at a faster rate than rent. The basic reason for this he argued is that the demand for land in Pakistan is price inelastic because of its importance to social status and the inheritance law. He argues that even though land is a factor of production just like labor and capital, land is significantly different because it is not man made and has limited scope of extension.

Renkow (1993) showed that in both irrigated and rain fed areas of Punjab, productivity increases have led to greater returns to land in the form of higher real land rents and higher real land prices. Evidence was collected from the wheat producing province of Punjab. Other factors positively affecting land prices are remittances from abroad, mechanization, improved usage of wheat seed varieties, fertilizer usage, and changes in agronomic practices of rain fed areas.

It is worth mentioning here that apart from these studies mentioned above, not much work has been done to examine what affects land prices specifically in Pakistan. Most of the work on land in Pakistan such as Naqvi *et al.* (1989 and 1987) has focused more on the impact of land reforms. The Federal Bureau of Statistics does publish agricultural statistics and agricultural census data which described changes in land usage and ownership patterns. The most recent Pakistan Agricultural Census was completed in 2010.

It is far more common to find international literature examining factors affecting land prices. In this case, a far more widely used approach is done using hedonic modeling. The basis for a hedonic pricing model can be found in Rosen (1974) and this model can be used to estimate the impact of a range of characteristics such and economic, environmental, and location variables and how they affect the price of goods. In this case, the assumption is that consumers value the characteristic of goods or the services they produce rather than the goods themselves. However, no such study has been found examining land values in Pakistan.

For example Peterson (1984 and 1986) used a hedonic regression model to analyze land prices in Africa and Europe. The author found that 70% of the variation in land prices was due to non-farm factors such as precipitation. Taylor and Brester (2005) look at the impact of a noncash income transfer program on agricultural land values. Specifically they use a hedonic regression model to look at the impact of a sugar program on agricultural land values in Montana. They find that noncash income transfers have a positive impact on land values. Similarly Roberts *et. al* (2003) provide examples where government cash transfers or other government programs can have a positive impact on land prices. Bover and Velilla (2002) also use a hedonic price model to determine if quality indicators such as location and floor size affect land values of multi-unit housing in various cities in Spain. Results by city vary, however the hedonic regression results indicate that overall there is a positive relationship. Vural and Fidan (2009) provide further evidence while using a hedonic price model studying the effects of factors affecting land prices in Turkey. Results indicate a high correlation between type of organic matter in the area and land size. Saita (2003) uses a similar approach in examining factors affecting land values during auctions in Tokyo. The author's results contradict results mentioned earlier mainly because the housing market bubble in Tokyo had collapsed around the time. The author finds that land prices respond mostly to market conditions.

Researchers that did not use a hedonic model approach to study land values include Vasquez *et al.* (2002) who used data on 453 sales from the years 1993-1994 for Idaho farmland prices. They found that development variables had an effect on land prices compared to region specific data. Similarly Cavailhès and Wavresky (2003) also analyzed the impact of urban influence on farmland prices. They found that farmland prices fall sharply close to the city and then fell slowly the further you move away. Their data consisted of more than 2,000 sales in Dijon and the surrounding region in France. Guiling *et al.* (2009) examine the impact of urban proximity on agricultural land values using Oklahoma's agricultural land data. In this case urban proximity is defined in terms of population, time and real income. The authors determine that population and income have more of an impact on agriculture land values whereas distance does not seem to have an impact meaning that there is no preference towards living closer to a city.

Plantinga and Miller (2001) find evidence from New York State that future land development has a positive effect on current land values. The implication here is that perceived future development will cause perceived rent on agriculture land to be higher and therefore the price of current agriculture land will increase.

Gardner and Nuckton (1979) describe how land prices increased rapidly in the United States from the 1950s to the 1970s. The authors attribute this increase in land price to an increase in income from land ownership, increase in productivity of agriculture, government support, and other income support programs. Other factors affecting land values is rapid urbanization and foreign investment from companies entering the market.

Deininger et. al. (2014) also acknowledged that while the importance of land governance in agricultural growth and development has been acknowledged, the extent to which it has been effectively administered or implemented over time has not been successful in African countries. Deininger argues in favor of using the Land Governance Assessment Framework (LGAF) as a diagnostic tool (developed by the World Bank) used to identify how land governance affects productivity. Using such an approach allows for transferring policy recommendations into a more valued impact on agricultural productivity.

Ciaian *et. al.* (2012) attempt to examine institutional factors affecting rent and land values of agricultural land. The authors find that agriculture policy promoting income, land markets, institutions, and regulations, type of land usage and social capital (government fixing land prices) has a positive impact. Other factors such as high transaction costs and credit market constraints have a negative impact on land prices. Similarly, Du and Mulley (2007) find that the introduction of a public rail system can have a positive impact on land values however the change occurs over a longer period of time.

Stillman (2005) examines changes in the value of land in New Zealand from 1989 to 2003. Specifically the authors examines if profitability of land, alternative land usages, local climate, and local conditions has an impact on land values. The author finds that value of rural land increased a great deal during the mentioned period. This increase can largely be attributed towards climate, local conditions, and initial usage of land.

III. Methodology

The Pakistan Strategy Support Program (PSSP) recently completed two related rounds (known as round 1.0 and round 1.5) of a rural household survey in 2012 in which 2,090 households from 19 districts across Pakistan were interviewed. These 19 districts included 12 from Punjab, 5 from Sindh and 2 from Khyber-Pakhtun-Khwa (KPK)[1]. Round 1.0 was a multi-topic survey which included questions from different economic areas and Round 1.5 was a survey specifically focused on agriculture. Therefore the sample of Round 1.5 only included households from Round 1.0 who were involved in farming (942 households). For a detailed description of the sample please refer to Table 4 in the Appendix section. This survey is known as the Rural Household Panel Survey (RHPS).

This paper will utilize the data from the PSSP's rural household survey. Specifically the paper will use data relevant for land valuation from Round 1.0 by using community level data

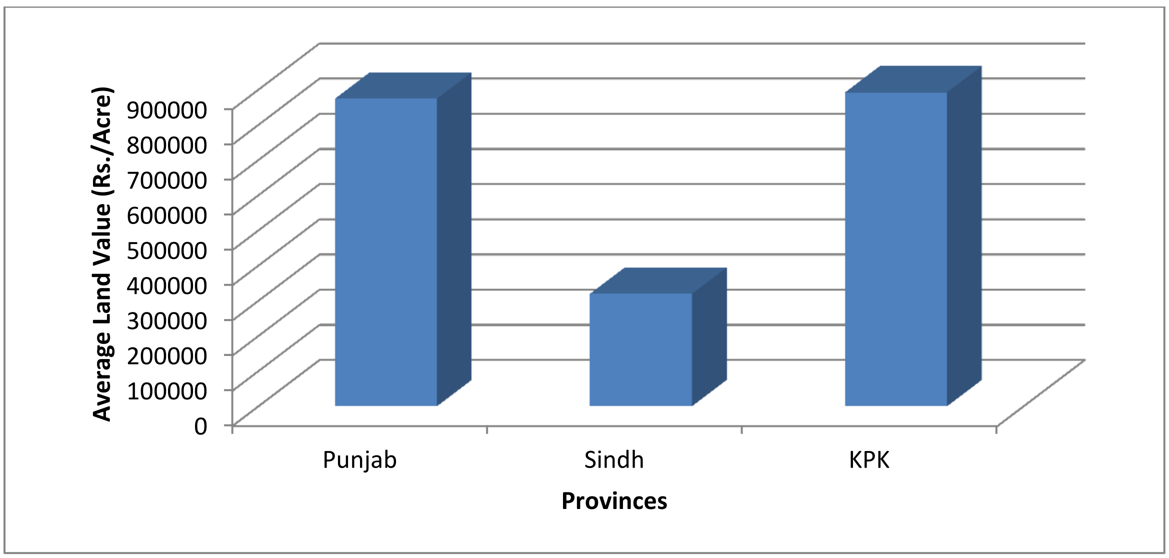
[1] Note: Balochistan was removed from the sample due to security reasons.

and data from Round 1.5 of the survey. Following the literature review, this study will try to fill in a gap in the current literature by examining what factors affect land prices in rural Pakistan. A selection of variables (physical and economic), which theoretically have an impact on land values, will act as independent variables. Specifically we will be using a hedonic regression model and two-stage least square model approach which has not been used previously for studying land prices in Pakistan. Section IV below provides sample characteristics and Section V will describe the model in more detail.

IV. Sample Characteristics

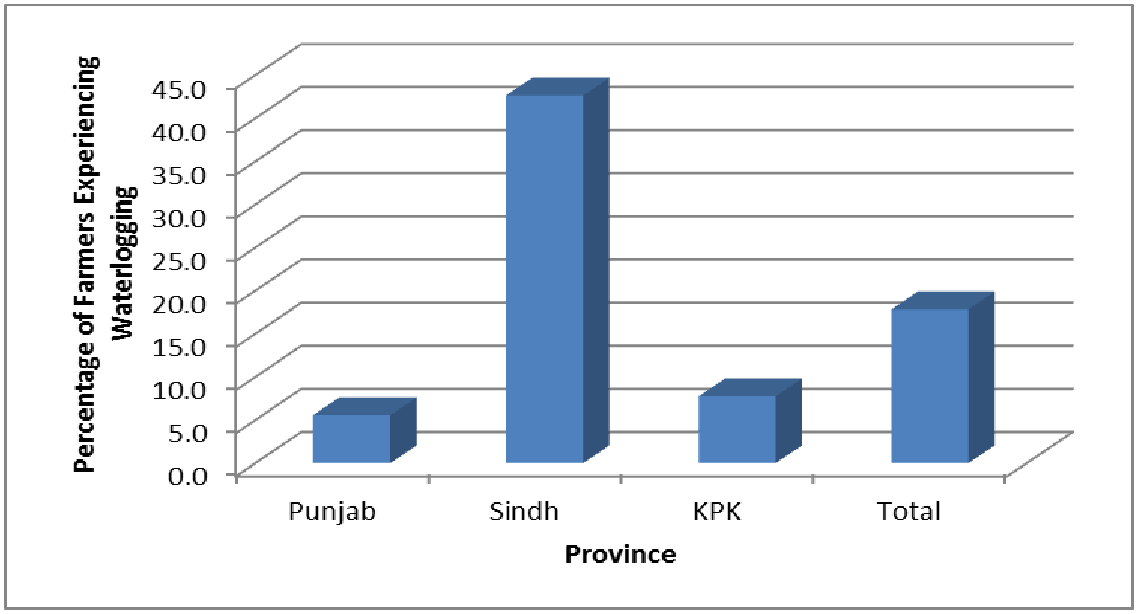
The sample we will be using has 942 households out of which 521 are in Punjab, 305 are in Sindh, and 116 are in KPK. Figure 1 below provides data on perceived value of land per acre in this sample. In this case the household was asked about the perceived value of the agricultural land (Rs./Acre) if it was sold today.

Figure 1: Perceived Value of Land (Rupees / Acre)



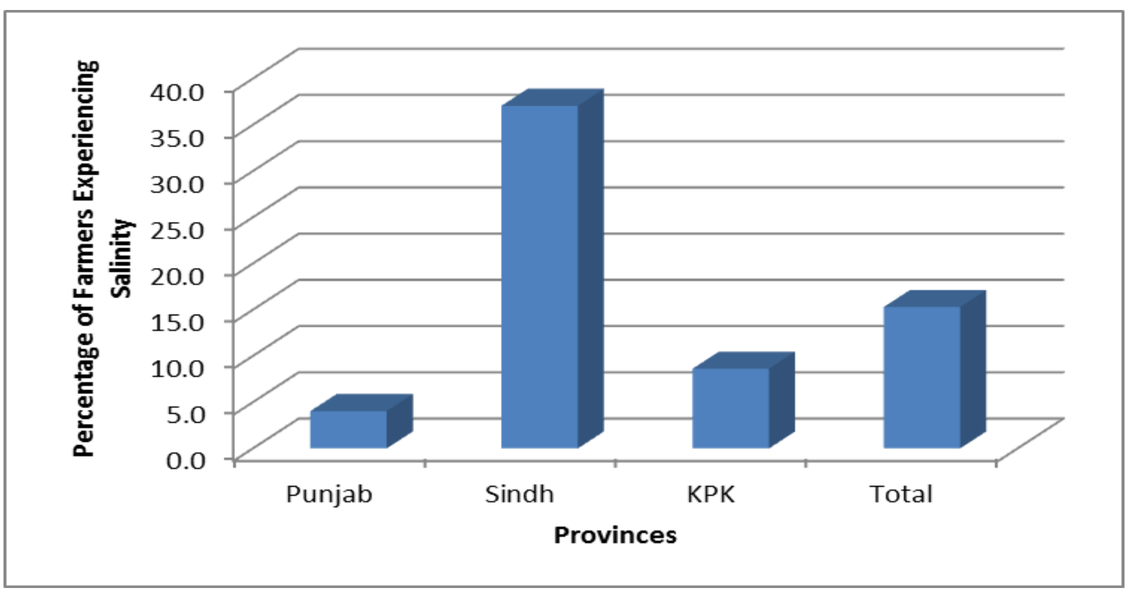
The data indicates that the self-reported value of land per acre is highest in KPK at 892,115 Rs/acre. This is followed by Punjab with a perceived value of land at 874,439 Rs/acre. In Sindh the perceived value of land per acre is much lower at 319,650 Rs/acre. Lower perceived value in Sindh can largely be explained by physical characteristics such as a larger proportion of salinity and water logging issues. These households will have a lower perceived value of the land compared with other households located in Punjab or KPK. Another possible reason for lower perceived value of land is that the management of labor is not as efficient in Sindh compared to Punjab and KPK.

Figure 2: Percentage of Farmers Experiencing Waterlogging by Province



The figure above provides data on the percentage of farmers experiencing water logging by province. As expected, the province of Sindh suffered the most with 42.6% of the farmers stating that they experienced waterlogging on their plot(s). In Punjab 5.6% of the farmers and in KPK 7.8% of the farmers noted that they experienced water logging on their plot(s).

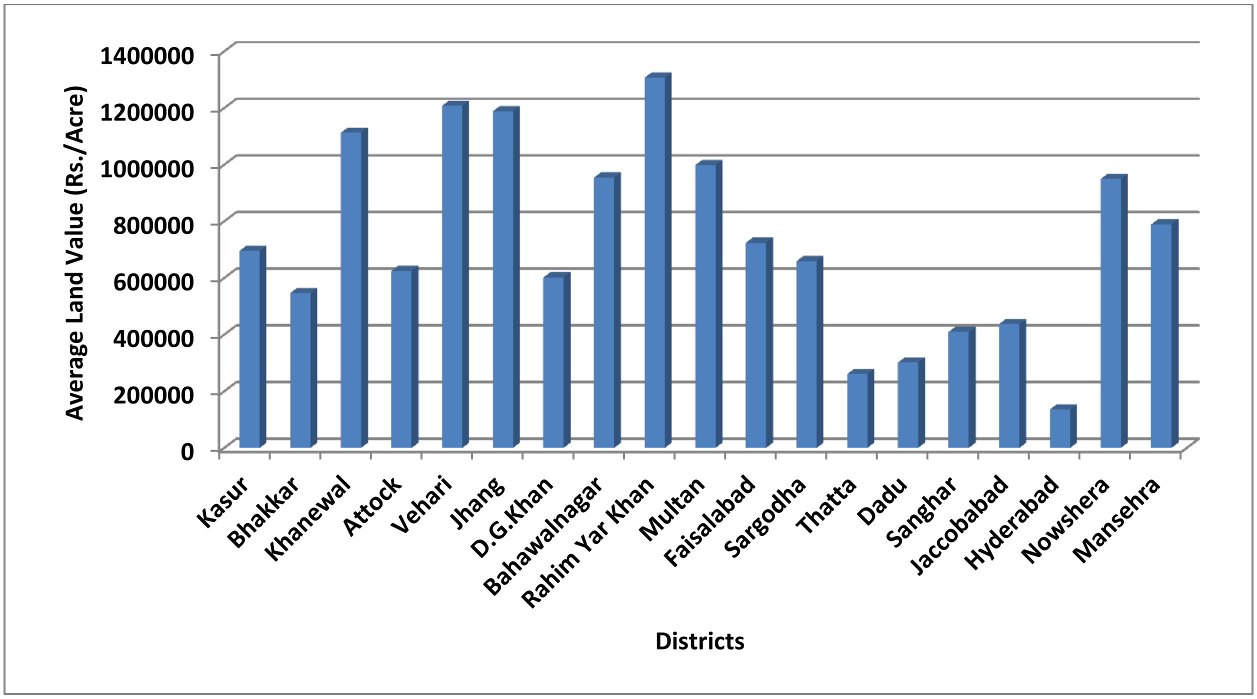
Figure 3: Percentage of Farmers Experiencing Salinity by Province



The figure above provides data on the percentage of farmers experiencing salinity by province. Once again, the province of Sindh fared the worst with 37% of the farmers responding that they experienced problems with salinity on their plot(s). Only 4.0% of the farmers in Punjab and 8.6% of the farmers in KPK responded that they experienced problems with salinity. Figures for waterlogging and salinity can be used to explain lower perceived value of land in Sindh. It must be noted that data was collected in 2012 only a year after the devastating floods which affected agricultural land in Sindh.

Figure 4 below disaggregates the data further into districts and provides the perceived value of land per acre by district.

Figure 4: Perceived Value of Land per District (Rupees per Acre)

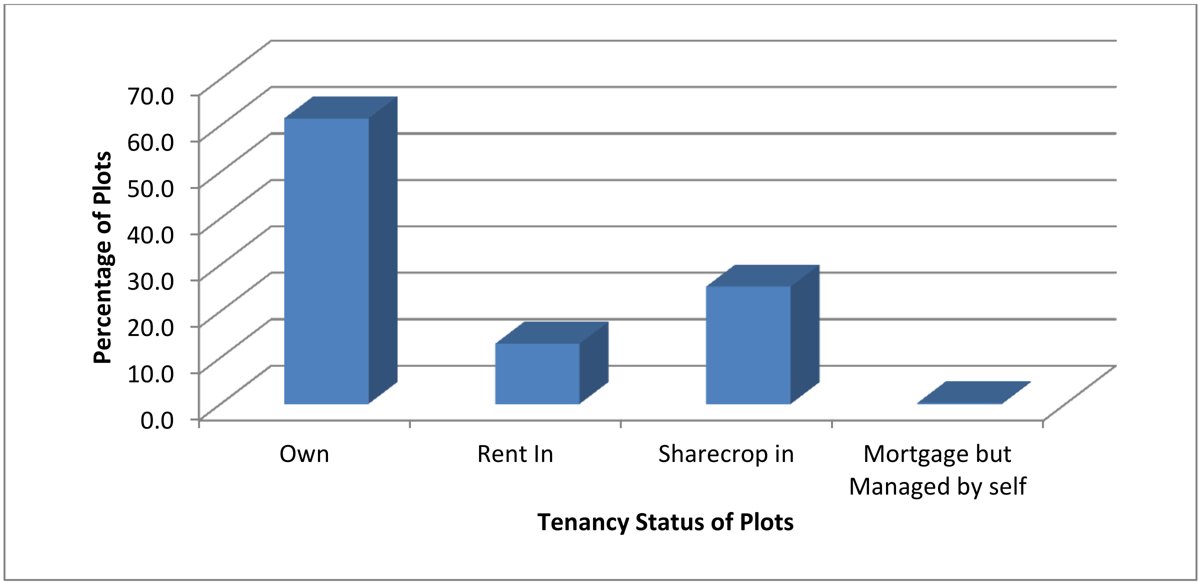


The results indicate that in terms of perception, the most expensive land is in Rahim Yar Khan at 1,306,863 Rs/acre. The least expensive agricultural land is in the district of Hyderabad[2] at 135,583 Rs/acre.

Figure 5 below provides the tenancy status of each of the plots in the sample. The 942 households in the sample owned a total of 1,296 plots.

[2] Note that the sample for the PSSP Rural Household Panel Survey was creating using data from the most recently available Census of 1998. Since then the district of Hyderabad has been divided into 4 districts known as Hyderabad, Tando Muhammad Khan, Tando Allahyar, and Mitiari. Villages in the sample are located outside current day Hyderabad district.

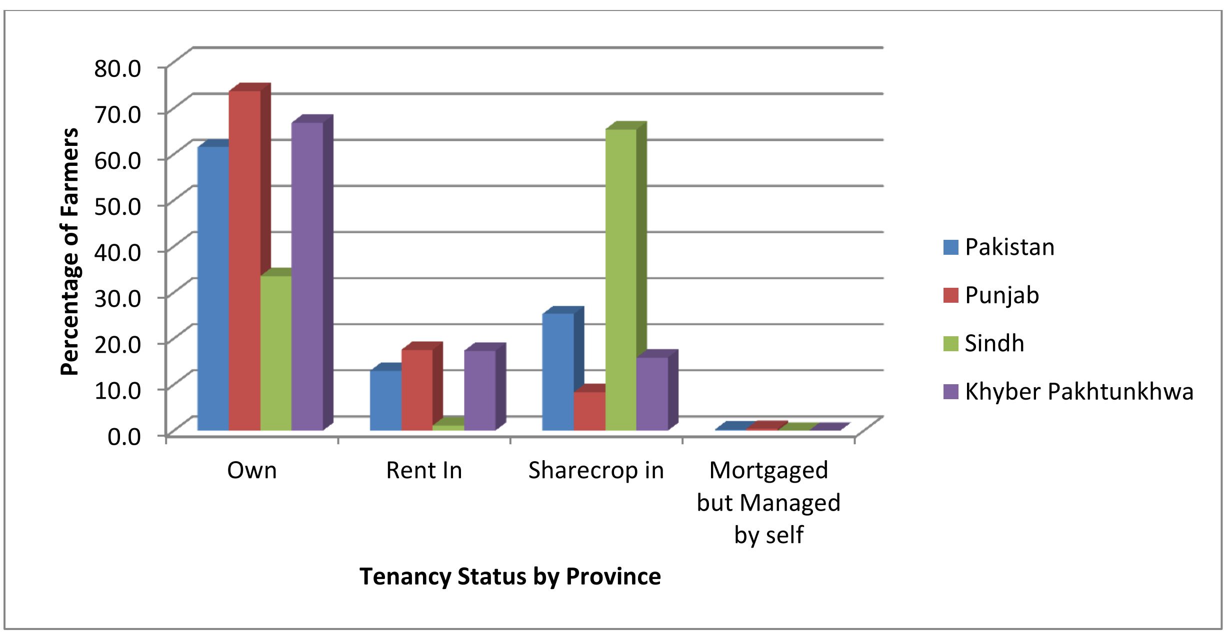
Figure 5: Tenancy Status by Plot



Results indicate that most of the plots (797 plots or 61.5%) are managed and owned by the households. In 168 cases (13%) the plot is rented by the household for a fixed rent per month or year. In 328 cases (25.3%) the plot is being managed by the household on a sharecrop basis with a specific percentage going to the owner. In 3 cases (.2%) the plot has been mortgaged by the household but is currently being managed by the household.

Figure 6 below disaggregates the data further and provides the tenancy status by province for each plot in the sample.

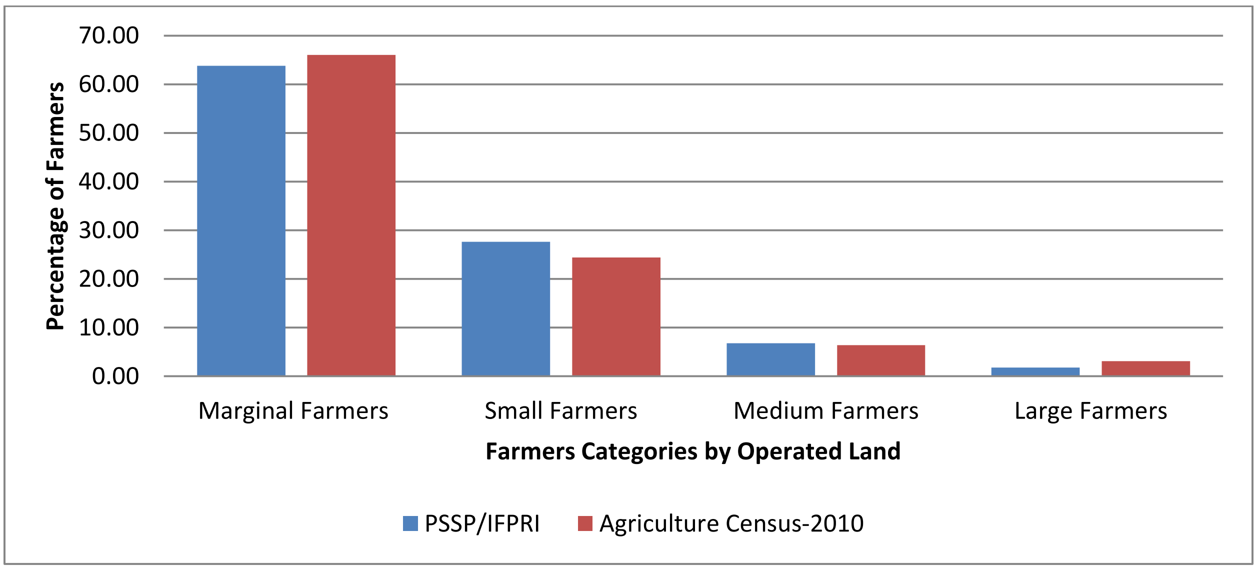
Figure 6: Tenancy Status by Province



The figure above shows that the tenancy status of the plots follows a similar distribution for the province of Punjab and KPK. In Punjab 73.7% of the plots are owned by the households themselves and this is the case for 66.8% of the plots in KPK. However the situation is different in the province of Sindh. In Sindh only 33.5% of the plots are owned by the households and most of the plots (65.4%) are being operated on a sharecropping basis by the household. The number of plots being operated on a sharecropping basis is only 8.4% in Punjab and 15.9% in KPK.

Figure 7 below gives a description on the type of farmers managing the plots in the sample. A marginal farmer is defined as a household which manages land less than 5 acres. A small farmer manages greater than or equal to 5 acres but less than 12.5 acres. A medium farmer manages greater than or equal to 12.5 acres but less than 25 acres. A large farmer manages 25 acres or above. Results from the RHPS sample are compared with the results from the Pakistan Agricultural Census of 2010.

Figure 7: Farmer Categories



Results indicate that in most cases (63.8%) the households can be classified as marginal farmers. Another 27.6% households can be described as small farmers. A further 6.8 % of households can be described as medium farmers and the remaining 1.8 % households can be described as large farmers. Additionally, results by farmer category are comparable across the RHPS sample and the Pakistan Agricultural Census of 2010. The figure below provides more details for the farmer categories. This figure provides the average number of acres owned by each farmer category group.

Figure 8: Sub Categories of Marginal Farmers

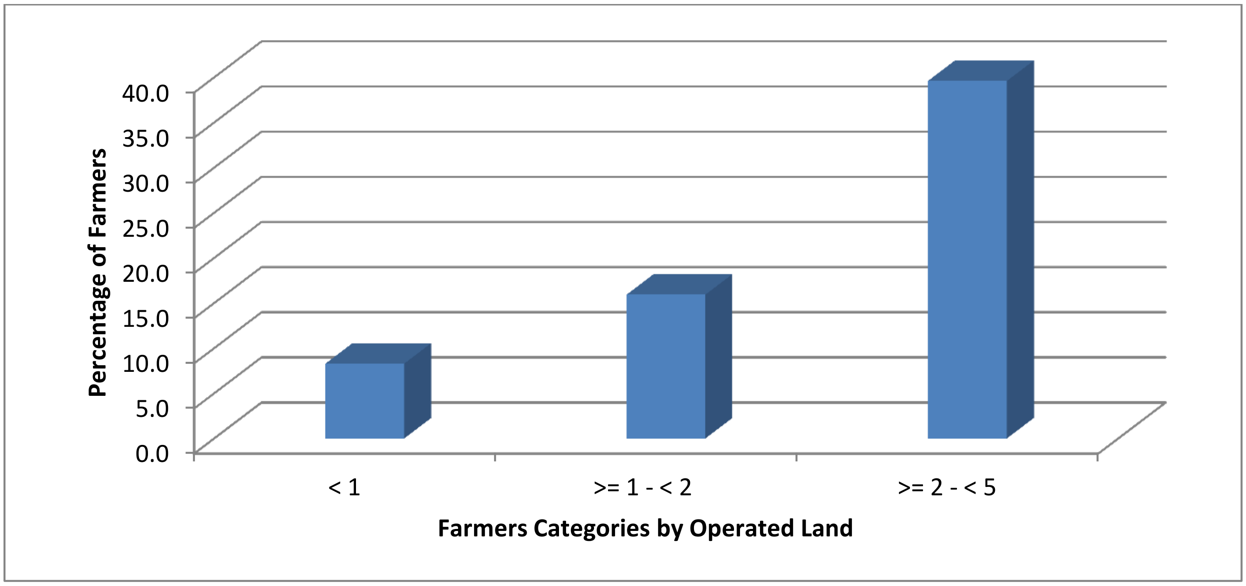
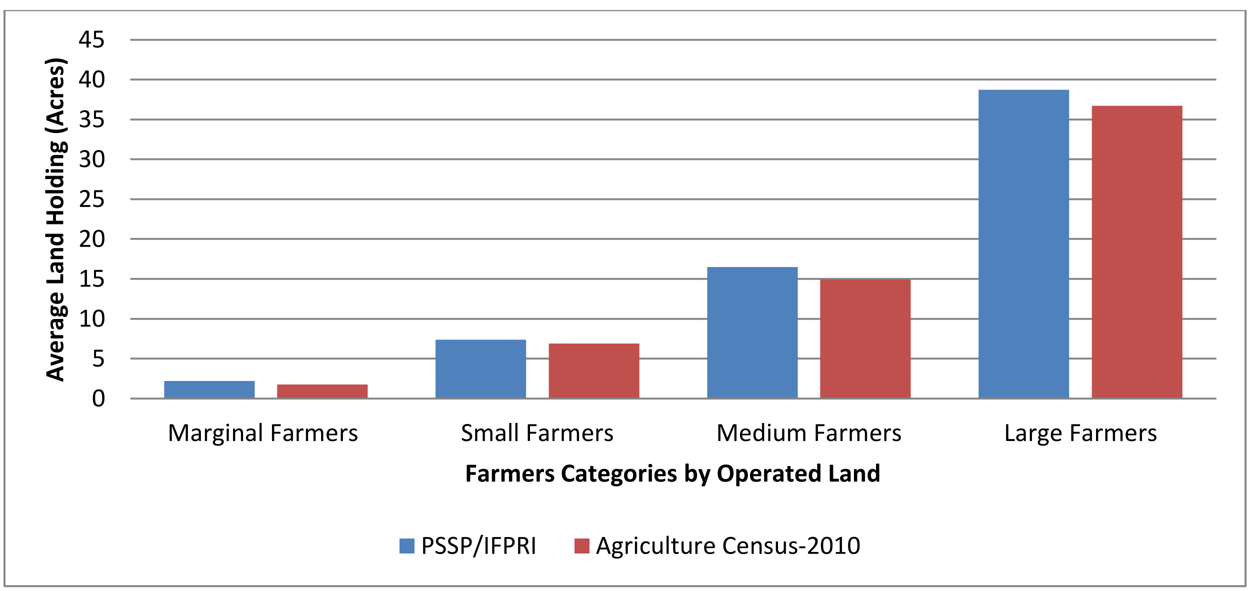


Figure 8 above divides the marginal farmers into sub categories. Here we are trying to see some facts in the distribution of the amount of acres owned by marginal farmers. The three categories are ownership of less than 1 acre, greater than or equal to 1 acre and less than 2 acres, and greater than or equal to 2 acres and less than 5 acres. The data shows that most marginal farmers (39.6% of the total number of farmers in the sample) own greater than or equal to 2 acres and less than 5 acres.

Figure 9: Average Land Holding by Farmer Category



Results for the figure above show that on average, marginal farmers own 2.22 acres of land, small farmers own 7.37 acres of land, medium farmers own 16.48 acres of land, and large farmers own 38.71 acres of land. Figure 7 and figure 9 provide proof that there is a large level of inequality for land ownership in Pakistan. Results also show that data from IFPRI's RHPS survey are comparable with the Pakistan Agricultural Census of 2010.

Figure 10: Tenancy Status for Farmer Categories

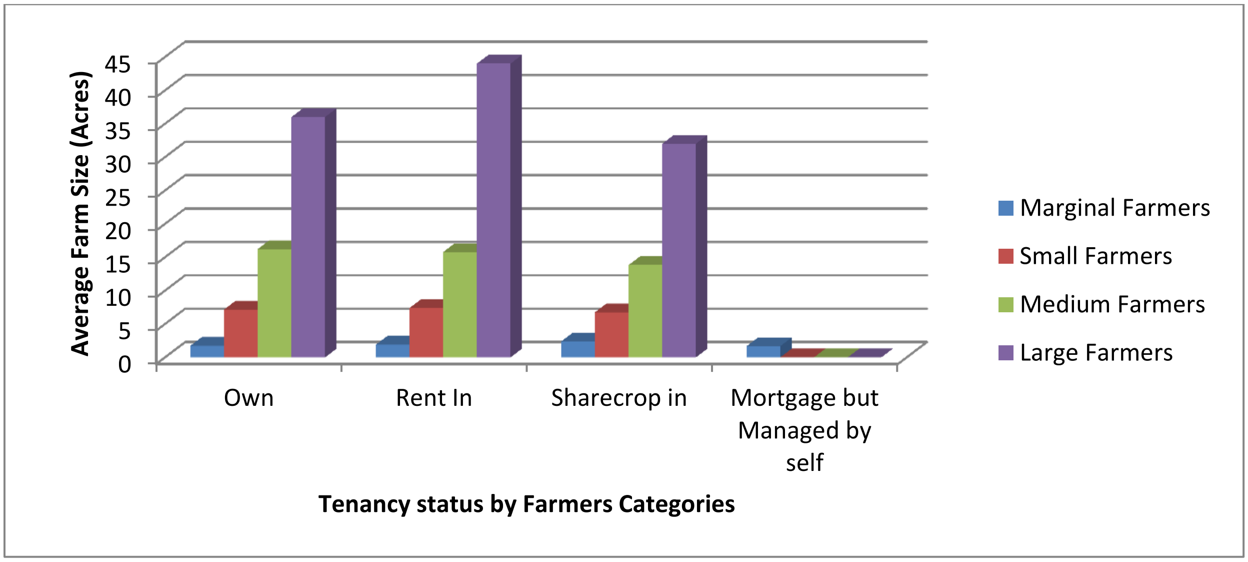


Figure 10 above shows the disaggregated data on average farm size by tenancy status of the plots and compare among farmers categories. For example, the figure above shows that the average farm size for large farmers who own land is 36 acres. Similarly the average farm size for medium farmers who own land is 16.22 acres, 7.16 acres for small farmers, and 1.73 acres for marginal farmers.

Data from the figure above once again proves that the distribution of land ownership is highly unequal with a small amount of households owning a large proportion of the rural agricultural land. Using data from the sample, we were able to calculate Gini coefficients for land ownership by households and compare results with earlier findings from Qureshi *et al.* (2004). Note that ownership is defined in terms of plots which are in the household's name which means that plots that were rented out or are being operated on sharecropping basis were attributed to the original owner.

Table 1: Gini Coefficient for Land Ownership in Pakistan from 1972 to 2012

Province / National	Qureshi *et al.* 2004				PSSP 2012*
	1972	1980	1990	2000	2012
Pakistan	0.66	0.65	0.66	0.75	0.68
Punjab	0.63	0.62	0.62	0.71	0.61

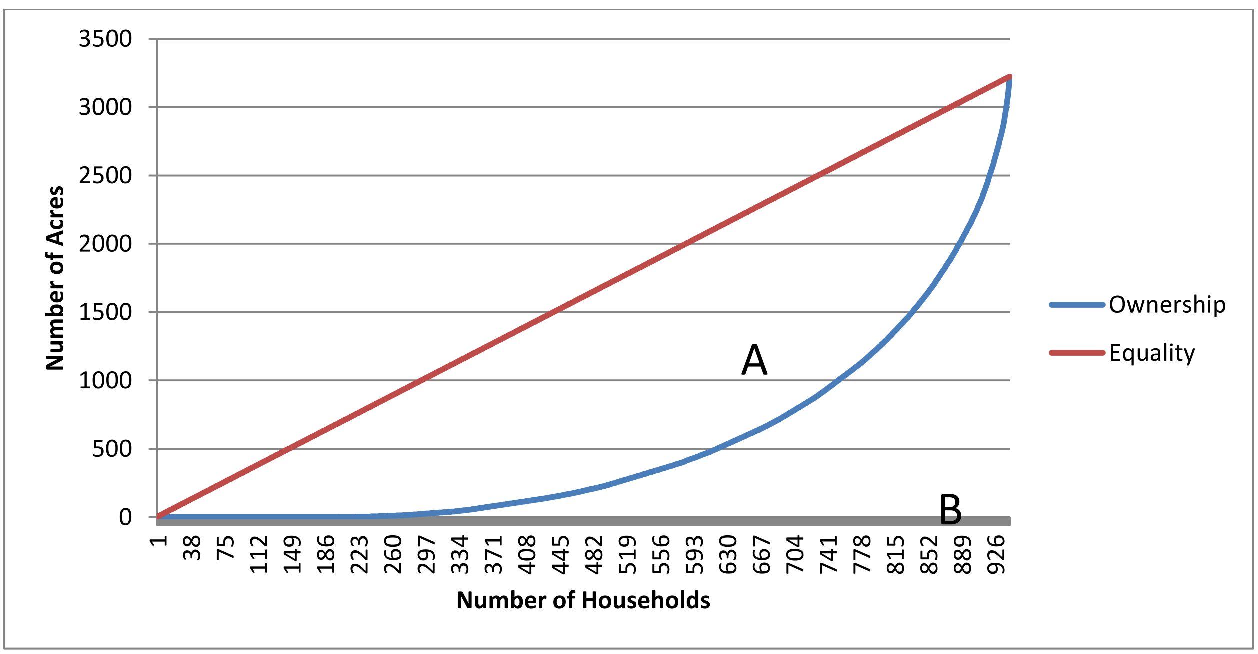
KPK	0.68	0.69	0.65	0.86	0.60
Sindh	0.69	0.63	0.63	0.67	0.76
Balochistan	0.69	0.68	0.7	0.68	NA**

*Authors own calculation **NA = Did not survey due to security reasons

Qureshi *et al.* 2004 showed that the Gini coefficient appeared to be rising in Pakistan overall from 1972 till the year 2000. A rising Gini coefficient implied that the inequality of land ownership appeared to be increasing during this time. Our calculation for the Gini coefficient is lower for Pakistan overall (0.59) and for each province. However this does not necessarily indicate that land ownership inequality is decreasing because both studies used separate data sources to calculate the Gini coefficient. Qureshi *et al.* (2004) used data from the Agricultural Census Reports which had a larger sample size and covered a larger number of districts. We used data from the PSSP's Rural Household Panel Survey. The PSSP's Rural Household Panel Survey excluded a few districts from KPK for security reasons. Additionally our sample did not cover the province of Balochistan.

Figure 11 below gives a graphic representation of how the Gini Coefficient was calculated from our sample. The red line is the line of equality (each household owns the same amount of land) and the blue line is the actual land ownership pattern. The Gini coefficient is calculated as the area of "A" divided by the area of "A" plus "B" (Gini = A / (A+B)).

Figure 11: Gini Coefficient for Pakistan



V. Model

We will be using a hedonic regression model and two-stage least square model to analyze the mentioned relationship. The advantage of a hedonic regression model is that it divides the explanatory variables into constituent parts and allows for analysis of different attributes (example physical variables vs economic variables) on the dependent variable. We will be using cross sectional data for the Pakistan's Strategy Support Program's Rural Household Survey from the year 2012. Based on the approach by Bover and Velilla (2002), we used a model with a theoretical form provided below:

$$p_i = \alpha_0 + \delta_i X_i + .\ldots + \delta_n X_n + \gamma_i Y_i + .\ldots + \gamma_n Y_n + \varepsilon$$

Where p_i is the log of perceived value of land per acre and X_i to X_n are a set of dummy variables to calculate the effect of specific demographic or physical characteristics and Y_i to Y_n are the log of specific demographic, location, or development variables. This model can be considered as a log-log model for continuous variables and not for other types of variables (ex. dummy variables). The independent variables in the model can be categorized into four categories which are demographic variables, site characteristics, development variables, and location variables. The difference between site characteristics and location variables is that location variables are usually fixed for the entire village and surrounding area and cannot be changed. Site characteristics can differ between each plot. Development variables capture the socio-economic wellbeing of the residents of the mouza. There are four different versions of the model and the first two are standard hedonic regression models where one considers the impact of renting a plot and the other considers the actual value of rent per acre. The next two models used a two-staged least squares approach in order to counter potential issues with endogeneity in which we used proxies to capture the effect of a change in wealth or development in a village. Theoretically it is safe to assume that villages with a higher level of income are more likely to travel longer distances, and therefore these variables can be used as proxies for average agricultural income. Variables such as distance to nearest bank, city, and market are meant to capture the effect of a change in the level of income of a village.

Summary statistics for the variables used in the model are provided in the table below.

Table 2: Summary Statistics for Variables used in the Model (Dependent variable: Land value (Rs/acre))

Variables	Obs.	Mean	Std. Dev.	Min	Max
Land Value (Rs. / Acre)	1296	724023.9	634639	16000	5200000
Age of Respondent	1296	41.80324	13.71747	14	92
Value of Rent	1296	2688	8317.84	0.01	75000
Average Mauza Income	1296	168779.6	146951.9	0.01	917090
Ever Attended School	1296	0.5933642	0.4913954	0	1
Dummy for Ownership of Plot	1296	0.617284	0.486238	0	1
Dummy for Renting in Plot	1296	0.1296296	0.336025	0	1
Dummy for Flat Land	1296	0.7091049	0.4543505	0	1

Variables	Obs.	Mean	Std. Dev.	Min	Max
Dummy for Fertile Land	1296	0.1589506	0.3657712	0	1
Dummy for Moderate Fertile Land	1296	0.7908951	0.4068265	0	1
Dummy for No soil erosion	1296	0.8333333	0.3728219	0	1
Dummy for Mild Soil Erosion	1296	0.1466049	0.3538482	0	1
Dummy for Salinity	1296	0.121142	0.3264182	0	1
Dummy for Waterlogging	1296	0.1535494	0.3606554	0	0
Number of Canal Irrigations	1296	10.02627	11.88117	0.01	77
Number of Ground Water Irrigations	1296	8.414097	10.91017	0.01	60
Dummy for Plot at Head	1296	0.087963	0.2833504	0	1
Dummy for Plot at Middle	1296	0.2214506	0.4153834	0	1
Dummy for Village Electrification	1296	0.9128086	0.2822242	0	1
Dummy for Internal Road	1296	0.2932099	0.4554096	0	1
Dummy for Cotton Grower	1296	0.0864968	0.142917	0	1
Dummy for Rice Grower	1296	0.1220263	0.194041	0	1
Dummy for Sugarcane Grower	1296	0.0306345	0.108021	0	1
Distance to Nearest City	1296	12.7284	7.644005	1	35
Distance to Nearest Tehsil Katcheri	1213	3.04642	0.5749389	0.7	4.32
Distance to Nearest Bank	1296	13.0463	8.247837	0	35
Distance to Nearest District Katchari	1296	42.77932	23.49335	10	115

VI. Results

Table 3 below provides the results from the hedonic regression models described above.

Variables	Log-Log (Dummy for Rent in)	Log-Log (Value of Rent-in)	2SLS Model (Dummy for Rent in)	2SLS Model (Value of Rent in)
Constant	12.70***	12.69***	10.79***	10.82***
	(0.502)	(0.499)	(0.602)	(0.544)
Rent	-0.0262	-0.00104	0.112	0.0111
	(0.0789)	(0.00549)	(0.542)	(0.0377)
Average Mauza Income	0.0135	0.0136	0.113***	0.113***
	(0.0129)	(0.0129)	(0.0316)	(0.0317)
Ownership of Plot	0.00320	0.00921	0.0881	0.114
	(0.0619)	(0.0620)	(0.291)	(0.291)
Age of Respondent	-0.0541	-0.0541	-0.0322	-0.0329
	(0.0616)	(0.0616)	(0.0634)	(0.0635)
Ever Attended School	-0.0174	-0.0178	-0.0359	-0.0376
	(0.0460)	(0.0460)	(0.0513)	(0.0510)
Flat Land	-0.000108	-0.000369	-0.0328	-0.0344
	(0.0529)	(0.0529)	(0.0557)	(0.0556)
Fertile Land	0.323***	0.322***	0.237**	0.233*
	(0.114)	(0.114)	(0.120)	(0.121)
Moderately Fertile Land	0.133	0.133	0.0732	0.0699
	(0.0985)	(0.0985)	(0.104)	(0.104)
No Soil Erosion	0.589***	0.589***	0.685***	0.684***
	(0.147)	(0.147)	(0.146)	(0.146)
Mild Soil Erosion	0.480***	0.480***	0.522***	0.522***
	(0.148)	(0.148)	(0.148)	(0.148)
Waterlogging	-0.152*	-0.153*	-0.220**	-0.219**
	(0.0913)	(0.0913)	(0.0938)	(0.0939)
Salinity	-0.125	-0.125	-0.155*	-0.156*
	(0.0930)	(0.0930)	(0.0941)	(0.0943)
Number of Canal	0.0397***	0.0396***	0.0369***	0.0368***

Variables	Log-Log (Dummy for Rent in)	Log-Log (Value of Rent-in)	2SLS Model (Dummy for Rent in)	2SLS Model (Value of Rent in)
Irrigations				
	(0.00975)	(0.00975)	(0.0103)	(0.0103)
Number of Ground Irrigations	0.0326***	0.0327***	0.0430***	0.0431***
	(0.00994)	(0.00994)	(0.0100)	(0.0100)
Plot Located at Head	0.363***	0.362***	0.254***	0.254***
	(0.0954)	(0.0954)	(0.0969)	(0.0969)
Plot Located at Middle	0.233***	0.233***	0.167**	0.166**
	(0.0641)	(0.0641)	(0.0681)	(0.0684)
Village Electrification	0.162	0.162	0.244**	0.243**
	(0.119)	(0.119)	(0.119)	(0.119)
Internal Developed Road	0.191***	0.191***	0.181**	0.184**
	(0.0651)	(0.0651)	(0.0776)	(0.0773)
Cotton Grower	0.359*	0.359*	0.115	0.115
	(0.212)	(0.212)	(0.221)	(0.221)
Rice Grower	-0.106	-0.107	0.234	0.232
	(0.243)	(0.243)	(0.250)	(0.250)
Sugarcane Grower	0.378*	0.375*	0.260	0.248
	(0.208)	(0.208)	(0.264)	(0.259)
Distance Nearest Weekly Market	0.00743	0.00752	-	-
	(0.0437)	(0.0437)		
Distance Nearest Bank	-0.00111	-0.00156	-	-
	(0.0395)	(0.0395)		
Distance Nearest City	-0.167***	-0.167***	-	-
	(0.0422)	(0.0422)		
Distance District Katcheri	-0.0327	-0.0323	-	-
	(0.0595)	(0.0595)		

Variables	Log-Log (Dummy for Rent in)	Log-Log (Value of Rent-in)	2SLS Model (Dummy for Rent in)	2SLS Model (Value of Rent in)
Distance Tehsil Katcheri	-0.0171	-0.0163	-	-
	(0.0461)	(0.0462)		
District Dummies	Yes	Yes	Yes	Yes
		Test Statistics		
Observations	1120	1120	1120	1120
R-squared	0.514	0.514	0.478	0.478

Robust standard errors in parentheses

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

(Note: Refer to Table 5 in the Appendix to confirm that the residuals are normally distributed)

The table above indicates that most of the site characteristics have a correlation with perceived plot value per acre. The site characteristics also have the expected sign; for example fertile land, no soil erosion, number of irrigations by canal and ground water, plot located at head and middle of water course all have a positive correlation with the dependent variables across most of the model versions. Similarly, waterlogging and salinity have a negative correlation on perceived value of land per acre although salinity is not statistically significant across all of the models. Four of the coefficients for development variables are correlated with the dependent variable. Access to electricity, internal road, cotton growers, and sugarcane growers are positively correlated with perceived land values across most of the model versions. Variables for access to electricity and cotton growers were chosen to act as a proxy for other variables which captured the effect of an increase in income or development of a village. Similarly dummies for cotton growers and sugarcane growers were chosen to capture the effect of an increase in prices of crops and choice of crop. Most of the physical variables were not correlated with the dependent variable with the exception of distance to nearest city. Demographic variables such as the age of the respondent or if the respondent has ever attended school do not appear to have any correlation with the dependent variable, however average mauza income does have a positive correlation with perceived land value in some of the model versions. Model results indicate that ownership status and renting of plots are not correlated with land value per acre.

Another way of looking at the results is by classifying the results that have a correlation with perceived land value at the 1% level. Three of these variables have an impact on soil fertility and erosion (quality of land) and four of these are related to water quality and access. This again shows the importance of access and maintenance of good quality land and water as well as the importance of physical characteristics such as waterlogging and salinity.

VII. Conclusion and Policy Implications

Land disputes and development of land markets has proven to be a difficult task in the history of Pakistan. Land is an important social and financial asset and previous literature has proven that an increase in productivity of agricultural land will lead to a decrease in poverty. Yet factors which increase agriculture productivity also indirectly increase the value of land. Therefore, this study attempts to fill a gap in previous research by identifying what factors affect agricultural land values in rural areas of Pakistan. Finding out what factors affect perceived value of land per acre in rural Pakistan could help the Government of Pakistan decide what to invest in to promote development of rural land. This in turn will make rural land more attractive to local and foreign investors which will increase investment and development and decrease poverty.

Our research study used a hedonic regression model and two-staged least square model to determine what demographic, site, development, or physical characteristics have a correlation with the perceived value per acre of agricultural land. Four different versions of the model were used to analyze the impact of rent vs value of rent and to counter potential issues of endogeneity. Data for this study was obtained from the Pakistan Strategy Support Program's Rural Household Panel Survey (RHPS) of 942 households across 19 districts and 3 provinces who are currently involved in agriculture. Overall, the results are consistent with international literature on the subject. Model results indicate that most of the site and physical characteristics are correlated with perceived land value and only a few of the development indicators and none of the demographic variables have a correlation with perceived land value. Specifically fertile land, lack of soil erosion, number of canal and ground water irrigations, location of plot at head and middle of watercourse, access to electricity, internal road, cotton grower, sugarcane grower, and average mauza income are positively correlated with perceived land value per acre. Waterlogging, salinity, and distance to nearest city are negatively correlated with perceived land value.

These results provide some important policy implications which the Government of Pakistan can consider. It is worth noting that the Government of Pakistan has already announced a series of reforms to boost the economy and development. One of the main themes of the Vision 2025 of the Government and the Planning Commission include modernization of infrastructure and regional initiatives. Results from the model above suggest that the improvement of infrastructure and usage of regional initiatives could have the desired effect of increasing agriculture productivity through land development. For example, the results on site and physical characteristics suggest that the quality of land and how the farmer uses the land is important for productivity. Most of the site and physical characteristics are correlated with perceived land value which indicates that the Government of Pakistan should initiate policies which promote regional or rural initiatives which improve water access and maintenance of watercourses. Fertility level of land, soil erosion, and salinity can be controlled to a certain extent by sufficient access to good quality water and proper maintenance of the land and watercourses. Therefore, if the Government provides training and other resources at the micro-level, farmers will have a better chance to ensure that their land is of high quality and water access is sufficient to ensure higher productivity. Similarly access to electricity is important and the Government should ensure access to electricity throughout Pakistan.

One of the limitations of the model used above is that we could only include characteristics which were measurable or observable (ex. access to road, access to water, soil quality etc.). Theoretically, there are other variables that could be correlated with perceived land value. For example, implementing institutional rules which improve good governance, land titling policies, inheritance policies, and promoting ownership of land by foreigners could all be positively correlated with land values. All of these factors could be used as mechanisms to achieve the desired objective to promote agriculture productivity and development in rural areas.

Lastly, considering the development needs of Pakistan, the area of land ownership and development of rural agricultural land cannot be ignored. Similarly, proper investment into rural areas can turn them into centers of commerce which will boost productivity and economic growth. In the long run, this will improve investment and competition in the area.

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IX. Appendix

Table 3: Description of Sample from Round 1.5 of PSSP Rural Household Survey

Province	District	Number of Households
Punjab	Attock	16
Punjab	Bahawalnagar	58
Punjab	Bhakkar	78
Punjab	DG Khan	42
Punjab	Faisalabad	43
Punjab	Jhang	55
Punjab	Kasur	39
Punjab	Khanewal	45
Punjab	Multan	22
Punjab	Rahim Yar Khan	42
Punjab	Sargodha	27
Punjab	Vehari	54
Sindh	Hyderabad	57
Sindh	Jacobabad	86
Sindh	Sanghar	26
Sindh	Thatta	86
Sindh	Dadu	50
KPK	Mansehra	45
KPK	Nowshera	71
Total		**942**

Description of the Variables:

Log of Perceived Value of Land Per Acre

This variable is the dependent variable of the model and asks the farmer what is their perceived value of the land if it was sold today. The total value of the land was divided by the number of acres owned by the household. The natural log of this new variable was used.

Log of Respondent’s Age

This variable takes the log of the farmer’s age. The expected sign is positive

Average Mauza Income

This variable provides the annual average income per person in a given mauza

Dummy for if the Respondent has Ever Attended School

This dummy variable assigns a value of “1” if the farmer has ever attended school, otherwise the value is “0.” The expected sign is positive.

Dummy for Ownership of Plot

This dummy variable assigns a value of “1” if the farmer owns the plot that they are managing. Expected sign for this variable is positive.

Dummy for Renting a Plot

This dummy variable assigns a value of “1” if the farmer rent-in a plot that they are managing. Expected sign of this coefficient is positive.

Value of Rent

This variable provides the annual value of rent per acre for a given plot

Dummy for Mechanization

This dummy variable assigns a value of “1” if the household used a laser land leveler, tractor, or thresher on their plot. Otherwise the value was “0.” The expected sign is positive.

Dummy for Flat Land

If a farmer’s land is flat this variable has a value of “1” otherwise the value is “0.” Expected sign of the coefficient is positive.

Dummy for Terraced Land

If a farmer’s land is terraced this variable has a value of “1” otherwise it has a value of “0.” Expected sign of the coefficient should be negative.

Dummy for Fertile Land

If a farmer's land is fertile this variable has a value of "1" otherwise it has a value of "0." Expected sign of the coefficient is positive.

Dummy for Moderate Fertile Land

If a farmer's land is moderately fertile this variable has a value of "1" otherwise it has a value of "0." Expected sign of the coefficient is uncertain but probably negative.

Dummy for No Soil Erosion

If there is no soil erosion on farmer's plot, this variable is assigned a value of "1" otherwise the value is "0." Expected sign of the coefficient is positive.

Dummy for Mild Soil Erosion

If there is some soil erosion on farmer's plot, this variable is assigned a value of "1" otherwise the value is "0." Expected sign of the coefficient is unclear but probably negative.

Dummy for Salinity

If the soil on a plot is saline, this variable is assigned a value of "1" otherwise the value is "0." Expected sign of the coefficient is negative.

Dummy for Waterlogging

If the soil on a plot is waterlogged, this variable is assigned a value of "1" otherwise the value is "0." Expected sign of the coefficient is negative.

Dummy for Plot at Head

If a farmer's agricultural plot is at the head of the watercourse, this variable is assigned a value of "1" otherwise the value is "0." Expected sign of the coefficient is positive.

Dummy for Plot at Middle

If a farmer's agricultural plot is in the middle of the watercourse, this variable is assigned a value of "1" otherwise the value is "0." Expected sign of the coefficient is positive.

Number of Canal Water Irrigations

Log of the number of times the farmer used canal water to irrigate the plot. Expected sign should be positive.

Number of Ground Water Irrigations

Log of the number of times the farmer used ground water to irrigate the plot Expected sign should be positive.

Dummy for Non-Farm Income

If a farmer is earning income from a source other than agriculture, this variable is assigned a value of “1” otherwise the value is “0.” Expected sign should be positive.

Dummy for Village Electrification

If electricity is available in the mouza, this variable is assigned a value of “1” otherwise the value is “0.” Expected sign of the coefficient is positive.

Dummy for Internal Road

This variable has a value of “1” if the village has an internal road made of gravel, asphalt, bricks, or concrete. For other materials used for the road (example mud) and if there is no internal road this variable has a value of “0.” Expected sign of the coefficient is positive.

Dummy for Gas Cylinder

If gas cylinder is available in the mouza, this variable is assigned a value of “1” otherwise the value is “0.” Expected sign of the coefficient is positive.

Dummy for Cotton Grower

This variable has a value of “1” if the farmer grows cotton on the plot that they manage. Expected sign of the coefficient is positive.

Dummy for Rice Grower

This variable has a value of “1” if the farmer grows rice on the plot that they manage. Expected sign of the coefficient is positive.

Dummy for Sugarcane Grower

This variable has a value of “1” if the farmer grows sugarcane on the plot that they manage. Expected sign of the coefficient is positive.

Log of Nearest City

This variable takes the log of the distance from the village to the nearest city in kilometers. Expected sign of the coefficient should be negative.

Log of Nearest Output Market

This variable takes a log of the distance from the village to the nearest Output market. Expected sign of the coefficient is negative.

Log of Bank

This variable takes a log of the distance from the village to the nearest bank. Expected sign of the coefficient is negative.

Log of District Mandi

This variable takes a log of the distance from the village to the nearest district market. Expected sign of the coefficient is negative.

Log of Tehsil Katcheri

This variable takes a log of the distance from the village to the nearest tehsil headquarters. Expected sign of the coefficient is negative.

District Dummys

This variable is a dummy for each of the given districts in the sample

Table 4: Distribution of Residuals