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Introduction

Village surveys have long offered a window through which to closely examine production conditions in Indian agriculture. There is a large literature which has analysed the nature of agricultural production in developing countries, a large part of which has been in the Indian context. Within this literature, the institution of sharecropping has received a great deal of attention. It is increasingly recognised that in order to understand the purpose and role of this institution one needs to understand as well the nature of inter-linkages1 between markets for, and choices concerning, factors of production, especially in light of the fact that markets are often imperfect and risk is important.. Various explanations for the existence of sharecropping have been put forward. Most of these are built on neo-classical assumptions of complete and well-functioning markets. These explanations have generally failed to receive widespread acceptance as it is generally acknowledged that reality is generally far more complex than the assumptions of neo-classical economics would allow. After all, if markets functioned perfectly they would achieve all that is needed for efficiency and as a result, sharecropping would be redundant. The reality is that many markets are absent; many are imperfect and some factors of production indivisible. Share tenancy may represent an institutional response to such missing markets, thereby providing a more efficient outcome than what is possible without such institutions; full efficiency is unlikely to be achievable in such a context.

One of the early writers to suggest that share cropping might lead to an inefficient outcome was Marshall. The notion of Marshallian inefficiency arises from the fact that in share cropping, labour application by the tenant is a fraction of the maximum that would equate his marginal product of labour with to its opportunity cost. That is, if the tenant chooses his labour allocation there is no incentive for the tenant to apply labour to the most efficient level but rather to only apply his labour to the point where his returns are equal to the opportunity cost of his labour2. Cheung (1969) proposed that the existence of sharecropping is a result of a combination of high transaction costs and the benefit of risk-sharing that sharecropping entails. These together determine whether fixed-rent tenancy would be dominant, or sharecropping. In his model, Cheung assumed that the landlord is in a position to observe the efforts of the tenant and can enforce the terms of the contract in an inexpensive and effective way. He then proved that in the absence of risk and transaction costs required to enforce the contract, the presence of many landlords and tenants would bring in an element of competition and consequently, the share rent and the labour allocation which follow from sharecropping would be the same as in the case of fixed rent tenancy. In other words, under these assumptions, the sharecropped land would be cultivated in the same

[1] By inter-linkages, we mean transactions in different markets (e.g. labour, land and credit), taking place at the same time and in a linked way, between related, or the same individual agents.

[2] Marshall, wisely as ever, noted that in this context the landowner would wish to press for or insist on labour application and practices.

way as owned or rented on fixed rent, and therefore, sharecropping would be an efficient system.

Comparison between a family's average inputs and yield on own land versus that on sharecropped land has been used in many empirical studies to test the efficiency of sharecropping. The results have been mixed. Shaban (1987) conducted an empirical study on eight ICRISAT villages and rejected the monitoring approach of Cheung in modelling share tenancy. In a similar study, Bliss and Stern (1982) could find no significant evidence to suggest that in Palanpur tenancy makes any difference to the level of output per acre or the level of inputs between owned and sharecropped land.

A second type of explanation for different tenurial contracts is based on asymmetry of information between the landlord and the tenant regarding the tenant's abilities. This approach was originally developed by Hallagan (1978) and Newbery-Stiglitz (1979). In their framework, it is argued that tenants of different ability self-select into different contracts available. Sharecropping plays a role in matching the most productive tenant with the most productive contract. In particular tenants with high ability choose a fixed-rent contract despite a high rent stipulated by the landlord, because they get the returns to their productivity. This approach has been criticised on many counts and the strongest criticism is that in villages, people know each other quite well and it is hard to believe that the abilities of prospective tenants are unknown. Even if the abilities are unknown at some point of time, once the tenants self-select, their abilities will be revealed and the asymmetric information cannot persist over time. As a result, sharecropping can only be a temporary feature and a continuous influx of new tenants is needed for the institution to continue to exist. In practice, sharecropping has been seen to persist over long periods of time, also in environments characterized low turnover of tenants. This casts some doubt on this line of argument.

Another approach to tenancy theory, which can be seen in the works of Bell and Zusman (1979), Pant (1983), Bliss and Stern (1982) among many others, focuses on market imperfections beyond simply the land market to explain the emergence of tenancy. Bliss and Stern (1982) found that in Palanpur the bullock market and the market for family labour were highly imperfect. A farmer will generally be unwilling to rent out his bullock for fear that it would be mistreated, and at the same time be loath to plough another farmer's field because of the demeaning "labourer" status this would impart. Being a "labourer" in Palanpur is associated with membership of a low social status, low income group which is unlikely to own valuable assets such as bullocks. Labourers will thus be unable to provide the ploughing services required for successful cultivation. In order to use the services of these two markets, the landlord has to make the owners of these factors residual claimants; hence, a role for tenancy. These arguments are in addition to important element of risk sharing, provided by share tenancy. According to Bliss and Stern (1982) information, monitoring and observation also play a role in this decision. The landlord cannot be present to monitor every action of the tenant. Moreover, cash rent requires liquidity which is often binding constraint for village households. Liquidity shortages can thus also provide a reason for sharing cash inputs.

Eswaran and Kotwal (1985) have argued that the comparative advantage of the tenant may lie in supervising labour, while that of the landlord may lay in managing production operations. If the tenant is relatively more efficient at supervising than at management and at the same time, the landlord is relatively more efficient at management than supervision, then the contract chosen will be sharecropping. However, if the tenant becomes relatively more efficient at management, then the contractual choice, to provide the appropriate incentive,

will shift towards fixed rent. A further contribution within this framework by Ghatak and Pandey (2000) is novel in the sense that it allows for existence of moral hazard in risk taking, as well as in effort, and explains the existence of sharecropping contracts as a result of the mechanism which balances the moral hazard among its two components. However, the Ghatak and Pandey (2000) model is applicable only in conditions where the tenant faces limited liability. In Palanpur and similar areas of Northern India, limited liability is conspicuous in its absence. It is thus difficult to see this particular model explain the existence of sharecropping in Palanpur.

It is clear that available theories on tenancy and contract choice, despite being rich in their intellectual content, leave quite a lot to be explored and explained empirically. Some of these issues were considered important during the early phases of the "green revolution" in India and some of these concerns have continued to remain important for understanding the formation of factor markets and their functioning in developing country settings such as Palanpur. The previous surveys of Palanpur have dealt with some of these issues in detail, in particular Bliss and Stern (1982). This paper offers a preliminary attempt at looking at some of these issues with the most recent round of data collected from Palanpur during 2008-2010. The scope of this paper is limited to analysing various issues related to tenancy in Palanpur. Discussion of some of the issues related to farm size productivity debates from the Palanpur survey of 2008-2010 is available in Kawatra (2009). Details on the nature of changes in agriculture in Palanpur are available in the accompanying paper (Tyagi and Himanshu, 2011).

Tenancy in Palanpur

A fairly detailed description of changes in agricultural production and tenancy can be found in Tyagi and Himanshu (2011). We highlight here the major changes in the nature of tenancy in Palanpur as compared to previous surveys. First, tenancy continues to remain a prominent feature of the Palanpur economy. In fact, the area under tenancy continues to show an increasing trend since 1974-75 with land under tenancy accounting for almost one-third of the operated area of the village. Second, although the area under tenancy shows an increase, the percentage of households engaged in the tenancy market out of total village households shows a decline from 1983. Third, in 1983 there were more landlords compared to tenants, but by 2008, there are more tenants than landlords. Fourth, batai3 remains the largest form of tenancy but is no longer the dominant form of tenancy with fixed rent tenancy and chauthai jointly contributing to almost half of total tenanted land. Fifth, chauthai has emerged as the new form of tenancy. This tenancy contract, which is closer to a "pure" labour contract than a "pure" tenancy contract, is a new development in the village. Sixth, there are only two households which are simultaneously involved in leasing in and leasing out as against 16 households (11%) in 1983.

[3] 'Batai' is the sharecropping contract in which the tenant pays half of cash inputs, performs himself or hire the labour required in the cultivation and receives half of the total output at the harvest time. Peshgi is the fixed rent contract with the payments to the landlord made before the season starts (if cash-rent) or at the harvest time (if kind rent). Chauthai is a contract where the tenant's sole responsibility is performing labour (his own or hired) and he receives one-fourth of the total output. See Tyagi and Himanshu (2011) for a detailed description of the contract arrangements in Palanpur.

These developments in the tenancy market need to be situated in the broader context of changes in the labour market, incomes and distribution of assets4. A preliminary analysis of some aspects of change in the labour market and migration is available from Mukhopadhyay (2011). The essential point emerging from the analysis of the Palanpur economy over the decades is that agriculture appears to have a weakening role in determining the growth and distribution of incomes. While Palanpur has continued to integrate itself with the outside world in the form of employment opportunities and access to markets through better communication with the outside world, it has also benefited from the changing environment of economic policies which have been important in building such backward and forward linkages. Although our understating of the many ways in which these factors operate is limited, there is certainly some evidence to indicate that outside jobs are playing an important role in determining the demand and supply of labour in the village and also in the determination of both agricultural and non-agricultural wages in the village. Some of these developments have affected the way agriculture is organised in the village, in particular, the institution of tenancy.

Findings from Discussions

This paper presents some preliminary results on the possible economic roles played by tenancy. It also provides some explanations as to the reasons for dominance of certain tenancy contracts and changes over time. Along with questionnaire-based information, opinions on some of the issues which have been raised in the existing literature were also collected from a sample of households which were engaged in tenancy. A discussion questionnaire was designed and a random sample of landlords and tenants were interviewed. The sample consisted of 83 farm households (which are 61 percent of all farm households in Palanpur engaged in tenancy), with a caste distribution that matches the share of each caste in the village's population. The sample consisted of 48 pure tenants and 23 pure landlords. This proportion resembles the distribution of tenants and landlords in the population of total farm households of Palanpur participating in tenancy. We were unable to interview any non-resident of Palanpur who is in a tenancy contract with a Palanpur resident.

Figure 1 shows that the major reason for leasing-in land among tenants is the desire to earn a higher profit. Apart from this, a majority leases-in land to utilise the excess family labour. Utilisation of other household assets like a diesel pump set and money is also a reason for leasing in. Figure 2 highlights the major reasons for leasing out for a landlord. A majority leases-out because they just do not have adequate family labour to work on the land: a mirror-image of the situation of tenants. In this sense, the needs of landlords and tenants are clearly complementary to each other.

Another major reason for leasing out land is the existence of an urgent cash requirement. Leasing out land on a fixed rent serves as a substitute for taking loans for these households. In fact, there are farmers who believe in the dictum "neither a borrower, nor a lender be" and are strictly averse to taking loan. For them, leasing-out land on fixed rent is a secured means of meeting urgent cash requirements of the household.

Among the other reported reasons for leasing-out, an unusual one is the monkey menace on plots. Monkeys are a big menace for the farms in Palanpur and a lot of labour time

[4] It should be noted that the issues of incentive, risk allocation, asymmetric information, indivisibility etc play very important role in markets, transactions and institutions in all countries.

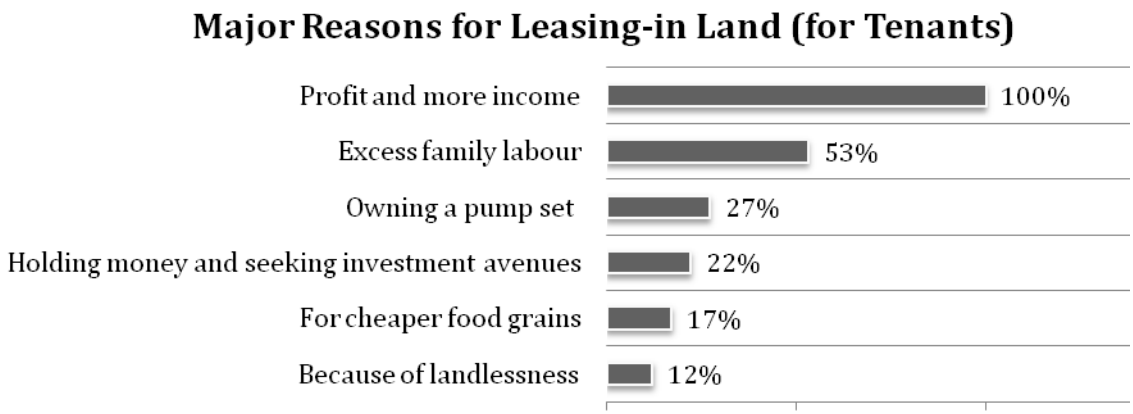
has to be devoted to vigilance and protection against monkeys. So, landlords lease the land out on sharecropping, preferably to a tenant who lives close to the land.

Figure 3 shows that sharing of cost and risks are the major reasons for tenants to prefer sharecropping to fixed-rent tenancy. Landlords mainly prefer sharecropping as against fixed-rent tenancy because it gives them higher profits (Figure 4). Cost-sharing also figures in the landlord's motivation behind sharecropping. Among the other prominent reasons, one stands out from the rest. There is a feeling among some farm households that they find it difficult to save if they have cash in hand. If they lease-out land on fixed-rent (given they can lease it out on sharecropping too), then they will spend the cash earned on consumption (or wasteful expenditure, as some said) and by the end of the season they will have neither the money, nor the food grains to consume in the next season. Therefore, they find it reasonable to lease land only on sharecropping, unless other reasons like cash requirement are dominant.

Tenants prefer fixed-rent leases to sharecropping because there are no hassles or coordination problems with the landlord (Figure 5). Also, it gives them the highest profit among all the other standard leases. We do not have exact statistics on the reasons why landlords prefer fixed-rent to sharecropping, as we did not interview the absentee landlords who constitute the majority of landlords in fixed-rent. But it should be clear that they find it difficult to manage a sharecropping contract when they stay far away and hence find it easier to get cash rent for the land.

Figure 6 indicates the traits tenants look out for in a prospective landlord and figure 7 shows the reverse. The trait which matters a lot to both of them is trustfulness. The landlord wants the tenant to stay faithful in application of inputs, while the tenant wants the landlord to stay faithful regarding the terms of contracts and payment of his input-costs share on time. They also seek out a partner who is resourceful with regards to working capital and ownership of diesel pump sets. Apart from these, a landlord would like his tenant to be hard-working and possessing plentiful family labour. The Landlord would also prefer to choose tenants from amongst his friends or relatives. Tenants look out for the quality of the soil, irrigation facilities on the land and proximity of the tenanted land to owned land.

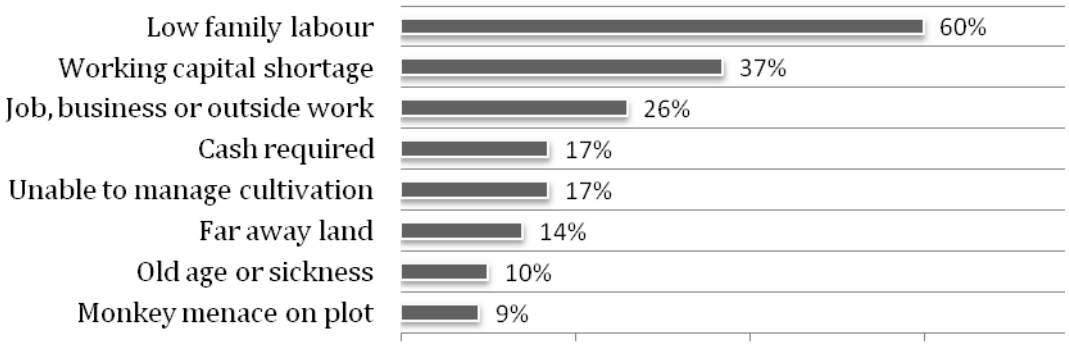
Figure 1



Note: The figures are a percentage over the total number of tenants interviewed. Multiple options were allowed.

Figure 2

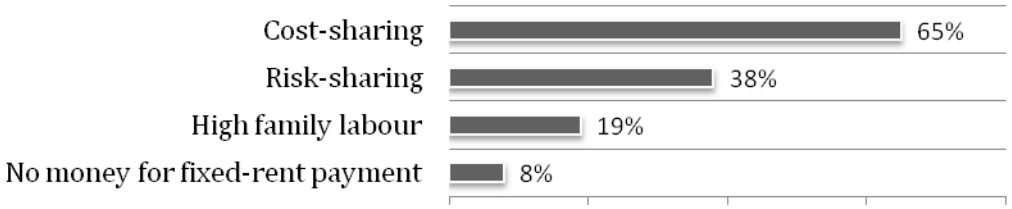
Major Reasons for Leasing-out Land (for Landlords)



Note: The figures are a percentage over the total number of landlords interviewed. Multiple options were allowed.

Table 3

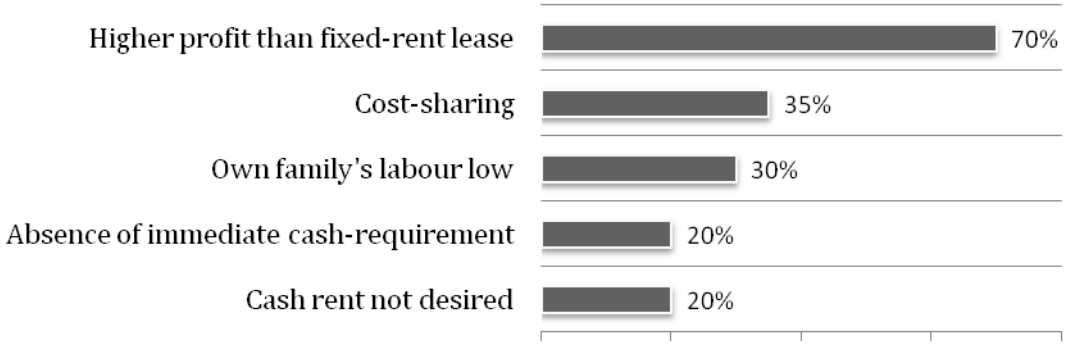
Major Reasons for Preferring Sharecropping (for Tenants)



Note: The figures are a percentage over the total number of pure tenants who prefer sharecropping to fixed-rent lease in the sample. 65% of the pure tenants prefer so. Multiple options were allowed.

Figure 4

Major Reasons for Preferring Sharecropping (for Landlords)



Note: The figures are a percentage over the total number of pure landlords who prefer sharecropping to fixed-rent lease in the sample. 87% of the pure landlords prefer sharecropping to fixed-rent leases. Multiple options were allowed.

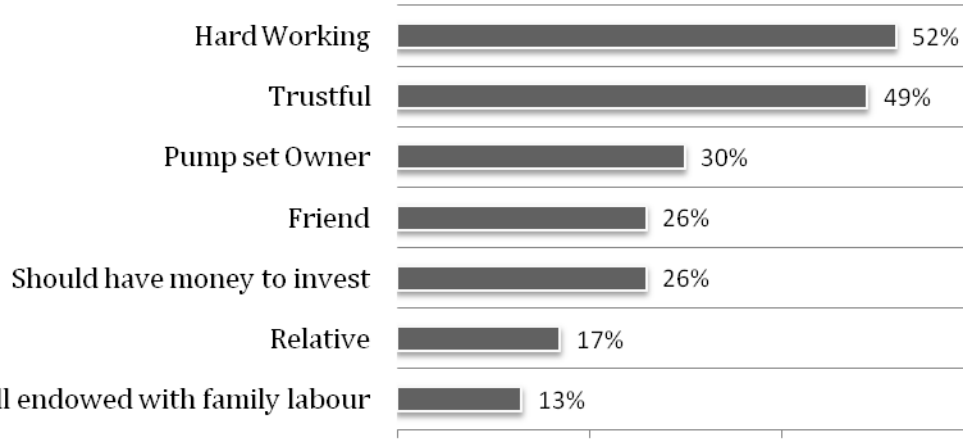
Figure 5

Major Reasons for Preferring Fixed-Rent Leases (for Tenants)

Note: The figures are a percentage over the total number of pure tenants who prefer fixed-rent lease to sharecropping in the sample. 35% of the pure tenants prefer so. Multiple options were allowed.

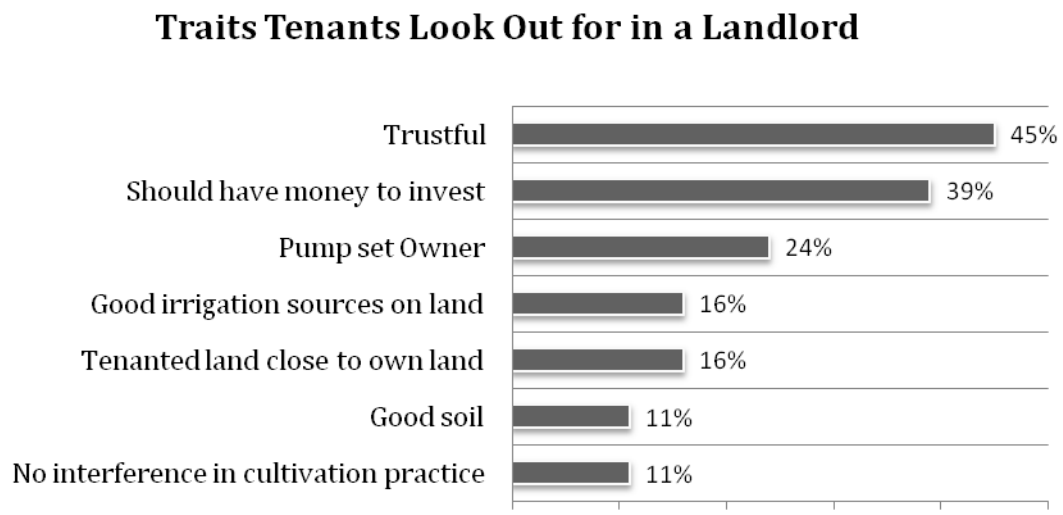
Figure 6

Traits Landlords Look Out for in a Tenant



Note: The figures are a percentage over the total number of pure landlords in the sample. Multiple options were allowed.

Figure 7



Note: The figures are a percentage over the total number of pure tenants, who were not looking only for fixed-rent lease, in the sample. Multiple options were allowed.

Productivity analysis

In this section we test the hypothesis that sharecropping is an inefficient system of tenancy relative to own cultivation, at least in the particular sense of labour output per bigha. We first run simple t tests to find differences between the yields on sharecropped and non-sharecropped land. We can reject the null hypothesis if we find no significant difference between the yields on sharecropped and non-sharecropped land. Subsequently, we use Data Envelopment Analysis (DEA) to examine the efficiency of sharecropping.

We employ two methodologies for testing the hypothesis. The first approach is to test the yields of a given crop for households cultivating the crop either on self-cultivated owned land or sharecropped land, but not both. We run unpaired t-tests to check if the average yields belong to the same categories.

Table 1 highlights the summary statistics for this methodology for major crops. The column 'Significance level' denotes the significance level beyond which the means are statistically different from each other. If it is less than 5, then the yields are statistically different from each other at 5% level. As the table shows, only for Bajra we can say that the yields are statistically different under own land and sharecropped land. But yields are higher on sharecropped land than on self-cultivated land; a perverse result, relative to the null hypothesis.

The second method is to use the data on the households who have cultivated the crop on owned land as well as on sharecropped land and then test if the difference in yields as obtained on these 2 different groups of land is significantly different. This method is more precise in testing the question of efficiency as it controls for various aspects which can vary across farm households. We test the hypothesis by running paired t-tests to check if the means belong to the same population.

Table 1: Efficiency - Methodology I

Crops	Self-cultivated own land			Sharecropped land			Significance Level [a]
	No of Obs.	Mean	Std. Dev.	No of Obs.	Mean	Std. Dev.	
Wheat	71	216.07	51.24	9	239.18	48.15	20.37
Mentha	83	2.8	1.71	16	2.43	1.94	43
Paddy	47	186.04	83.74	25	199.57	48.15	52.5
Bajra	63	50.5	42.7	7	84.7	60	5.7
Urad	62	28.6	31.7	4	17.83	6.48	50.2

a. Level shows the minimum significance level at which the means are statistically different across two categories

Table 2: Efficiency - Methodology II

Crops	Self-cultivated own land			Sharecropped land			Significance Level [a]
	No of Obs.	Mean	Std. Dev.	No of Obs.	Mean	Std. Dev.	
Wheat	31	213.06	59.99	31	230.28	54.44	16
Mentha	15	3.18	2.25	15	3.28	1.76	85.6
Paddy	7	191.66	95.44	7	166.3	49.29	52.3

a. Level shows the minimum significance level at which the means are statistically different across two categories

Table 2 shows the results and the significance level for means to be different is not sufficient to conclude that yields are different among self-cultivated own land or sharecropped land. For urad and bajra, the number of observations is insufficient to produce any reasonable analysis.

We can reject the null hypothesis as we fail to find any significant difference between self-cultivated land and sharecropped land for major crops. We find no evidence to suggest that sharecropping is an inefficient mode of cultivation as compared to own cultivation, in the sense of resulting in lower yields.

Data Envelopment Analysis

Data Envelopment Analysis (DEA) is a non-parametric approach used to test the efficiency and productivity of production units, taking into account a given set of possible inputs and outputs. It involves the use of linear programming methods to construct a non-parametric piecewise frontier over the data, in order to be able to calculate efficiencies relative to this frontier. A major advantage of this approach is that there is no need to assume an underlying production function for estimating efficiencies. Also, the technique obviates the need for price data to arrive at the relative efficiencies of the production units (in this case, farmers). This is an appealing feature relative to over those approaches that examine efficiency by comparing the value of marginal product with the price of the input5.

The model in this paper is based on Charles, Cooper and Rhodes (1978). Assume that i^{th} Decision Making Unit (DMU), $i \in [1, n]$, uses $x_i = \{x_k\}$ of inputs ($k \in [1, r]$) and produces a single output y_i, then X will be a (r x n) input matrix and Y will be a (1 x n) output vector for all n DMUs. In the *ratio form* of the DEA, we will obtain a measure of the ratio of the output

[5] The major point of difference from the methodology used in the previous section to examine the efficiency of production units is that the DEA method takes into account not only the output, or yield to be specific, but also the input bundle used in the process. Suppose 2 farmers; let us call them A and B, obtain the same amount of yield, but farmer A uses lower level of inputs than farmer B. Then, in the productivity analysis approach described above would find both to be equally efficient, but with the DEA approach, the farmer A, who uses lower inputs, will be judged more efficient than farmer B.

over all inputs, $u' y_i / v' x_i$, where u is a scalar denoting output weight (as there is a single output) and v is a r x 1 vector of input weights. We select the optimal weights by specifying the following problem:

Maximize ($u' y_i / v' x_i$) by choice of u and v, subject to:

$$u' y_j / v' x_j \leq 1, \; j = 1,2,...,n$$

$$u, v \geq 0$$

The above problem finds the value of input weights and output weight such that the DEA efficiency measure of the i^{th} unit is maximized, subject to the constraint that all efficiency measures are less than or equal to one. A further condition, $v' x_i = 1$ is imposed because the above problem has infinite number of solutions. The maximization problem, therefore, takes the *multiplier* form and becomes:

Maximize ($\mu' y_i$) by choice of μ and ν, subject to:

$$\mu' y_j - \nu' x_j \leq 0,\ j = 1, 2,...,n,$$

$$\nu' x_i = 1,$$

$$\mu, \nu \geq 0$$

Here, μ and ν reflect the transformation from u and v. Using *duality* in linear programming,

we derive an equivalent *envelopment* form of this problem, which is as follows:

Minimize θ (by choice of θ and λ), subject to:

$$-y_i + Y\lambda \geq 0,$$

$$\theta x_i - X\lambda \geq 0 \text{ and}$$

$$\lambda \geq 0$$

$\theta \in [0, 1]$ denotes the technical efficiency score for the i^{th} DMU, obtained with input

orientation and under constant returns to scale. A score of 1 denotes the most efficient DMU, the efficiency decreases as θ decreases and a DMU with θ = 0 is the most inefficient DMU. λ

is a (n x 1) vector of constants. It is constrained to be non-negative in order to keep the θ

within the limits of 0 and 1. The envelopment form imposes fewer constraints and is easier to solve than the multiplier form.

The above LP problem has been solved n times, once for each DMU to obtain the efficiency

score which is being evaluated under different sets of observation as an envelope. We have used the DEAP software (version 2.1) for our calculations.

We undertake the Data Envelopment Analysis separately for kharif 2008 season (July 2008 to November 2008) and rabi 2009 season (November 2008 to June 2009). A similar analysis for rabi 1984 (November 1983 to April 1984) and kharif 1984 (July 1984 to November 1984) has also been undertaken. The analysis of both the survey years excludes the sugarcane crop. (This exclusion is due to the fact that sugarcane, once cultivated, can last for 3 years. Initial costs like land preparation and seed expenditure will be present for the crops in first year but will be absent for the mature crops, thereby favouring mature crops in efficiency estimation.) Other low-valued crops which were primarily cultivated for home-consumption and are difficult to value have also been excluded.

The variables to be included in the efficiency estimation need to be selected carefully because an increase in the number of inputs or outputs tends to increase the number of efficient units. It is very likely that when an extra variable is added to the DEA model, an inefficient unit will dominate on the added dimension and will become efficient. Hence, a parsimonious use of variables is essential to avoid losing the explanatory power of the model. Accordingly, we have selected only those inputs which are a common practice in the agriculture of the village (excluding for example, expenditure on sowing by machine because it is a relative infrequent practice, generally seed is sown manually with no cash input cost for the sowing itself).

Prices of inputs do not pose such a problem because they have stayed more or less constant during the agricultural year in question. We are viewing efficiency here as producing higher output value on a bigha per rupee spent on each input, therefore the inputs and outputs are not in physical terms. The prices used for valuing inputs have been kept the same for all the farmers and have been carefully selected to reflect the actual price during the year.

In the 2008-09 analysis, the inputs we have included in the DEA model are: land preparation, seeds, basal fertilizer, top dressing fertilizer, irrigation, labour and harvesting. For 1983-84, we have excluded the land preparation variable because of the lack of data on this input.

We consider only one output variable, which is the value of output per bigha6. Prices for certain crops fluctuate on a daily or weekly basis. Variations in the output value per bigha based on price changes will distort the estimation of efficiency in the favour of those farmers who sold their output when the price was high. Therefore, crop prices have been carefully selected to reflect the average prices during the time of harvest and a single price value is used for each crop.

For testing the differences in the efficiency of self-cultivated and leased farms in Palanpur, we employ 2 major sets of methodologies. The first methodology takes into account only those farms, which leased-in area under batai contract and also cultivated on owned land. For each of these farm households, we therefore, have 2 separate input and output variables. We treat each household as 2 decision making units, one for a self-cultivation farm and the other for batai, and for each DMU, we run the DEA model as described above. If farmers in Palanpur treat batai as secondary to self-cultivation, then we should expect to see a clear domination of self-cultivation in efficiency estimates.

Table 3 presents the summary of the technical efficiency estimate 'θ' for the seasons in question. For the kharif 2008 season, the mean efficiency score of self-cultivated farms in this group is 0.68, which is slightly lower than the corresponding score for batai. For rabi 2009, the score is the same for both self-cultivated farm and farms under batai. When we calculate the difference between the means of efficiency score on self-cultivated farms and batai farms using t-tests, the results of which are not presented here, we find no statistically significant difference. We do the same analysis for rabi 1984 (See Table 4) and we find that the mean efficiency score for self-cultivated farm is 5 percentage points higher than that for batai farms. However, the difference in mean is not statistically significant. Moreover, when we run the test for kharif 1984, the mean efficiency score for batai farms is higher than the self-cultivated plots. The difference in mean, in this case, is also statistically significant, indicating that batai farms on the average were more efficient, in the DEA sense, than the self-cultivated farms in kharif 1984.

These results clearly indicate that farmers, who operate on batai farm as well as self-cultivated farm, do not give strict preference to self-cultivated farms as against the batai farm. There is nothing to support the claim that with respect to input application and output production, the batai farms are inefficient relative to self-cultivated farms. This aligns well with farmers' responses to our 2008-09 discussion survey. When asked 'if they follow better agricultural practices on self-cultivated land as compared to land they lease on batai', an overwhelming 58 of the 60 tenants reported that practices on both the lands are the same.

Table 3: Comparing technical efficiency between select farms (2008-09)

[6] In Palanpur, 15.8 bigha is equal to 1 hectare.

Type	Obs.	Mean of 'θ'
Kharif 2008		
Self	22	0.68
Batai	22	0.71
Rabi 2009		
Self	25	0.74
Batai	25	0.74

Table 4: Comparing technical efficiency between select farms (1983-84)

Type	Obs.	Mean of 'θ'
Rabi 1984		
Self	36	0.87
Batai	36	0.82
Kharif 1984		
Self	27	0.38
Batai	27	0.48

We also tested the relative efficiency of the farm households discussed above to other farm households in Palanpur, to see how the batai farms perform when competing against all the other farms (including the self-cultivated portion of the same farmer). As before, we run separate DEA model for kharif 2008, rabi 2009, rabi 1984 and kharif 1984.

Table 5 and 6 present the summary of technical efficiency estimates 'θ'. For Kharif 2008, the mean efficiency score is higher for batai and chauthai (among which, batai is the "real" sharecropping contract in 2008-09 survey round, while chauthai is more of a labour-contract, see Tyagi and Himanshu (2011)) than self-cultivation farms. An even higher difference in mean efficiency score between batai farms and self-cultivated farms exist for Rabi 2009. For Rabi 1984, the mean efficiency score for batai is slightly lower than that for self-cultivated farms. However, for kharif 1984, the mean efficiency score for batai is higher relative to self-cultivated farms.

Table 7 presents the distribution of efficient and inefficient units in different lease contracts for the 2 seasons in the year 2008-09. In cultivation, there are many factors outside the control of the farmer that can affect efficiency negatively. There may be untimely rains

affecting some farmers more than the others, technical failure in equipment, illness in the family among many other things. Therefore, a farmer with an efficiency score slightly below 1 may be efficient in the sense that he did his best but due to uncontrollable factors could not earn an efficiency score of 1. Therefore, we treat all the farms with efficiency score greater than or equal to 0.9 as efficient (except for Kharif 1984, where average efficiency is lower and therefore, we have used 0.8 and above as the definition of efficient units). All the rest are deemed to be inefficient.

For Kharif 2008, we find that the proportion of efficient units in batai is more than double as compared to self-cultivation. In Rabi 2009, the proportion of efficient units is almost the same in batai and self-cultivation. Table 8 presents a similar analysis for the year 1983-84. The proportion of efficient farms in batai contract is almost the same as in self-cultivated farms for Rabi 1984. However, considering the kharif 1984 season, batai farms have a higher percentage of efficient units than do self-cultivated farms.

Table 5: Summary of Technical Efficiency Estimates (2008-09)

Type	Kharif 2008		Rabi 2009	
	Obs	**Mean of 'θ'**	**Obs**	**Mean of 'θ'**
Self	142	0.52	123	0.52
Batai	49	0.62	35	0.66
Peshgi	35	0.55	27	0.5
Chauthai	4	0.71	-	-

Table 6: Summary of Technical Efficiency Estimates (1983-84)

Type	Rabi 1984		Kharif 1984	
	Obs	**Mean of 'θ'**	**Obs**	**Mean of 'θ'**
Self	71	0.8	70	0.34
Batai	41	0.75	37	0.45
Peshgi	10	0.76	7	0.43
Chauthai	2	0.89	2	0.14

Table 7: Distribution of Efficient and Inefficient Units (2008-09)

Type	Inefficient		Efficient		Total
	Freq	%	Freq	%	
Kharif 2008					
Self	104	85	19	15	123
Batai	22	63	13	37	35
Peshgi	22	81	5	19	27
Total	148	80	37	20	185
Rabi 2009					
Self	110	83	22	17	132
Batai	27	82	6	18	33
Peshgi	22	76	7	24	29
Chauthai	3	100	0	0	3
Total	162	82	35	18	197

Table 8: Distribution of Efficient and Inefficient Units (1983-84)

Type	Inefficient		Efficient		Total
	Freq	%	Freq	%	
Rabi 1984					
Self	56	79	15	21	71
Batai	33	80	8	20	41
Peshgi	8	80	2	20	10
Chauthai	1	50	1	50	2
Total	98	79	26	21	124
Kharif 1984 a					
Self	62	89	8	11	70
Batai	27	73	10	27	37
Peshgi	5	71	2	29	7
Chauthai	2	100	0	0	2
Total	96	83	20	17	116

Because of lower average efficiency figure, 0.8 and above is used as a definition for efficient units, instead of usual 0.9.

Taking together the results from this, and the preceding, section, we can conclude that there is no reason to suggest that sharecropped farms are cultivated inefficiently in Palanpur. If anything, it appears that batai farms perform better than self-cultivated farms by a slight margin. There could be a number of reasons for this. First, with the exception of the quality of labour inputs being applied, landlords in Palanpur find it relatively easy to monitor the application of all the other inputs. Land preparation is a standard mechanised process and landlord can easily monitor the instances of ploughing done. Usually, either the landlord or the tenant owns irrigation equipment and therefore timely irrigation can always be arranged for. Quality of seeds and the amount of fertilisers applied (both of which are shared equally among the landlord and the tenant) are not so easy to monitor but in the event that the landlord discovers that the tenant is applying lower quality seeds and is not applying the agreed-upon quantity of fertilizer, the tenant will be discredited and the lease may not be continued the next season. Moreover, given the high number of prospective tenants as compared to landlords, it will be difficult for a tenant with a damaged reputation to find another lease. For a landlord, ensuring that manual labour of good quality is being applied remains a tricky issue but the problem is not so severe because a landlord can always be careful to choose only a hard-working tenant. Palanpur is a small village, people know each

other well and information on the skills of the prospective tenant is easy to acquire. Therefore, as far as monitoring and supervision is concerned, Palanpur landlords can do a good job if they put in a reasonable level of effort.

Moreover, there are some obvious gains from an arrangement like batai. Some of them have been mentioned in the 'findings from discussions' section. It is not uncommon that farmers find themselves unable to provide timely inputs such as fertilizer or, irrigation because they are running low on working capital. In batai, it is very common for one partner (be it landlord or tenant) to incur a cost in full, so that the cultivation operation can be completed on time, and to then be repaid by his partner later. This is normally an interest free loan from one party to the other. For a self-cultivating farmer, working capital shortages imply that he would have to take a small loan from the village money-lender (with interest between 3 to 5 per cent per month). If such a loan is not readily available, he would have to compromise on the cultivation practice, leading to inefficiency in production. This is not to say that there are no disagreements between landlord and the tenant. But for the village as a whole, the instances of disagreements are a lot fewer in number than the instances of mutual cooperation in time of need. In addition to the advantage of timeliness, where more than one input source or its finance might be available, there is the general argument that discussion may produce better decisions – "two heads may be better than one".

Therefore, neither empirically, nor theoretically do we find any strong reason to expect that sharecropping is an inefficient institution relative to self-cultivation in the village.

Why tenancy and sharecropping?

Management and supervision are generally the key ingredients when more than one person is involved in cultivation. Both of these inputs depend on various observable and unobservable factors. Management of the farm is influenced by and is related to the land preparation assets the household owns, ownership of irrigation equipments, cash-flows at the household's disposal which also includes credit availability, cultivation knowledge and organizational skills. Supervision on the other hand deals with executing the work to be done as well as possible in order to raise productivity (in the context of the incentive structure in place) of land and other factors as far as possible. Supervision is influenced mainly by the dexterity, physical ability and sincerity of the labour. A household may be strong in both the components at a given time or may be weak in one or other.

We use the term "management ability" here to cover both the ownership of assets which allow the farming of land (tractors, diesel pump set etc) and the ability to organize. The former is likely to be correlated with the latter. Supervision being labour intensive, is characterised particularly in terms of the availability of the appropriate type of labour.

We can broadly categorize Palanpur farm households in the following categories:

I. Management categories:

1. Households with high management ability relative to land owned - such households own cultivation assets like tractors, diesel pump sets, tube wells cultivation experience and suitable cash-flows for cultivation but, but do not own enough land to employ these assets fully.

2. Households with management ability which fits well with land owned – these households own cultivation assets which are just enough, or we can say “optimal”, for self-cultivation.

3. Households with lower management ability relative to land owned - such households possess larger landholdings than can be optimally cultivated given the households’ cultivation assets such as a tractor, tubewell, diesel pump sets, cultivation experience and suitable cash-flows for cultivation.

II. Supervision categories:

4. Households with high supervision ability relative to land owned– These are households whose labour to land owned ratio is quite high. Agricultural labour tends to be seasonal in nature and getting a wage job is not assured. Due to social norms, women do not work as a daily wage labourers on farms. Outside jobs are not regularly available and not all the labourers possess the necessary skills for specialised jobs. As a result, a considerable number of household members may remain unemployed for a significant number of days in a month.

5. Households with supervision ability fitting well to land owned – this group has family labour available for work in agriculture, appropriate to that required for the cultivation of the land in their possession.

6. Households with lower supervision ability relative to land owned– this group owns large amount of land relative to labour power to work the land optimally. It includes the households who are on the richer scale of income and could afford sending their children to better schools and colleges. Many of them found employment in services within or outside the village and are unable to devote themselves full time to cultivation practices. As a result, the labour power required to work on farm is very limited within the household. This group also includes those who on the basis of ownership of the farm mechanized assets have started providing mechanized services like tube well irrigation, land preparation by tractor, etc, to other farmers in the village.

Both management and supervision are, to some degree, difficult to market and cannot, therefore, be adjusted in the short run to the household’s requirement for them. The household takes account of the management and supervision at its disposal and decides the potential area it can cultivate. Tenancy arises, or at least, is sought, when the owned land amount is different from the potential area that the farmer can cultivate.

Based on the discussions with a sample of landlords and tenants (as presented before), we can broadly outline the factors influencing the choice to enter the tenancy market and the contract to be chosen. Table 9 highlights the general preferences of households given the management and supervision categories to which they belong.

Table 9 indicates that households try to adjust their land under cultivation and tenancy contract to fit with their management and supervision ability and thus to make appropriate use of these not-so-perfectly marketed factors. That is the basic hypothesis. It is based on the above reasoning and on the discussion material (Table 9).

We have tried to examine this hypothesis using our data on tenancy. Table 11 presents regression results of leased-out land using area under particular leases as a dependent variable. Table 10 presents the descriptive statistics for this exercise. Important results from

the regression are as follows. First, absence of appropriate management and supervision ability combined with or without a credit need, is the main motivation behind leasing out on Peshgi. The dummy variable on Loan outstanding is significant only at the 10% level but this is perhaps not surprising; loan and peshgi are substitutes for each other to a considerable degree, although they are not perfect substitutes. Informal credit is the primary source of loans in Palanpur for a majority of the households and considering the high interest rates these are associated with, many households prefer to lease out land on Peshgi rather than taking out loans. In out sample we therefore observe some households who do not have a loan outstanding but who have leased out the land on Peshgi in order to meet their credit needs. As the coefficient on the loan outstanding dummy is significant at 10% level, this offers some support to the notion that households with a credit crunch are likely to lease out land on Peshgi. It appears that many households choose a middle path of leasing out some land on Peshgi and taking out a loan as well.

Secondly, households who lease out on batai are likely to have low family labour along with a certain lack of cash flows to invest in agriculture. We can regard households with life insurance policy and salaried employment as those who have sufficient cash flows to invest in agriculture. The significant negative coefficients on both these variables highlight that lack of cash flows is a main reason to lease out on batai. It is instructive to note that salaried employment also implies a lack of family labour to a certain extent and can work in favour of leasing out land to access the labour power of a potential tenant. But the supervision component here is already significant indicating that the effect of salaried employment is purely financial in nature.

Thirdly, the education of the head is positively related to leasing out land on batai. There is a view in the village that educated young adults are not inclined towards agriculture because they look down upon the physical labour or because they believe that they are better at managing farm operations as compared to working themselves on agriculture. The coefficient is small in absolute value but may be capturing this growing perspective.

Fourthly, rich households with high management ability lease out on Chauthai. The supervision component is not significant here but possibly in this case we are unable to capture the actual factor influencing the supervision ability of the household. Even if rich households have sufficient labour power to devote to cultivation of their own land, they may feel inclined to divert some of that labour power to activities that take them off the farm.. Given a choice between strenuous manual labour on their own field or a relatively comfortable job of land preparation on the farm of others through the hiring out of tractor or tube well services a richer farmer can reject the physical labour work while leasing out his land on Chauthai to ensure that the appropriate amount of labour is applied on his farm.

Table 9: Tenancy decisions

Management category	Supervision category	Contract
1 (high)	4 (high)	Lease in on Peshgi.
1 (high)	5 (optimum)	Lease in on Peshgi and if required, hire labour to do the work.
1 (high)	6 (low)	Lease out on Chauthai.
2 (optimum)	4 (high)	Lease in on Batai.
2 (optimum)	5 (optimum)	No lease.
2 (optimum)	6 (low)	Lease out on Chauthai.
3 (low)	4 (high)	Lease in on Chauthai.
3 (low)	5 (optimum)	Lease out on Batai with certain member of the household not actively engaged in agriculture anymore.
3 (low)	6 (low)	Lease out on Peshgi.

Table 10 : Descriptive Statistics

Variable	All households		Land owning households	
	Mean	Std. Dev.	Mean	Std. Dev.
Tractors owned	0.07	0.25	0.09	0.28
Diesel Pump sets owned	0.38	0.55	0.46	0.57
Loan Outstanding dummy	0.50	0.50	0.57	0.50
Kisan Credit Card (KCC) dummy	0.26	0.44	0.32	0.47
Kuccha house dummy	0.14	0.35	0.13	0.34
Adult males engaged in agriculture	1.36	1.05	1.48	1.05
Total land owned	9.52	11.99	11.79	12.31
Pucca house dummy	0.33	0.47	0.35	0.48
Business/enterprise dummy	0.28	0.45	0.30	0.46
Maximum education of household head	6.50	4.47	6.90	4.49
Life insurance policy dummy	0.27	0.44	0.30	0.46
Salaried employment dummy	0.19	0.40	0.20	0.40
Tubewell owned	0.06	0.23	0.07	0.25
Thakur dummy	0.23	0.42	0.27	0.44
Murao dummy	0.26	0.44	0.30	0.46
Members who worked in agriculture per bigha of own land	0.32	0.50	0.40	0.53
Asset rank lowest quintile dummy	0.19	0.40	0.16	0.36
Jatab caste dummy	0.17	0.37	0.17	0.38

Table 11: Regression results - Leased-out Land

	Peshgi	Batai 1	Batai 2	Chauthai
Constant	0.65 ** (.312)	0.471 (0.681)	1.168*** (0.676)	-0.574 (0.629)
Tractor	- 1.597* (0.575)			6.833* (1.236)
Diesel Pump sets	-0.466*** (0.275)			-1.435** (0.647)
Loan Outstanding	0.487*** (0.283)			
KCC dummy				1.856* (0.73)
Kuchha House	0.716*** (0.409)			
Adult males in Agri.	-0.419* (0.136)	-0.801* (0.315)	-0.9* (0.312)	-0.197 (0.327)
Total own land	0.061* (0.014)	0.186* (0.029)	0.205* (0.029)	
Pucca house dummy				1.572** (0.712)
Business dummy		-1.267*** (0.737)	-1.453** (0.733)	0.812 (0.772)
Max education of head		0.157* (0.08)	0.188** (0.08)	
Life insurance policy		-1.683** (0.716)	-1.323*** (0.724)	
Salaried employment dummy		-1.663** (0.849)	-1.54*** (0.824)	
Tubewell				3.645* (1.376)
Thakur dummy		1.665** (0.742)		
Murao dummy			-2.01* (0.723)	
R2	0.154	0.3	0.31	0.25
N	176	176	176	176

* significant at 1% level

** significant at 5% level

*** significant at 10% level

Standard errors in the brackets.

Notes:

1. The dependent variable is area under the particular lease.

2. Landless households have been ignored in this regression as they practically cannot lease out land. There has been a case of a household leasing in land to lease it out further but it is an exception.

3. Two regressions on batai differ because of the caste dummy included. The first one includes Thakur caste, while the second one includes Murao caste.

Table 12: Regressions Results - Leased-in Land			
	Peshgi	**Batai**	**Chauthai**
Constant	0.024 (0.337)	0.733 (0.579)	-0.183 (0.25)
Tractor	1.659*** (0.895)	1.512 (0.734)	
Diesel Pump sets	1.035** (0.423)	2.161* (0.035)	
Adult males in agriculture	0.126 (0.192)	0.77* (0.65)	
Members working in agri per bi of owned land			0.752** (0.384)
Total own land	-0.053** (0.021)	-0.109* (0.66)	
Pucca house dummy	0.264** (0.121)	1.184*** (0.071)	
Business dummy	1.403* (0.451)	1.282*** (0.765)	
Max education of head		-0.137** (0.677)	
Life insurance policy	0.63 (0.451)		
Salaried employment dummy		0.031 (1.401)	
KCC dummy		-0.324 (0.579)	1.856* (0.73)
Asset rank lowest quintile			1.49* (0.496)
Jatab dummy			2.385* (0.548)
R2	0.16	0.16	0.19
N	217	218	201

* significant at 1% level

** significant at 5% level

*** significant at 10% level

Standard errors in the brackets.

Note:

1. The area under specific lease is the dependent variable.

Table 13: Summary of Regression Results

Management ability	Supervision ability	Outcome
Low	Low	Peshgi Leased out
Lacking on Cash-flows	Low	Batai Leased out
High	Low	Chauthai Leased out
High with significantly higher cash flows	Low, moderate or high	Peshgi Leased in with hiring in labour if lacking on supervision ability
Moderate	High	Batai Leased-in
Low	High	Chauthai Leased In

Table 12 presents similar regression results for the leased-in land under different contracts. The main findings are as follows. First, the main motivation behind leasing in land on Peshgi appears to be management related in nature, with an excess of labour power not playing such an important role. Households who have sufficient cash flows to invest in agriculture (run own farm business, own a pucca house) and who also own farm equipment are likely to lease land in on Peshgi. The family labour variable in this case is not significant. This is not surprising considering the alternatives the household has when faced with an excess of management but a lack of supervision ability. A farmer with an abundance of farm equipment and enough cash to keep the cultivation process running smoothly is in a very good position to hire labour to work on the Peshgi land. It would not be efficient to lease in land on batai, hire labour to work the land, and settle for a smaller share than in Peshgi. It is impractical to lease in land on Chauthai when the farmer is relatively weak with the supervision component.

Secondly, households leasing in on batai are likely to have high supervision ability but relatively moderate management ability. The variable for diesel pump sets is significant with a high coefficient but other indicators of management ability like own business, salaried employment, tractor, and Kisan credit card are not significant. Households leasing in land on batai appear to be cash-flow constrained households with ownership of farm equipment and family labour in excess of what is required to work on their own farm. Their asset position seems to motivate them to look for a partner who can share costs with them.

Thirdly, Chauthai is the preferred contract for relatively poor households who own very high family labour relative to the land they own. These households belong to the lowest of asset category in the village and are mainly Jatabs, a caste group which has very low ownership of land per capita but high population.

Table 13 summarises the results from the regression exercise. The results go well with our hypothesis that households attempt to adjust their operational holding to the supervision and management factors they command and resort to sharecropping to achieve this end. This line of reasoning also explains the rise of Peshgi and Chauthai contracts at the cost of Batai post 1983-84. Due to household partitioning, sale of land to outsiders and migration of a

number of households, we observe a considerable decline in land owned per capita. So, the population pressure on land in 2008-9 is higher than in 1983-84. Technological change has occurred in irrigation and land preparation but the distribution of assets remains very unequal. Thus, on the one hand we have rich households with cultivation equipment and machinery, but who are unable to employ these assets fully on their own landholdings due to their small size. On the other hand, we have relatively poor households in terms of land owned and farm equipment, with an excess of family labour able to work in agriculture. The former group of households find Peshgi to be a suitable contract while the latter group of households favour a Chauthai contract. As a result, we see a reduction in the share of Batai contracts in the total leased in area and a rise in Chauthai and Peshgi.

A related comparison over time

A model proposed in Bliss and Stern (1982) to identify the determinants of the Net leased in area bears some resemblance to the approach taken here. The Bliss and Stern (1982) model concluded that family labour and bullock power for land preparation are two major non-marketed factors which determine the area a household will lease in7. We present a similar model here to highlight how changes in the market have shaped tenancy decisions. Table 14 presents the major variables and the descriptive statistics. Before proceeding, some notes on the variables are in order.

The number of adult males aged 15-61 engaged in agriculture is a suitable indicator for the labour power at the disposal of the household but it is not fully satisfactory. It neglects the role of women and to some extent the role of children engaged in agriculture. Women in Palanpur are actively engaged in agriculture (except in the richer households). Moreover, agriculture in Palanpur during this time was afflicted with a problem of monkeys damaging the crops and the labour of children played an important role in protecting the fields from monkeys. So, we need a measure of not only the males engaged in agriculture but the actual labour power engaged in agriculture. To this end, the variable AGMEM has been included.

The variable used for land preparation equipment (V1) is the number of items of equipment owned and not their actual value; the same goes for irrigation equipment (NPSO1, ENGINE and TW). The calculation of the value of these equipments is not a difficult task but it has not been included because the value of these assets is not a reliable indicator of the current services they render. A 10 yr old tractor worth Rs 100,000 in the village is able to do almost the same task as a Rs 600,000 new tractor. The smaller horse-powered engine with lower value irrigates a field somewhat less rapidly than a large engine, but this does not make such a big difference. There is a difference in the fuel consumption among the assets with differing values but it is not great enough to offset the variation attributable to differences in value for the purpose of measuring performance.

The asset ranking variable which has been presented here is the quintile ranking obtained through principal component analysis and those assets groups have been chosen (productive or non-productive) for which the ranking had the highest correlation with the per capita annual expenditure of the households.

The regression equation for the model is:

$$NLIR = a.LANDO + b.AGRIMEM + c.ENGINE + K + \varepsilon$$

[7] For further details, refer to chapter 5 in Bliss and Stern (1982).

Where ε is an error term with mean zero and the error terms for different households are independently and identically distributed.

Table 15 presents the results from this regression. Owned land is negatively associated with the NLIR: for a bigha of extra land owned, the NLIR is expected to decline by 0.6 bighas. Having one extra member in the household to work in agriculture leads to 1.5 bighas of more land leased-in. Owning an engine is the most important variable in its marginal effect and leads to 4.4 bighas of land being leased-in net.

Table 14: Description of major variables

Variables	Description	Mean	S.D.
NLI	Net Leased in Area in Rabi 09	1.6	9.9
CULT	Operational Area in Rabi 09	12.3	11.3
LANDO	Land Owned in Rabi 09	10.6	11.0
F3	Number of adult males between the age 15-61 engaged in agriculture	1.8	1.3
V1	Number of Tractors or ox-plough available, basically a dummy for own land preparation equipments.	0.2	0.4
NPSO1	Number of diesel pump sets plus tubewell owned	0.5	0.7
LOFA	Land owned per standardized family member. LOFA = (LANDO)/(1* No of Adult Males + 0.8* No of Adult Females + 0.5* No of Children)	2.5	2.6
C1	Dummy for caste Thakur	0.3	0.4
C2	Dummy for caste Murao	0.3	0.5
C7	Dummy for caste Passi	0.0	0.1
C56	Dummy for Muslim	0.1	0.3
C8	Dummy for caste Jatab	0.2	0.4
AGMEM	Number of household members which actually worked in agriculture for more than 10 days in Rabi 09.	2.8	1.9
SAL	Dummy for any member being employed in regular	0.2	0.4
HOUSING	Number of total rooms in the house	2.8	1.7
ARANK	Asset Ranking of the households8	3.2	1.4
ENGINE	Number of Engines owned	0.4	0.6
TW	Number of Tubewell owned (either 0 or 1)	0.1	0.2
KCC	Dummy for Kisan Credit Card	0.3	0.5

Among the variables not in the equation, LOFA is significant if included in the equation as a single extra variable. Among the caste variables significant under 10% level, being a Passi imply that the household will be leasing out around 8 bighas of the land in net.

[8] The variable has been calculated over the productive assets (eg: tractor, thresher, diesel pump set, land etc) and durable non-productive asset (eg: cycle, motor vehicle, mobile phones, TV etc) through Principal Component Analysis (PCA). It excludes financial assets and should not be seen as an "overall wealth" indicator.

Passis migrated in Palanpur many years ago from Eastern U.P. Members of the caste were employed in well-paid outside employment and came to own a substantial land area in the village over time. Despite substantial land ownership in the village, it is very common to see some of the household members, generally male adults, working out of Palanpur. It can be said that outside employment is a persistent characteristic of this caste. Many of the Passi households with some land in Palanpur, migrated out fully for work, thereby increasing the per capita land ownership for this caste. Those that remain in the village face a shortage of labour power and resort to leasing out land. Being a Jatab implies that the household will be leasing in 3 bighas of land in net and the coefficient is almost significant at the 5% level. The remaining variables not in the equation are not significant if included in the model.

Table 15: Regression Results

Dependent variable: NLIR			
Number of observations	181		
R-squared	0.3383		
Adj R-squared	0.3270		
Root MSE	8.19		
Variables in the equation			
	Coef.	**Std. Err.**	**P>t**
LANDO	-0.59	0.06	0
AGMEM	1.5	0.35	0
ENG	4.4	1.3	0.001
_K	1.6	1.1	0.156
Variables not in the equation			
LOFA	-1.62	0.4	0
TW	2.65	2.72	0.33
Caste 1	-0.6	1.48	0.67
Caste 2	0.15	1.3	0.91
Caste 7	-8.1	4.7	0.085
Caste 8	3.05	1.6	0.057

Comparing the results for this model with the similar model in Bliss and Stern (1982), we find a striking change. Instead of the 'value of draught animal' which was significant in the model, we have number of the diesel pump sets owned as significant in the model. This is an important change and is a direct result of the change in the nature of the markets, technology and assets.

In 1974-75, bullocks were the main sources for land preparation. The market for the hiring out of bullock services was absent because of the particular care bullocks require for usage in agriculture. Bullocks are not the same as any mechanical equipment and mistreatment can lead to ill health of bullocks or even death. Also, ploughing other person's farm with one's own bullocks was seen as 'manual labour for others', which was not a particularly respectful occupation in the village. Today ploughing of land has been taken over almost entirely by tractors and a farmer can get as much land ploughed as he wants at a fixed

rate per bigha. There are now 13 tractors in the village and around 10 of them are employed commercially. Driving your own tractor and ploughing another person's farm is not seen as 'demeaning' in the village.

The practice of tilling and harrowing is standardized with rates the same across all the service providers (except in case of personal relations). The market is competitive in nature and the tractor owners can plough almost as much land as they want at the given price. There is no tendency seen among the tractor owners to offer a lower price to attract more customers. In sum, the imperfection associated with the land preparation has disappeared. Those who own a tractor do not necessarily have to lease in land to reap the advantages of owning a tractor. They can easily enter the business of providing land preparation services and make money. Ownership of a tractor is an important part of a household's management ability, but there are other more important factors affecting management ability and influencing the tenancy decision.

The market for irrigation, on the other hand, has become quite imperfect. While superficially it may appear that the market for irrigation is the same as the market for hiring-in equipment, it is actually three markets for providing one homogenous good. The good involved here is water, or as we measure it, the irrigated area per hour (because the rates are generally charged per hour for irrigation). There are three ways to irrigate a field:

(i) Own pumpset: If the farmer owns a diesel pumpset then he will generally use it to irrigate his fields. A diesel pumpset is portable (it is attached to a wheeled cart) and can be transported to and from the field using manual labour or using bullocks. The cost of irrigating one bigha from an owned engine is in the range of Rs 35-37 depending on the diesel cost. There are problems associated with attaching the pumpset to a boring, transporting it to the field and bringing it back, inconvenience associated with going to the nearest town for fetching diesel etc.

(ii) Hired pumpset: Those who do not own an engine can hire a diesel pumpset to irrigate their fields. During Kharif 2008, the per hour rent (known as 'aapasi') for the engine was Rs 35 per hour. So, the average cost to irrigate a bigha with a hired pumpset is Rs 70-72. A hired pumpset presents all the inconveniences associated with diesel pumpsets and poses some additional problems of its own. The market for diesel pumpsets appears almost competitive in nature as the rate is given but the buyer cannot transact as much as he wants at the going rate. The owner of the pumpset is a farmer himself and may require the pumpset for his own usage. So, at times it can be difficult to find a pumpset for hire. Also, hirers of a pumpset are not generally as careful with it as the owner do and so hired-out units depreciate more quickly than non-marketed pump sets, making owners selective in terms of who they agree to hire-out to. So, the market for hired pump sets is not as competitive as one might suppose it to be.

(iii) Tubewell (hired): The market for tube well services is a fairly restricted one, because tubewell owners cannot sell as much as they want. It is easy to saturate the market. This is because tubewells are not portable like diesel pumpsets. They are erected on the field and can only serve the plots nearby through water channels or flexible plastic tubes. There are 13 tubewells in the

village. During kharif 2008, one hour of tubewell irrigation use cost Rs 30-35 per hour. Tubewells avoid many of the inconveniences associated with pumpset irrigation as the setting up time is more rapid and relatively few pieces of equipment have to be transported to the field. But, they are concentrated mainly around the residential areas of the village and beyond this circle, are not generally available.. Thus, not all farmers can avail of tubewell irrigation. Moreover, electricity supply is erratic and may not be available for days at a time. There are queues at the tubewell for irrigation and in busy periods waiting times can be prolonged. Tubewell owners give preference to their relatives, caste members or friends and side payments sometimes occur, such as the offer of a liquor bottle. Tubewells thus present their own sets of problems.

(iv) Tubewell (Own): Large farmers whose landholdings are concentrated in one place may own a tubewell for irrigation of their own plots. They may also hire the tubewell out when they have no need for it. These farmers pay an electricity payment of Rs 690 per month, irrespective of electricity consumption, and also incur depreciation and repair costs. Since they also hire out their tubewell services these farmers do not normally end up incurring any running costs for their own irrigation.

So, in the market for irrigation, a randomly selected farmer may either be using his own pumpset, using his own tubewell, using a hired pumpset or paying for tubewell irrigation. Depending on the category he belongs to, he pays a different cost. In this sense, it can be said that the market for irrigation is actually a combination of four different markets, with four different prices. A farmer may be in more than one market at a time (example: he can irrigate his field by tubewell and may also have an engine or be hiring-in an engine).

The market for irrigation is, thus, quite imperfect. And yet irrigation is one of the most important factors in Palanpur agriculture. Hiring out your own pumpset involves some complexities and leasing in land may be an appropriate method to increase earnings. If the farmer owns a tube well, then hiring out tubewell services is an easy way to increase earnings and the family may even opt to lease out land to solely concentrate on the tubewell business. In sum, imperfections in the irrigation market have become more prominent than imperfections in the land preparation market were in 1974-75. It is for this reason that we see a change of variables in the model.

Nonetheless, the changing nature of the markets still supports the original Bliss and Stern model's essence that tenancy exists in order to remove imperfections and indivisibilities associated with markets other than land.

Conclusion

In Palanpur, the two-and-a-half decades since 1983-84 have been marked by a significant reduction in per capita owned and operated land. The proportion of households participating in tenancy markets has declined but the area under tenancy has remained roughly the same in absolute terms. Given the decline in total land owned and land operated by villagers, tenanted area has come to exert a greater influence on the livelihood of farm households in Palanpur.

Sharecropped land was found to be at least as productive as self-cultivated land, a conclusion which, in the circumstances of Palanpur, and arguably much of rural India can be

understood in terms of basic economic reasoning. The mechanization of farm processes, almost equal cost-sharing among the partners in batai contracts and efficient stipulation of labour efforts in Chauthai contracts provide little reason to believe that productivity will be different in these two sets of land.

We used regression analysis to examine the factors influencing the tenancy decisions of the households and their choice of contracts. We concluded that tenancy exists when there is a mismatch between the cultivation potential of the assets a farm household possesses (many of which assets are not fully marketable) and its owned landholding. If the farm households own more supervision ability than its owned land and relatively lower management ability, it will go for sharecropping (Batai). This also explains why there has been a shift towards Peshgi and Chauthai contracts. The nature of development since 1983-84 has resulted in lower per capita landholding and two classes of farm households; one with more management ability relative to own land and second, households with more supervision ability relative to own land. The former opt for Peshgi, while the latter opted for Chauthai contracts.

Finally, we looked at the tenancy model of Bliss and Stern (1982) which argued that imperfection in labour market and bullock ploughing market leads to tenancy in Palanpur. In our adaptation of the model to 2008-09 data, we found that despite important changes in markets for agricultural inputs, the original model's essence that tenancy exists in order to remove the imperfections associated with markets other than land is supported.

As research agendas for the future, a first point is that a lot more can be done to attempt to understand better the relations between land and labour inside the village and outside. This paper makes it clear that land and labour interactions in the agricultural process are responding to changes, and in turn changing, the nature of institutions and markets. There is a need to study these interactions in detail in order to understand their impact and what they imply for the future. Keeping in view the quality of the cultivation data collected, there is also a great potential here for a detailed input-output analysis in agriculture.

Secondly, this paper does not utilise a large part of the data set collected in 2009 Kharif. These could help us look at the response of households to external shocks such as drought. Although preliminary analysis of cropping pattern suggests that such changes were significant, it would be interesting to analyse these changes with respect to other determinants of agricultural productivity.

Third, most of the debate in the Indian context on production conditions in Indian agriculture has revolved around the 'mode of production debate', 'size class productivity debate', 'interlinkage of factor markets' and finally 'tenancy'. The 'mode of production' debate has centred on the nature of social and production relations which characterise the production conditions. The second debate has been on the efficiency and productivity of small farmers compared to large farmers, also known as the size productivity debate. The third crucial debate has been the debate on sharecropping and its efficiency. All the three debates have largely been analysed in isolation and village surveys have played an important role in this primarily because most of these issues requires close observation of relationship between various factors of production which are not easy to capture in large scale secondary surveys.

However, although various theories have been tested and alternative explanations provided, conclusive answers to many of the puzzles remain relevant, yet remain elusive.. An

important reason for the inconclusiveness of these debates lies with the great heterogeneity of the Indian agrarian landscape, characterised by variations in the nature of land endowments, agrarian practices, cropping patterns and above all historically-grounded social relations. A second problem was methodological, where more often than not these issues were analysed in isolation without an underlying integrated model of the agrarian economy in a developing country context. Understanding the nature of inter-linkages between the factors of production under imperfect market conditions is important to understanding the emergence and survival of institutional responses such as sharecropping. It is in this context that issues of efficiency and incentives need not be analysed from the perspective of static efficiency of farms but should be seen as a response to issues of allocative efficiency of the system given land and labour endowments and their distribution. A further methodological issue has been the analysis of production conditions in agriculture in a closed economy model. Most of the models and analysis have not been able to adequately factor in the role played by the non-farm sector which has emerged as a major driver of change in the factor market for labour as well as land. The Palanpur survey has always provided an ideal platform to analyse some of these theoretical constructs. An agenda for future research would be to develop an integrated framework of analysis of all these dimensions in the context of recent changes, institutional as well as at the household level.

Finally, a multitude of factors have led to changes in portfolio of activities and incomes for village households. Some income sources have disappeared; other has declined in importance, while new activities and income sources have risen to prominence owing to development and changes within the village and nearby areas. Understanding the changes in income and activity portfolios of households in light of these broader forces of change will highlight the nature and extent of the development processes at work in the village. Also, given these choices and portfolios, it will be interesting to examine the attitudes to risk and uncertainty. Given the richness of Palanpur data and the fact that much of rural India is experiencing similar changes; this topic grows in both interest and importance.

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