Tenancy Inefficiency

A Study Based on West Bengal Agriculture

While several attempts have been made to explain the inefficiencies of sharecropping systems found in developing economics, they have been marked by certain definitional flaws. A more rigorous analysis of sharecropping that incorporates 'size-class' differences among owners and tenants thus becomes necessary. Earlier studies had also stressed on land productivity and intensity of farm resource utilisation as indicators of efficiency, but they are seen as measures of relative efficiency only under restrictive assumptions. This study stresses on the availability of irrigation resources as a factor that increases efficiency – for both owners and tenants.

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I Introduction

The efficiency of resource-use under different types of tenure is a subject of discussion which received considerable attention, theoretically as well as empirically, among the economists of both Marshallian and non-Marshallian tradition. In the early stages of discussion most writers, concerning the subject of resource allocation patterns, argued that share tenancy is inefficient compared to the alternatives of cash tenancy and owner cultivation.[1] Their argument supports the view that a tenant whose contract stipulates that only a fraction of the gross output is to be paid as rent will have an incentive to use variable inputs less intensively than an owner-operator or a tenant leasing in land on a fixed rent basis. Consequently, the output per hectare would be greater for a purely owner-operated farm and for a fixed rent tenant operated farm than for a tenant-operated sharecropping farm. The challenge to the poor opinion of sharecropping was exemplified from the very beginning by a small group of economists.[2] They held that sharecropping in fact could be an efficient way of organising agricultural production provided the landlord was able to induce efficiency in share tenancy by monitoring inputs.

Several attempts have been made to explain possible inefficiencies in sharecropping system prevailing in developing economies. Singh (1989) in this context listed several explanations. Following him it is possible to categorise the explanations provided by various economists as: (a) sharecropping as a risk sharing device [Cheung 1968, 1969a, 1969b; Pant 1983; Allen 1984; Bell 1986]; (b) sharecropping as an efficient organisational setup if input incentives are provided to the tenants (Eswaran and Kotwal 1985a, 1985b; Holmstorm and Milgrom 1987); (c) sharecropping serving as a screening device [Hallagan 1978; Newberry and Stiglitz 1979]; (d) sharecropping as an efficient contractual arrangement if there exists limited liability [Shetty 1988; Basu 1992; Sengupta 1997].

A major deficiency of all these approaches is that they lack concreteness in definition. As pointed out by Patnaik (1994), they tend to treat the categories 'owners' and 'tenants' as homogeneous. Empirical studies from the underdeveloped world seem to belie this logic. It is, however, unfair to treat on the same footing a small tenant having no asset base but trying to maintain his livelihood only from sharecropping land with a large owner-tenant, who has some asset base, leases in land to augment his land for achieving scale economies. Consequently, a rigorous analysis of sharecropping incorporating such views seems worthwhile.

However, till now, there seems to be a wide gap between existing theory and empirical research. The main point of dissent seems to be on the emphasis of efficiency by the neoclassical economists. In the neoclassical theory, production is defined as the optimum outcome from a given array of inputs. In empirical exercises however the usual procedure of 'fitting' production functions to the observed data often results in fitting an 'average' production function. Based on this approach most of the studies observe that any inefficiency in tenant cultivation is manifested either in the intensity of utilisation of farm resources or in the measure of productivity of land. However, as argued by Lee and Somwaru (1993), land productivity and input intensity are valid measures of relative efficiency only under very restrictive assumptions such as constant returns to scale. We have provided a methodology for assessing relative performances of the different categories of farmers which can overcome the limitations of production function approach. Our methodology is based on the non-parametric DEA technique.

The paper is divided into five sections. Section II makes a brief review of some of the major studies regarding relative performances of various categories of farmers in the Indian context. Section III discusses the methodology employed for our empirical exercise. Section IV provides the empirical results. Section V makes some concluding remarks.

II Review of Studies

Among the early attempts to assess productive performances of different categories of farmers, mention may be made of the work done by Vyas (1970). He found that resource use efficiency of tenant cultivated farms is higher than owner cultivated farms. The study was based on a survey data of four Gujarat villages in the 1960s. On the basis of empirical evidences, he came to the conclusion that, "the high efficiency of tenants, especially the medium and small ones, in resource use is indicated by the high

(average) input-output ratio on their farm" [Vyas 1970].

Another study was undertaken by Rao (1971). His analysis was based on farm-level observations taken from Farm Management Survey (FMS) data in a rice zone of Andhra Pradesh during 1957-58 and 1958-59. An attempt was made in this study to examine the comparative efficiency with which land is cultivated among the owner-operated and share-rented farms. The results of this analysis suggested that 'when the relative alternatives are specified, the evidence examined does not indicate significant inefficiencies in the use of land under sharecropping' [Rao 1971].

Also a Cobb-Douglas type of production function was fitted to the data. It suggested that there was a decline in marginal productivity of land with an increase in the size of holding among the owner-operated farms. Over a wide range, the marginal productivity of land among the share-rented farms is higher than owner-operated farms of corresponding size and not lower than large owner-operated farms, which accounts for bulk of the land leased-out. Rao (1971) ultimately concluded that the sharecroppers cultivate their land more intensively than the large owner-operators.

Rudra and Chakravarty (1973) used farm-level data taken from FMS reports relating to five districts in three states of West Bengal, Andhra Pradesh and Punjab.[3] About 15 different variables were used by them to capture different aspects of farm economics.[4] They used two different test-statistics in order to ascertain the differences in performance pattern of various categories of farmers. One is the usual t-statistic in order to test the equality of mean (of the various variables considered by them) between two different categories of farmers (owners and tenants). However, there were some information (such as 'the predominance' of higher values of some of the variables) in the data which were not expressed in the significance and non-significance of the t-statistic. This suggested the conducting of a second set of tests of significance, one for each variable and for each size class, known as the binomial test. Both the tests permitted them to conclude that tenant farms perform better than owner-operated farms when the comparison is confined to small-sized farms, but not so when medium or big farms are thought of.

In the above set of results, they defined 'owners' and 'tenants' in a rather gross fashion. In order to take care of this Rudra and Dwivedi (1973) provided a second set of results based on the approach of defining a continuous variable by:

$$x = \frac{\text{total land leased in for cultivation}}{\text{net cultivable area}} \quad \ldots(1)$$

and treating it as an independent variable in relation to a certain number of variables such as output, assets, labour and material inputs (all in value terms), etc. The data used were taken from FMS report for the Hooghly district of West Bengal for the year 1970-71. They conducted three different tests in order to see the differences in performance patterns of various categories of farms. The first test was used to adjudge the strength of association between the classifying variable x (which is defined in equation 1 above) and a set of dependent variables (such as output per acre, material input per acre, and human input per acre)in terms of correlation ratio. The second test was the standard test procedure to ascertain equality of sample means between the class of 'pure owners' (x=0) and 'pure tenants' (x=1). For this purpose, they used both Fisher's t-test and Cochran's test. The third test was designed to verify whether there is any difference in the cultivation of owned and rented plots among the class of 'owner-cum-tenants'. Their findings seem to suggest that there were indications of some differences between the pure owner and pure tenant particularly among smaller size-classes. However, when one considers the owner-cum-tenant class, most of the characteristics of farming behaviour do not seem to vary in terms of the proportion of leased-in land to total operated area.

We may now turn to an exercise done by Bharadwaj (1974) regarding certain relationships between levels of tenancy and input and output per unit of land. An attempt was made in that study to compare costs and returns between different levels of tenancy in a region of Maharashtra. According to Bharadwaj (1974), 'with increasing levels of tenancy output per acre showed a tendency to decline. Also at lower levels of tenancy, inputs were applied more intensively'.

Another exercise carried out with data obtained from the Farm Management Survey is that of Junankar (1976). He used farm level observations for the period 1968-69 and 1969-70 in Punjab. He tested two different aspects of the relative performance of various categories of farmers. First, he tested for relative differences in yield rates between owners and tenants. For this he used a proxy variable to capture tenancy, viz, the ratio of leased-in land to total operational holding. He carried out a multiple regression analysis and observed that large owners are more productive than large tenants, but no significant difference in yield rates between owners and tenants was found in smaller-sized farms. Second, he used the Cobb-Douglas production function to test the differences among various categories of farmers in terms of input-output relations. This study, however, did not indicate any difference between owners and tenants in terms of such relations.

Bell (1977) undertook a sample survey in Purnea district of Bihar and collected data for the year 1971 to study the performance of farmers belonging to pure tenant and owner-cum-tenant categories. He selected 25 tenants and 31 owner-cum-tenants by random sampling procedure. This study provides some interesting results:

(i) pure tenants are less efficient than owner-cum-tenants.

(ii) among the owner-cum-tenants, land productivity is higher in the plots owned by them than the rented plots.

These results were found to be true not only for individual crops (viz, jute, maize, summer paddy, winter paddy, pulses, etc) but also for all crops taken together.

Yet another study was carried out by Chattopadhyay (1979). He used a sample of 808 farms selected from 12 villages of Sriniketan in Birbhum district of West Bengal during 1976-77. The study indicated that owner-cultivators cultivate their land more intensively than the tenant-cultivated farms of the corresponding class of holdings except the biggest one. In fact, the large tenant cultivators behave more or less in the same fashion as owner cultivators in so far as intensities of different types of inputs as well as productivity of land are concerned. The evidence thus did not indicate inefficiencies in the use of land under large tenant cultivators. This, however, was not true in the case of small tenants.

There is another interesting study by Pant (1980). He used a sample of 80 households selected from two villages of Sholapur district in Maharashtra during 1975-76. The data was collected by ICRISAT.[5] The data contains detailed information on output produced and various quantities of inputs used (both in value and real terms). It also contains information on certain characteristics of farm

households (such as age-sex composition, educational qualifications, family inventories, etc). In order to test the tenancy-inefficiency thesis, Pant (1980) used plot level input-output data. He tested differences in the intensity of input-use between owned and rented plots. It is seen that for both the villages, input intensities appear to be higher among the owned plots. However, the result is significant only for a few types of inputs (such as hired labour, total human labour, bullock labour). A multiple regression was then carried out using the various types of input intensities as the dependent variable. Among the various inputs, it was found that owner-tenants appear to divert more of their family labour to their owned land. Pant's (1980) study could thus provide little support for the relative inefficiency of tenant cultivators.

An intensive village study was undertaken by Bliss and Stern (1982) in Palanpur in the Moradabad district of Uttar Pradesh, where they devoted a considerable amount of time in studying the problem of tenancy efficiency. They studied 47 farmers in this village among which 9 were tenants. They used Fisher's t-statistic to test the differences in several parameters (such as yield rate, intensity of input use, etc) for both owned and rented land. However, in order to verify the viability of this test, they also tested the equality of variances between the samples. This test was conducted for a number of crops such as wheat, barley, pea, gram, etc. However, due to lack of adequate data, they concentrated on wheat only. Though for wheat, tenanted land indicated higher yield, no significant difference was observed for fertiliser use. A multi-step regression analysis using 22 variables was conducted.[6] Tenancy could not be included as an explanatory variable. In other words, they concluded that there existed no significant differences in farm efficiency among the owners and tenants so far as their sample was concerned.

Tripathy's (1986) study was based on a sample of 200 farmers from Rohtas district of Bihar. He used data for crops such as paddy, wheat and maize covering several agro-climatic zones (a 'hilly area' and a 'canal irrigated area') and two cropping years (1978-79 and 1979-80). He observed that the value of output per hectare is higher among owner farms in comparison to the tenant farms for all the crops, years and zones. He then subdivided the tenants into fixed rental tenants and sharecroppers. However, no difference was observed between fixed rental tenants and sharecroppers in terms of land productivity (measured by the value of output per hectare). The picture was not so clear with respect to labour productivity, capital-labour ratio and input-output ratio. A Cobb-Douglas type production function was fitted to the data. Except for material inputs, all other inputs (bullock labour and human labour) indicated a higher level of marginal productivity for the owner-operated farms as compared to the tenant farms.

A fairly large-scale data was collected by International Crop Research Institute for the Semi-arid Tropics (ICRISAT) during late seventies and early eighties. Shaban (1987) used these data consisting of 2,268 households spread over semi-arid regions in India to examine the relative efficiency of owners, sharecroppers and fixed tenant cultivators. He compared input intensities on owned and sharecropped plots of the same households for testing tenancy efficiency. Such comparisons are based on the assumption of constancy of the farm specific characteristics, such as management, access to non-traded inputs, and prices of traded inputs and outputs. He specified an elaborate system of equations involving input intensities on various (owned and rented) plots and the parameters that might explain such intensities. He used the Zellner's method of seemingly unrelated regressions (SUR) technique. His results were mixed. He found the effect of irrigation, plot size and soil quality to be of utmost important. If these factors are held constant, then for the owner-cum-sharecroppers, 'the pure effect of tenancy is to generate lower input (and output) intensities; this is particularly true for family and bullock labour, where the difference is sizeable and statistically significant'. However, the result is totally different for the owner-cum-fixed rental tenants. For them, there is not much difference between productivity and efficiency of owned and rented plots.

Similar attempts were made by some other researchers (e g, Bhaumik 1993, Chattopadhyay and Sarkar 1997) to study tenurial efficiency in different regions of India. Bhaumik's (1993) sample consisted of 224 households spread over four blocks of Midnapore district of West Bengal during 1986-87. He examined the differences in performances of the households across various plots of land in terms of the value of output per acre and the intensity of input use (bullock labour, human labour and material inputs) per acre. He divided the sample of farmers into three categories : owners, sharecroppers and fixed-rent tenants and compared the performances of these three types of tenure. The study was conducted for a number of crops (such as aman paddy, boro paddy, potato and sugarcane). He observed that only for paddy, sharecropped plots showed greater degree of efficiency than the owned plots. On the other hand, the intensity of resource use as well as land productivity appeared to be invariant between owned and fixed-rent plots.

Chattopadhyay and Sarkar (1997) studied the problem with reference to 150 farming households situated in North 24 Parganas district in West Bengal. Using the variables capturing output productivity and intensity of input use, they observed that there was no remarkable difference in the utilisation of different types of inputs (human labour, bullock labour, material inputs, etc) and output per unit of land among the groups of tenants and owners. A multiple regression set-up using a number of variables suggested that fertiliser and irrigation are the most important variables in explaining the variations in agricultural output as well as yield per acre for the region under study.[7]

Shaban (1987) and Bhaumik (1993) raised a number of questions regarding the methodology adopted by the various authors discussed above. First, most of the empirical studies on this subject do not make the distinction between pure owners and pure tenants. This point was also raised by Rudra and Dwivedi (1973). Empirical evidences show that the incidence of pure tenants in the cultivation is exceedingly small and most of the farmers are of the mixed categories (i e, owner-cum-tenants). They therefore suggested that testing exercise should be carried out in such a way that the differences in productivity and intensity of input use might be compared between owned and rented land operated by the owner-cum-tenant family. However, availability of data is the main problem of such kind of analysis particularly in India. Secondly, there is a problem of selection of appropriate test-statistic to examine the performances of different types of tenure. While most of the studies use Fisher's t-statistic, some use other statistics as well.[8] Those who used Fisher's t-statistic argued that this statistic could be applied even if the sampling distribution is non-normal, but the sample size should be large. Again, though application of Fisher's t-statistic requires the assumption of equality of variances, it is applicable

even if the ratio of the sampling variances lies between 0.4 to 2.5. In other words, it is a robust statistic.

It is clear from the above studies that use of Fisher's t-statistic is considered as a valid measure of efficiency comparisons between owners and tenants. They, however, seem to be unconcerned with the fact that the conclusion drawn by them on the basis of the t-tests carried out by them for the significant difference of the regression coefficient from zero is dependent on the assumption that the regression relations assumed by them are valid. No one, however, has attempted to examine the validity of this assumption empirically. We have therefore avoided to use this methodology and alternatively used data envelopment approach which involves no assumptions whatsoever about relation between dependent and independent variables of the production function.

We may now turn to discuss our methodology to examine the performances of different types of tenure in agriculture.

III
Methodology and Data

In this paper we propose to study the performance of farmers using the framework of Data Envelopment Analysis (DEA).[9] DEA is basically a non-parametric approach to estimate the efficiency and productivity of farms from the given set of inputs and outputs. The major advantage of this approach is that one can measure the efficiency of a production unit without prior assumption of production function. This approach does not require any price data to estimate the efficiency of units. Since we are dealing with the production units of an unorganised sector (particularly, in an LDC like India) the data on prices are frequently questionable. Also it is very difficult to assume any specific production function to get estimate of the required parameters.

Given these constraints we have decided to measure the efficiency score of each unit, based on a non-parametric frontier estimated by DEA approach. DEA is a linear programming technique for constructing a non-parametric piece-wise linear envelope to a set of observed output and input data. The mathematical programming approach of DEA makes no room for "noise" and so does not 'nearly envelop' a data set as the way most econometric models do. Let producers (farmers) use inputs $x = (x_1,...,x_n) \in R_+^n$ to produce output $y=(y_1,...,y_m) \in R_+^m$ where R^m_+ and R^n_+ denotes positive orthants of m-dimensional output and n-dimensional input space respectively. Now, Farrell's measure of efficiency based on frontier technology is defined as follows:

$$E_i = \min_{\alpha_i} \{\alpha_i : F_i(y, \alpha_i x) \leq 0\} \quad ...(2)$$

The linear programming approach to measure efficiency from the envelope is

$$\max_{E_i,\lambda} E_i \quad ...(3)$$

$$\text{subject to } y_i \leq \lambda Y;\ \lambda X \leq E_i x_i;\ \lambda \geq 0$$

where X is a n × I input matrix with column x_i, Y is a m × I output matrix with column y_i, λ is a I × 1 intensity vector and I is the number of farms in a particular set of observations. Problem (2) has been solved for I times to get each producer's efficiency score which is being evaluated under different sets of observations as envelope.

We have considered only three inputs – human labour, bullock labour, and fertiliser as well as output of paddy in physical terms per hectare for our study. Thus in our analysis n=3 and m=1. The linear programming technique described above is applied to estimate the values of the parameter E_i that captures the degree of efficiency. The imposition of constraint on the intensity vector λ guarantees that E_i lies between zero and one. Now, in order to identify the factors that can explain the differences in efficiency scores, we have undertaken some regression analysis incorporating the relevant variables. In our analysis we separated the data into efficient and inefficient subsets. Ideally one can treat farms with efficiency score equal to unity as efficient while those less than one as inefficient. However, since we have not taken into account the effect of random events (such as natural holocausts, machine or equipment failures, product defects, etc), it is highly possible that some farms with lesser efficiency scores are also efficient in the sense that they have been unable to attain unitary efficiency due to some technical constraints which are outside their control. Hence it would be better to treat farms with efficiency scores greater than 0.8 as efficient and others as inefficient.

The data which we have used in this exercise were collected by the Ministry of Agriculture, Government of India through the 'Comprehensive Scheme for Studying Cost of Cultivation' (CSSCC). The data were collected for every year beginning 1971 from various parts of India. We have used in this study farm-level disaggregate data pertaining to the year 1989-90 for West Bengal.

For the purpose of collecting CSSCC data in West Bengal, the entire state was divided into six agro-climatic zones based on cultivation practices, type of soil, irrigation facilities and rainfall.[10] Considering the information regarding total cropped area under aus paddy, aman paddy, boro paddy, jute, potato and wheat, zonal allocation of sixty blocks was made.

A multistage random sampling design was adopted from blocks to mouza and then from mouza to households. The landless labourers were excluded from the set of households. In this way a total of 600 households were selected. Out of these 600 households, only 597 cultivates paddy.

Since our purpose is to evaluate the effect of tenancy on the production frontier we considered only those villages where the coexistence of owner and tenants is evident.[11] We were able to identify 10

Table 1: Frequency Distribution of Farming Households by Level of Efficiency (E_i) Obtained from DEA Analysis

Levels of Technical Efficiency (Per Cent) (1)	No of Farms (2)
Up to 0.75	13
0.75-0.80	13
0.80-0.85	10
0.85-0.90	16
0.90-0.95	9
0.95-1.00	39
All	100

Table 2: Frequency Distribution of Efficient and Inefficient Farms by Types of Tenure

Types of Tenure (1)	Efficient $E_i \geq 0.8$ (2)	Inefficient $E_i < 0.8$ (3)	Total (4)
Owners	49	22	71
Tenants	25	4	29
All	74	26	100

Table 3: Frequency Distribution of Efficient and Inefficient Farms by Size-Classes of Holdings and Types of Tenure

Size-Classes of Holdings	Efficient Farms		Inefficient Farms		Total
	Owners	Tenants	Owners	Tenants	
(1)	(2)	(3)	(4)	(5)	(6)
Up to 0.25	3	0	0	0	3
0.25-0.50	5	2	1	0	8
0.5-1.00	5	8	2	2	17
1.00-2.00	22	7	5	2	36
2.00-3.00	7	7	6	0	20
3 and above	7	1	8	0	16
Total	49	25	22	4	100

such villages spread over four zones (namely, Zone I, II, IV and VI) comprising of 100 households for our study.

It may be interesting to note the relative incidence of owner and tenant farms in the four zones under study. We find that Zone I has the largest percentage of owner cultivated farms (about 90 per cent) while it is 83.33 per cent in Zone IV. The dominance of tenant farms, on the other hand, is most pronounced in Zone II (50 per cent) and to some extent in Zone VI (about 40 per cent). It may be noted in this connection that Zone I which is Hilly Zone, ostensibly the most unfertile zone in terms of soil type, topographical features and rainfall, has the highest number of owner farms. Farming activity in this zone is likely to be associated with high degree of risk. In such circumstances, if there exists limited liability, sharecropping will not be an efficient mode of organising farm production.[12] We may now turn to our empirical results.

IV
Empirical Findings

In Table 1 we present the frequency distribution of farmers by efficiency level derived from the values of E_i. From this table one can draw some interesting conclusions regarding the nature of efficiency of farmers. The table shows that there are very few farms with efficiency level less than 0.75. The highest number of farms belong to the efficiency group 0.95-1.00. It implies that the empirical distribution of efficient farms is asymmetrical in nature.

As mentioned earlier, we have treated farms having the efficiency score greater than 80 per cent as efficient and others as inefficient. In Table 2 we present frequency distributions of the farms categorised as 'efficient' and 'inefficient' by types of tenure i e, owners and tenants. Table 2 shows that out of 71 owner-cultivated farms 49 are efficient and out of 29 tenant-cultivated farms 22 are efficient. Thus, the preponderance of efficient farms seems to be larger among the tenants in our study. Obviously, our findings seem to contradict the basic neoclassical logic of inherent inefficiency of tenant farms as propounded by Marshall (1920). There may be various reasons behind such a phenomenon. It may, for example, be argued in this context that the inefficiency views expressed by economists, belonging to both Marshallian as well as non-Marshallian tradition, might be valid at a certain stage of development characterised by low technological inputs as was observed in India for the period from 1950-70. Under changed agricultural scenario, where both owners and tenants strive for betterment of their livelihood, the portrayal of this process cannot remain unchanged.

We now present data on the distribution of farms separately for efficient and inefficient categories by size-classes of holdings and types of tenure in Table 3. The table shows that majority of efficient farms, irrespective of any tenancy type, belong to the medium-sized farms. It is also seen from this table that the number of inefficient farms increases with the increase in size-class of holdings particularly among the owner-operated farms. Thus, our empirical observations are in agreement with Rudra's (1992) results which show greater efficiency of medium-sized farms in West Bengal.

We may now turn to verify the above findings in terms of a very common technique known as the regression analysis. In the regression analysis we have used six variables, namely, value of output per hectare (O/A), net cultivated area (A), use of machine cost as a percentage of total cost (PM), non-irrigation material cost (which include cost of manure, fertiliser, insecticides, pesticides and seeds) as a percentage of total cost (PMC), irrigation cost as a percentage of total cost (Pirri) and a dummy (d_1) to capture differences in tenurial category. We have treated value of output per hectare as the dependent variable and others as explanatory variables. The regression analysis was carried out both for the efficient and inefficient farms as well as for all the farms taken together. Results of our analysis presented in Table 4 show that the value of R^2 is relatively high for the efficient category. It may also be noted that the effect of material cost (excluding irrigation cost) on yield is insignificant insofar as the efficient farms are concerned. However, material costs without irrigation has a negative impact on productivity both for the entire sample as well as for the inefficient farms. This implies that material cost excluding irrigation cannot by itself raise productivity. They have to be complemented with adequate irrigation facilities. Thus, the most important variable explaining efficiency is the irrigation cost. Our results clearly show that it is the spread of irrigation that accounts for significant increase in productivity. The effect of size (as denoted by A) is not so clear. The 'size-coefficient' is insignificant for both the efficient and inefficient farms. This implies that there is not much difference in efficiencies of farmers belonging to various size groups. As for categorisation among tenants and owners, we have used the dummy variable d_1. The dummy is again insignificant for all the categories. This implies that there is no significant efficiency difference between owners and tenants.

Now, combining the results based on the two lines of analysis (i e, DEA and Regression Analysis), we may conclude that there is no significant difference in the utilisation of different inputs and output per hectare among the farmers of similar size groups under owner and tenant cultivated farms. However, middle farmers of both types of tenure seem to cultivate their land more intensively in the sense that they put in more of labour per hectare and probably more of irrigation per hectare for obtaining higher output.

V
Conclusion

In this paper we have taken into account the size-class differences among owners and tenants in the context of measuring sharecropping efficiency. Our analysis shows that the medium-sized farms belonging to both owner and tenant categories are efficient. Among the factors that help them to

Table 4: Results of Linear Regression Analysis with Yield (O/A) as the Dependent Variable

All Farms: N = 100 and R^2 = 0.38						
O/A =	9251.4	+341.38 d_1	-49.65A	-11984 PM	-24320 PMC	+36142 PIrri
t-ratios	(7.7049)	(0.6066)	(-0.2368)	(-0.7586)	(-3.5755)	(5.6066)
Efficient Farms: N=74 and R^2 = 0.56						
O/A =	8601.7	-1271.5 d_1	+187.14 A	+6293.1 PM	-10526 PMC	+ 66277 PIrri
t-ratios	(5.0237)	(-1.2522)	(0.5743)	(0.2245)	(-0.6489)	(4.2632)
Inefficient Farms: N=26 and R^2=0.40						
O/A =	10393	+ 332.31 d_1	-257.57 A	-23467 PM	-28543 PMC	+ 30897 PIrri
t-ratios	(6.6281)	(0.4848)	(-0.9338)	(-1.1836)	(-3.5380)	(4.0849)

Notes: Description of the variables:
O/A is output per hectare; A is the net area cultivated in hectare; PM is the machine services as a percentage of total cost; PMC is the material cost (including manure, insecticides, etc) as a percentage of total cost; PIrri is the irrigation cost as a percentage of total cost and d_1 is the dummy for tenurial categorisation.

be efficient, the availability of irrigation seems to be very important. Use of machine has no positive role while non-irrigation material cost provides very little support. Benefits of irrigation facilities, however, are mostly enjoyed by the medium-sized farms. It is obvious that poor small farmers cannot bear such cost while larger-sized farmers are plagued by scale diseconomies. Thus, emergence of medium-sized farmers as efficient allocators of resources seem to be the reality of the present day economy of rural West Bengal. EPW

Notes

1 As is well known, the beginning of this line of theoretical work was with Adam Smith (1937). For a brief summary of early literature, see Johnson (1950). For recent debates, see Cheung (1969a,b), Bardhan and Srinivasan (1971), Koo (1973), Stiglitz (1974), Sen (1975), Bell and Zusman (1976), Reid Jr (1976), Newberry (1977), Bell (1977), Swamy (1988), etc.

2 In the line of theoretical work, Cheung (1968a, 1969a,b) held that the inefficiency of sharecropping could be eliminated or even reversed if the lessor was able to enforce the desired intensity of cultivation.

3 The farmers were categorised into owners and tenants. Farmers who were owners of at least 50 per cent of their cultivated land were designated as owners while others were categorised as tenants. This can be contrasted with Rao (1971) who treated 'all those who lease in area – part as well as pure tenants – as tenants'. Again, Junankar (1976) considered two different criteria of classification of tenants: (i) those who lease in 25 per cent or more; and (ii) those who lease in 50 per cent or more of their cultivated land. The problem is a thorny one as argued by Shaban (1987).

4 They categorised these variables under four headings: (a) variables relating to costs and benefits, (b) variables relating to material inputs, (c) variables relating to land and capital, and (d) variables relating to labour inputs.

5 International Crop Research Institute for Semi-Arid Tropics (ICRISAT) collected data on farming practices, crops procured, inputs used and other aspects of farm economy from sample villages spread over semi-arid regions in south India.

6 The variables used by Bliss and Stern (1982) included a number of farm characteristics of which a dummy was used to capture tenancy.

7 They used variables such as the size of operational holdings, percentage of area irrigated, fertiliser cost per acre, percentage of leased-in area to total cultivated area, etc.

8 For example, Bell (1977) used Hotelling T^2 statistic, Bhaumik (1993) used Fisher's t-statistic while Chakravarty and Rudra (1973) used both Fisher's t-statistic and binomial statistic to compare the efficiency level of different types of tenure.

9 The standard statistical technique of fitting production function usually assumes a randomly distributed error term. The method does not account for effect of inefficiencies. As a result the estimated coefficients are averaged across the observations.

10 The whole state of West Bengal (in India) has been classified into six zones, viz, (i) Hill, (ii) Terai, (iii) Old Alluvial, (iv) New Alluvial, (v) Coastal Saline, and (vi) Red Laterite.

11 In West Bengal, the incidence of fixed rent tenants is virtually nil. The tenant households which we studied here belong to the sharecropping category only.

12 The idea of limited liability encompasses an arrangement whereby a farmer is entitled to pay only a meagre amount if there happens to be crop failure. It has been argued that it is a basic ingredient of many sharecropping arrangements in underdeveloped countries like India [Basu 1992].

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