The Impact of Share Tenancy on Resource Allocation: Evidence from Nepal

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Abstract

A fully interactive two group model is used to examine the issue of resource allocation under alternative tenancy systems in Nepal. The results support the Marshallian hypothesis that both mixed and pure share tenants apply variable inputs less intensively in their rented-in plots than in owner operated plots.

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The issue of resource allocation under alternative tenancy system has always been a fruitful source of controversy in economic literature. The Marshallian economists maintain that the share tenants apply variable inputs less intensively than the fixed rent tenants or owner operators while the Cheungian economists argue that there would be no difference in input intensity across the tenure systems (Shaban). This study examines the empirical validity of these two approaches using evidence from two tarai villages of Nepal.

Nepalese share tenants come from two different economic classes – mixed share tenants, who operate their own farm and rent-in additional piece of land to supplement their income and landless pure share tenants, who rent in land for sharecropping (Acharya). This distinction between mixed and pure share tenancy is important because ownership of land is a primary form of wealth. Furthermore, the level of income and the socioeconomic status of the populace is principally determined by the size and productivity of land owned (APROSC, Seddon). Thus, a mixed share tenant would be in much better position to obtain credit and tenancy contracts with favorable terms and conditions as compared to a pure share tenant. Moreover, a mixed share tenant who can earn living from his land can wait longer for better opportunities than a landless tenant who is on the edge of subsistence (Acharya and Ekelund).

The differences in input intensities between owned plots of mixed share tenants and rented-in plots are examined by using a modified version of Chow test. This methodology is generally used to test the hypothesis that some or all of the regression coefficients are different in a subset of the data (Greene). A total of six different input equations are jointly estimated using Zellner's iterative method of estimating seemingly unrelated regressions.

Share tenancy in Nepal

Before the implementation of land reform program in 1964, sharecropping was one of the most common form of land tenure systems on the tarai region of Nepal. The main objective of this program was to protect the interest of peasant population by providing long term security of tenancy contracts. Since sharecropping was considered to be inefficient mode of production, initially all share contracts were converted into fixed rent contracts and tenancy certificates were distributed to the actual tenant cultivators. However, the process of tenant registration could not be continued for long due to strong opposition from the landed class. Many of the tenants who received official tenancy certificates were illegally evicted and no attempt was made to restore their rights (Koirala).

Although the land reform program of 1964 failed and since then no attempt has been made to revive it in any other form, landlords are becoming more cautious in renting out land for farming purposes. As a result, almost all of the recent tenancy contracts are verbal and can be terminated after each cropping season. Land distribution is highly skewed and employment opportunities in non-agriculture sectors are limited. More than 56 percent of rural households farm plots of less than 0.5 ha., which cannot support the bare necessities of their family (Seddon). Whenever possible, these small farm families rent in an additional piece of land on crop sharing basis to supplement income from their own farm (Acharya).

As in other less developed countries such as India (Bell, Shaban), Pakistan (Quibria and Rashid), and Bangladesh(Nabi), Nepalese share tenants come from two distinct economic classes - mixed and pure sharecroppers (Acharya and Ekelund). Mostly, Nepalese mixed share tenants are the small farmers who operate their own land and rent in an additional piece of land on crop sharing basis. Tenants who have no land of their own to cultivate but lease in land from others for sharecropping are defined as pure share tenants.

The data set used in this study are developed from a survey conducted by the author in September and October of 1991 (see Acharya, Acharya and Ekelund for further details). Mahottari District, which lies on the central development region, was randomly selected out of 27 districts of Nepal, where the rent payable to the landlords by the fixed rent tenants is officially fixed for different categories of land . Two villages within this district, Gausala and Nigaul, were selected based on the existence of multiple tenure systems. A list of 300 households involved in tenancy contracts was prepared and 150 households were randomly selected from the list. Three out of the total selected households were not interviewed because the tenancy contracts were only recently made.

Out of 147 households interviewed, 69 were mixed share tenants, 50 were pure sharecroppers, and the remaining 28 are fixed rent tenants. Most of the fixed rent tenants held official tenancy certificates, which provides them long term security of tenancy, while share tenants lease in land from private individuals on seasonal basis. Since most of the fixed rent tenants grow crops other than paddy and share tenants grow paddy in their own plots as well as in sharecropped plots, fixed rent tenants are not included in this study. Although, most share contracts are verbal and can be terminated after each cropping season, the average cumulative duration of these contracts is longer than10 years.

The basic characteristics of mixed and pure share tenants are reported in Table 1. All of the respondents were male household heads who make farming decisions with or without the consultation of the other family members. On the average, mixed share tenants have larger family size, more years of schooling, and longer farming experience than pure share tenants. The cropping intensity in owner operated plot of mixed share tenants is much higher than in both mixed as well as pure sharecropped plots. Among the two sharecropping systems, plots operated by pure share tenants are cultivated more intensively than those operated by mixed share tenants.

The empirical model

A tenant operating k plots of his own land and l plots of rented in land on sharecropping basis is defined as a mixed sharecropper. Thus, a mixed share tenant faces three alternative uses of his economic resources. The tenant can allocate his resources among his own plots (Y^o_i), shared plots (Y^s_i), and outside employment at a given market price (p_i). Assuming that both tenant's output share (1-r) and plot size (t^s) are determined by the landlord and the tenant chooses the levels of variable inputs, the mixed share tenant's optimizing behavior would entail

$$P \frac{dF(Y^o, t^o)}{dX_i} = p_i = (1-r)P \frac{dF(Y^s, t^s)}{dX_i}.$$

where F(.) = a well behaved twice differentiable production function, and P = output price. These marginal conditions of tenant behavior, which imply that share tenants have economic incentive to under supply variable inputs in their shared plots, provides the basis for the Marshallian inefficiency argument. However, as postulated by Cheungian economists, if it is possible for landlords to stipulate and monitor tenant activities effectively, then the marginal conditions of tenant behavior are (Cheung)

$$P \frac{dF(Y^o, t^o)}{dX_i} = p_i = P \frac{dF(Y^s, t^s)}{dX_i}.$$

As shown by Shaban, the Marshallian inefficiency argument implies that mixed share tenants use variable inputs per unit of land more intensively in their own plots than in shared plots, i.e.,

$$Y_i^o > Y_i^s \,, \qquad \text{where} \quad Y_i^k = Y_i^k \Big/ t^k \,.$$

A land less peasant, who has no land of his own to cultivate but rents in land for sharecropping is defined as a pure share tenant. Unlike mixed sharecroppers, pure share tenants face only two alternative uses of their owned resources. The relative efficiency of pure share tenancy, however, can be tested by comparing output and input levels in pure sharecropped plots ($Y^{ps}{}_i$) with those owned and operated by mixed share tenants. Thus the Marshallian inefficiency hypothesis for the case of pure sharecropping would imply

$$Y_i^o > Y_i^{ps} \qquad \text{where} \quad Y_i^k = Y_i^k \Big/ t^k \,.$$

Empirical studies show that a mixed sharecropper's input (Y) intensity in owned and shared plots are determined by factors such as tenant's household specific attributes (h), crop variety (v), and plot specific characteristics (p) (Shaban; Acharya and Ekelund), i.e.,

$$y_i^k = f(h, v, p) = f(X).$$

A farmer's household specific characteristics may include factors such as initial endowment of production resources, shadow prices of owned resources, and managerial ability (Shaban, Acharya). In a subsistence economy, where the level of income and the socioeconomic status of the populace is mainly determined by the size and productivity of land owned, farm size may serve as a composite index of household specific characteristics (APROSC, Seddon, Acharya and Ekelund). On the other hand, plot specific characteristics such as plot value, soil fertility, and availability of irrigation water may affect tenant's input decisions. Since most of the high yielding crop varieties are more responsive to fertilizer and irrigation water than traditional varieties, crop variety may also play an important role in determining input intensities.

Most of the earlier studies addressed the issue of resource allocation under alternative tenure systems by comparing gross input and output intensities in sharecropped plots with those operated by fixed rent tenants or owner cultivators without accounting for the impact of household and plot specific characteristics (Chakravarty and Rudra, Chattopadhya, Zaman, Bell). Shaban proposed a robust estimation procedure capable of separating pure tenancy effect from total observed differences in input and output intensities between owned and shared plots of mixed share tenants. Shaban's method utilizes the sample characteristics to measure pure tenancy effect. Since the input and output sharing rules of tenancy contracts were uniform within a village but varied across the region, he used village dummies to capture the impact of tenancy on input application.

Shaban's methodology, however, cannot be used when input and output sharing rules are uniform across the regions or the sample includes observations only from a single geographical region with uniform sharing rules. Moreover, owner operators and share tenants may respond differently to the changes in explanatory variables (i.e., $b^o \neq b^s$). In this case, a more robust estimation procedure would be to use a modified version of chow test, which allows parameters to vary across the groups.

Let $y^k_i = f(X^k_j) + e = f(X) + e$ be the input intensity functions of the two groups, where k refers to the group (o=owner operators and s=sharecroppers), i refers to the inputs, and j refers to the factors determining input intensities and e is a vector of error terms with zero means and finite variances but the correlation between error terms of different input equations may not be zero. These input functions can be expressed in matrix notation as

$$Y = xb + e, \quad \text{where} \quad Y = \begin{vmatrix} Y^o \\ Y^s \end{vmatrix}, \quad x = \begin{vmatrix} X^o \\ X^s \end{vmatrix}, \quad \text{and} \quad e = \begin{vmatrix} e^o \\ e^s \end{vmatrix}.$$

The two group fully interactive model can be expressed as $\mathbf{Y} = \mathbf{X}\mathbf{b} + \mathbf{e}$, where the X matrix is

defined as $\mathbf{X} = \begin{vmatrix} \mathbf{X}^o & \mathbf{X}^o \\ \mathbf{X}^s & \mathbf{0} \end{vmatrix}$, then $\mathbf{b} = (\mathbf{X}`\mathbf{X})^{-1}\mathbf{X}`\mathbf{Y} = \begin{vmatrix} \mathbf{b}^s \\ \mathbf{b}^o - \mathbf{b}^s \end{vmatrix}$.

In this procedure, the test on the relative efficiency of share tenancy would be based on the second set of parameters (i.e., $b_j^{\,o}$- $b_j^{\,s}$). Unlike in Shaban's method, this procedure can be used even if the sample size of the two groups is unequal. Moreover, since the data matrix is formed by pooling observations on owner operated and sharecropped plots of mixed share tenants, we gain degrees of freedom.

The estimated Equation

Let a mixed share tenant's input (Y) intensities in owned and sharecropped plots be defined as a linear function of soil fertility, crop variety (plot specific characteristics), and farm size (household specific characteristic), i.e.,

$$Y_i^o = \alpha^o + \beta_1^o DS_1^o + \beta_2^o DS_2^o + \beta_3^o DV^o + \beta_4^o PS^o + \varepsilon^o$$
$$Y_i^s = \alpha^s + \beta_1^s DS_1^s + \beta_2^s DS_2^s + \beta_3^s DV^s + \beta_4^s PS^s + \varepsilon^s$$

where Y^k_i = $(y^k_1, y^k_2, ..., y^k_7)$ denote variable inputs; compost (y^k_1), fertilizers (y^k_2), bullock power (y^k_3), other inputs (y^k_4), family labor (y^k_5), and hired labor (y^k_6),

DS^k_j = average dummies measuring fertile and moderately fertile soils,

DV^k = average dummy measuring crop variety,

PS^k = farm size, and

ϵ^k = error term.

All the variables used in the model are measured in per unit of land basis except for the farm size. For example, the dummy variable measuring crop variety for a tenant who plants improved variety of paddy in two plots of size 2 ha. and 4 ha. and traditional variety of paddy on the third plot of size 4 ha. would be equal to 0.6 (6/10). The error terms in the input equations are supposed to capture the unobserved characteristics of the tenants that are not captured by other explanatory variables.

Similarly, the differences in output levels between owner operated and sharecropped plots is estimated as a function of same set of explanatory variables by ordinary least square. The same form of estimating equations are adopted to make comparison between 1) owner operated plots of mixed share tenants and pure sharecropped plots and 2) two sharecropped plots operated by mixed and pure share tenants.

The relative inefficiency of sharecropping as opposed to fixed rent tenancy or peasant proprietorship can be tested as follows. The case of perfect monitoring by the landlords would hold if

$$\mathbf{H_0}: \Sigma(\beta_j^o - \beta_j^s) = \mathbf{0}.$$

The Marshallian hypothesis that mixed share tenants use variable inputs more intensively in their own plots than in sharecropped plots would prevail if

$$\mathbf{H_0}: \Sigma(\beta_j^o - \beta_j^s) > \mathbf{0}.$$

A one tail t-test is used to test the significance of a single variable and an F-test is employed to determine the joint impact of explanatory variables. An F-test based on Hotelling's T^2-statistics was also used to determine whether the vector of mean differences in output and input intensities across the tenure systems is significantly different from zero.

Empirical results

Input intensity functions for both owned and shared plots were estimated separately as well as a two group fully interactive model using Zellner's seemingly unrelated regression method. Since we are interested on the differences in mean input and output intensities between owner operated and sharecropped plots, only the second part of the parameter estimates ($b_j^{\,o}$- $b_j^{\,s}$) are reported (the complete set of estimated parameters can be obtained from the authors on request).

The joint test based on Hotelling's T^2-statistic shows that the vector of mean differences in input and output intensities between owned and shared plots of mixed share tenants is jointly significantly different from zero. This result is consistent with those reported by Bell and Shaban. We also compared the output and input levels in owned plots of mixed share tenants with those cultivated by pure share tenants. Again, the vector of mean differences in input and output intensities is jointly significantly different from zero.

The parameter estimates measuring differences in marginal response of mixed share tenants with respect to the changes in explanatory variables (i.e., $\beta_j^{\,o}$- $\beta_j^{\,s}$) are reported in table 1. The overall explanatory power of the individual models, as measured by R^2, ranges between 0.25 to 0.71, which is considerably high for studies based on crossection data. On the average, the marginal input intensity of mixed share tenant's is significantly higher in owned plots than in plots rented in for sharecropping.

The coefficients of the variables representing fertile and moderate soils are significant in most equations except in the equation for fertilizer and other inputs and held expected signs. As expected, crop variety dummy holds positive sign in all input and output equations and is significant in most cases. Coefficients of farm size, however, carry significantly negative sign in equations for hired labor and bullock power. The negative sign in hired labor equation is consistent with the fact that mixed share tenants use family labor more intensively in their own plot and use more hired labor in shared plots to supplement family labor. However, we could not find any plausible explanation for the negative coefficient associated with farm size in bullock power equation other than error in measurement.

The parameter estimates of the model comparing the level of output and inputs between plots owned and operated by mixed share tenant and plots operated by land less tenants under crop sharing basis are reported in Table 2. Both input and output levels are significantly higher in owner operated land than in lands operated by pure share tenants except for hired labor. However, these differences are relatively smaller than in the case of owned and sharecropped plots of mixed share tenants. In particular, the difference in non-shared inputs such as compost manure, and family labor, is significantly smaller. Once again, this result supports the Marshallian hypothesis.

The parameter estimates of the third set of models, which compare differences in output and input levels between two sharecropped plots operated by pure and mixed share tenants is reported in Table 3. In this case, the differences in output and input intensities are much smaller and hold conflicting signs. While family owned resources are used more intensively in plots operated by pure share tenants, mixed tenants apply purchased inputs more intensively. However, there is not much difference in output intensity between these two plots.

Thus, both output and input intensities in owner operated plots of mixed tenant are consistently higher than in plots operated by mixed and pure share tenants under crop sharing basis. The differences in input level are more obvious in the case of tenant owned resources such as compost manure and family labor. Among two sharecropped plots, family owned resources are used more intensively by pure share tenants and purchased inputs are used more intensively by mixed share tenants. These results are consistent with the results reported by Bell.

Summary and Conclusions

Although one would expect Cheungian hypothesis to prevail in a subsistence economy where a large number of small farm families are competing for tenancy contracts to supplement income from their own farm, the results of this study are in contrary. More than 56 percent of rural households farm plots of less than 0.5 ha., which cannot support the bare necessities of their family (Seddon). Available estimates indicate that only about 21 percent of these small farm families are able to find tenancy contracts (Pant). Despite such competition among tenants, input and output intensities in both mixed and pure sharecropped plots are consistently lower than in owner operated plots of mixed share tenants. This result, like those of Bell and Shaban, add support to the Marshallian as opposed to Cheungian hypothesis.

We also compared the input intensity between two rented-in plots operated by mixed and pure sharecroppers and the result shows that pure share tenants tend to apply family owned resources more intensively than the mixed share tenants. This finding supports the arguments that mixed share tenants are in better position to obtain tenancy contracts with favorable terms and conditions than pure share tenants.

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Table 1. Sample size and (average) basic household characteristics

Characteristics	Mixed Sharecroppers	Pure Sharecroppers	Total
Number of respondents	63.00	50.00	113.00
Number of years of schooling	2.50	1.90	2.23
Farming experience	23.02	16.80	20.27
Family size	6.92	5.96	6.50
Plot size (in hectares)			
Owned	0.78		0.78
Shared	0.80	0.84	0.82
Cropping intensity			
Owned (%)	190.00		190.00
Shared (%)	130.00	170.00	147.70

Table 2. Differences in input and output intensity between owned and mixed sharecropped plots

	Compost[1]	Fertilizer	Bullock Power	Others Inputs	Family Labor	Hired Labor	Output
Fertile	2.53 *	10.96	5.40	-45.10	13.93 *	18.35	4.92
	(1.92)	(0.42)	(1.40)	(-0.44)	(1.77)	(1.35)	(1.25)
Moderate	1.59	4.07	6.81 *	-65.46	15.13 *	24.77 *	6.15 *
	(1.30)	(0.17)	(1.91)	(-0.69)	(2.07)	(1.96)	(1.68)
Variety	2.20 *	21.02	7.21 *	186.64 *	3.91	23.52 *	3.92
	(1.69)	(0.82)	(1.90)	(1.86)	(0.50)	(1.75)	(1.01)
Farm Size	3.97 **	22.69	-7.58 **	157.82 **	2.00	-36.12 **	-3.99
	(4.61)	(1.33)	(-3.02)	(2.38)	(0.39)	(-4.06)	(-1.55)
$\Sigma(\beta_j^{\,o} - \beta_j^{\,s})$	10.28 $_0$	58.74 $_0$	11.84 $_0$	233.9 $_0$	34.97 $_0$	30.52 $_0$	11.00 $_0$
	(7.02)	(2.03)	(2.78)	(2.07)	(4.00)	(2.02)	(2.51)
R^2	0.54	0.42	0.71	0.25	0.37	0.69	0.64

Note: The model was estimated by iterative SUR method and results were obtained after two iteraions. t-values are in parenthesis. The F-value, based on Hotelling's T^2, is 79.28 with (8,117) degrees of freedom. It is significant at 1 percent level. This implies that the vector of mean differences in input and output intensities, $E(dY_i^k)$, is significantly different from zero vector.

1 Output and input variables are measured as follows: output=output of paddy per ha measured in 100 kg., compost=gada per ha (1 gada=approximately 500kg), fertilizer=chemical fertilizer applied per ha of land, bullock power=a pair of draught animals including ploughing equipment for 5 hours, other inputs=cost of irrigation, pesticides, and herbicides measured in NRs/ha (1 US$=approximately 48 NRs), family and hired labor=man days/ha (a day=5 hours).

** Significant at 1 percent level.
* Significant at 5 percent level.
++ Jointly significant at 1 percent level.
+ Jointly significant at 5 percent level.

Table 3. Difference in Inputs Intensity between Owned and Pure Sharecropped Plots

Variable	Compost	Fertilizer	Bullock Power	Others Inputs	Family Labor	Hired Labor	Output
Fertile	0.45	33.22	6.45	-114.54	22.40 *	5.56	5.64
	(0.25)	(0.97)	(1.35)	(-0.94)	(2.05)	(0.33)	(1.29)
Moderate	-0.65	25.95	10.38 **	-47.65	16.93 *	10.80	6.27
	(-0.42)	(0.89)	(2.55)	(-0.46)	(1.81)	(0.76)	(1.56)
Variety	2.15	48.70	7.09	226.28 *	5.66	17.82	4.51
	(1.19)	(1.43)	(1.49)	(1.87)	(0.52)	(1.08)	(1.03)
Farm Size	3.30 **	-8.81	-10.85 **	144.67 *	-30.16 **	1.68	-4.64
	(2.79)	(-0.39)	(-3.48)	(1.82)	(-4.22)	(0.15)	(-1.62)
$\Sigma(\beta_j^{o} - \beta_j^{ps})$	5.25 **	99.06 **	13.07 **	208.77	14.84	35.85 *	8.54 *
	(2.74)	(2.74)	(2.59)	(1.62)	(1.28)	(2.04)	(1.92)
R^2	0.33	0.43	0.68	0.26	0.5	0.5	0.74

Note: The model was estimated by iterative SUR method and results were obtained after two iteraions. t-values are in parenthesis. The F-value, based on Hotelling's T^2, is 14.77 with (8,92) degrees of freedom. It is significant at 1 percent level. This implies that the vector of mean differences in input and output intensities, $E(dY_i^k)$, is significantly different from zero vector.

** Significant at 1 percent level.

* Significant at 5 percent level.

++ Jointly significant at 1 percent level.

+ Jointly significant at 5 percent level.

Table 4. Difference between pure and mixed sharecropper's propensity to apply inputs.

Variable	Compost	Fertilizer	Bullock Power	Other Inputs	Family Labor	Hired Labor	Output
Fertile	2.04 *	-23.60	-0.91	57.00	-8.41	13.36	0.65
	(2.15)	(-0.99)	(-0.49)	(1.09)	(-0.90)	(1.22)	(0.22)
Moderate	2.22 **	-23.61	-3.51 **	-28.36	-1.94	14.74 *	1.17
	(2.88)	(-1.21)	(-2.32)	(-0.67)	(-0.26)	(1.66)	(0.5)
Variety	0.09	-26.69	0.01	-30.29	-1.80	5.29	-0.43
	(0.10)	(-1.20)	(0.01)	(-0.63)	(-0.21)	(0.52)	(-0.16)
Farm Size	0.67	33.11 *	3.22 **	23.01	32.29 **	-38.52 **	1.04
	(1.12)	(2.18)	(2.73)	(0.69)	(5.46)	(-5.56)	(0.57)
$\Sigma(\beta_j^{ps} - \beta_j^{s})$	5.02 **	-40.78 *	-1.19	21.35	20.14 *	-5.14	2.43
	(5.38)	(-1.73)	(-0.65)	(0.41)	(2.19)	(-0.48)	(0.85)
R^2	0.33	0.5	0.95	0.17	0.64	0.83	0.84

Note: The model was estimated by iterative SUR method and results were obtained after two iteraions. t-values are in parenthesis.

** Significant at 1 percent level.

* Significant at 5 percent level.

++ Jointly significant at 1 percent level.

+ Jointly significant at 5 percent level.