The Meaning of Kinship in Sharecropping Contracts

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Analysis of a household survey from the Philippines shows that the behavior of sharecroppers with a kinship relation with their landlord is not affected by the disincentive effects of product and factor sharing, while behavior of the other sharecroppers responds to the contract terms. We characterize the meaning of kinship ties through a survey of opinion conducted among tenants. The survey shows that kin landlords help or are expected to help more frequently in case of emergency than other landlords, and they do so with a wider range of instruments, providing the incentive for cooperative behavior in sharecropping contracts among kin.

Key words: efficiency, kinship, sharecropping.

Theoretical analyses of sharecropping have called upon several arguments to explain under which particular circumstances this contract may be no less efficient than direct cultivation or fixed-rent contracts, despite the disincentive effect created by sharing the product. These arguments include (*a*) observing that there are situations where the tenant's individual behavior is identical to the landlord's optimum, (*b*) expecting that the landlord can specify in the contract the level of resource use and enforce it with supervision, (*c*) considering the contract as a long-term relationship with gift exchange to induce cooperation, and (*d*) embedding the contract in a multipurpose relationship with the landlord where interlinkages serve as an enforcement mechanism. Most empirical studies directed at testing this efficiency hypothesis have compared sharecroppers' levels of input use or yield with those of owner-operators or fixed-rent tenants. Their findings are mixed, with some studies showing no difference between contracts and others observing clear under-use of inputs and lower yields among sharecroppers. However, these studies cannot identify the potential reasons why specific sharecroppers may be efficient despite their presumed self-interested behavior. To do this, sharecroppers with a particular characteristic that is the presumed source of efficiency need to be contrasted with sharecroppers that do not have this characteristic (who are found to be less efficient) as well as with nonsharecroppers (who are found to be equally efficient). In this paper, we use a household survey that we conducted in three villages of the Philippines to show that kinship ties with the landlord are a key determinant of cooperative behavior by sharecroppers and hence a key determinant of efficiency.

To elucidate the significance of kinship ties for efficiency, we first review the theories and empirical evidence on efficiency in sharecropping. This is followed by a discussion of the Philippine survey, which includes questions about the perceptions that sharecroppers have of the benefits derived from kinship relations with their landlord and shows that they expect kin landlords to provide insurance more often than other landlords despite being generally of lesser wealth. We use a formal model of contract choice to construct a test of efficiency of sharecropping with a kin landlord. We then estimate the sharecropper's labor input and fertilizer demand equations to show that the terms of the contract affect negatively the input decisions of non-kin sharecroppers but not those of kin sharecroppers, and that the latter use inputs at levels similar to those of owner-operators and fixed-rent tenants.

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Debate on Inefficiency of Sharecropping

The Marshallian argument for the inefficiency of sharecropping is usually analyzed as a typi-

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cal agency problem between a principal (the landlord) and an agent (the tenant). Inefficient allocation of resources to production occurs because there is a difference between the tenant's optimum behavior (conditioned by the fact that he or she only receives a fraction of the product of his or her effort) and the "social" optimum (measured by the total benefit that both partners would obtain if they cooperated).

The argument can be summarized as follows (Otsuka and Hayami). If the contract can specify input levels, including the tenant's effort, and it can be enforced, then the optimal contract chosen by the landlord stipulates a level of effort by the tenant that is socially efficient. The terms of the contract are then chosen to ensure optimal risk sharing between the two parties and a level of utility for the tenant at least equal to his or her reservation level. If the level of effort is not enforceable, the choice is left to the tenant. Since the tenant receives only a fraction of the product, the optimal choice is less than the social optimum. Furthermore, in the contract offered by the landlord, the tenant bears more risk than is socially optimal. Hence, inefficiency of sharecropping includes two elements. The first is the incentive effect of the contract terms, which says that, at given risk-bearing level, sharecroppers apply less input than fixed-rent tenants and owner-operators. The second is the risk-bearing effect where, under nonenforceability, risk sharing for the tenant is less than the socially optimal level, although it is higher than under fixed-rent contract.

This issue of contract enforcement is common to all problems of cooperation. We thus can draw on the general theory of cooperation to establish the conditions under which landlord and tenant can be expected to behave cooperatively. This means that the tenant should choose the efficient level of labor use and that the landlord should respect payment of whatever compensating settlement has been agreed upon. Cooperative solutions are obtained under four types of conditions:

(*i*) *Individual noncooperative behavior is identical to the cooperative choice.* This may be due to pure technological constraints (Rao) or may happen when the landlord controls plot size and the elasticity of substitution between land and labor is equal to one (Otsuka and Hayami). It also occurs when partners are altruistic and when they have internalized the social optimum in their own objective (Arrow, Simon). When the tenant is highly risk averse, behaving according to the safety-first rather than the expected-utility rule, the tenant's choice corresponds to the efficient labor input (Sadoulet, Fukui, and de Janvry). Finally, the contract terms also can induce efficiency when the sharing rules on all inputs and output are identical (Heady, Nabi), unless there are secondary markets for purchased inputs (Bardhan and Singh).

(*ii*) *The tenant's work effort can be costlessly enforced by landlords* (Johnson, Cheung). A requirement for enforcement is that the effort be observable not only by the landlord himself but also by a third party so that the landlord cannot be accused of cheating on the tenant if he or she imposes sanctions, and that there exist sufficiently high penalties that can be imposed cheaply on the tenant.

(*iii*) *Infinitely repeated contracts.* In many cases, there is no obvious "punishment" that can be imposed on the tenant beyond loss of the cooperative benefit. Threat of eviction may act as an effective deterrent to cheating, and cooperation becomes sustainable when the benefits are sufficient and appropriately shared. Standard cases are infinitely repeated contracts with sufficiently low discount rates, or finite contracts with uncertain termination date but sufficiently high probability of continuing. In those cases, the cumulative benefit of cooperation over an extended period of time is higher than the short-term gain from cheating (Dutta, Ray, and Sengupta). In a principal-agent framework with gift exchange, the minimum level of benefit and the range of sharing that can sustain cooperation, and, hence, efficiency, can be established (Sadoulet, Fukui, and de Janvry).

(*iv*) *Interlinked contracts* open another range of enforcement mechanisms. Credit transactions, insurance, and, sometimes, marketing of the tenant's product by the landlord are commonly observed complementary contracts between landlord and tenant (Otsuka, Chuma, and Hayami). In some situations, interlinkage can be used to change the tenant's incentive structure, for instance, by reducing his or her risk aversion to mitigate the Marshallian disincentive (Subramanian). In other situations, interlinkage acts as a threat that induces cooperative behavior if the punishment for cheating on one contract cancels the greater benefits derived from other transactions.

Kinship networks incorporate several of these determinants of cooperation. Elements of altruism among kin reduce the conflict of interest between the two partners and create relations of trust and confidence in which cheating is less likely to occur. Families are, by nature, long-term relationships prone to repeated contracts.

Finally, family members are likely to engage in interlinked transactions, particularly for assistance through stages of the life cycle and mutual insurance. While anthropologists have given importance to kinship networks, the concept has not been extensively used in economics where the unit of analysis has usually been the farm, the household, or the community. Yet, kinship networks are important to reduce moral hazards and provide a commitment device when intertemporal resource transfers are involved (Foster and Rosenzweig). Kinship networks are thus particularly effective in providing mutual insurance and can be designed to improve provision of insurance through the choice of location of husbands (Rosenzweig and Stark). Migration networks evidence the role of kinship in the circulation of information about migration and employment opportunities (Taylor). Kinship relations are also fundamental in explaining intergenerational resource transfers. In this paper, we show that kinship induces efficient contracts, even when defined on a share basis, because it makes possible interlinked transactions that involve mutual insurance.

Empirical evidence on the efficiency of sharecropping is mostly based on the comparison of average output and inputs per unit of land between sharetenancy and direct cultivation or fixed-rent tenancy. Otsuka and Hayami, who recorded 366 such comparisons, conclude that, while there is some dispersion in the results, on average there is no systematic bias of lower yield or input use by sharecroppers. Their interpretation does not negate the Marshallian inefficiency but suggests a natural selection of contracts whereby mostly efficient sharecropping contracts are left to be observed (Otsuka, Chuma, and Hayami).

In the studies that support the efficiency of sharecropping, authors report that contracts are made between family members (Cohen), in patron-client relationships (Hayami and Kikuchi, Bardhan and Rudra), or when tenants can be easily monitored (Nabi for Pakistan). Cases of inefficiency are usually related to policy interventions that constrain the choice of contract. In two studies from India that exhibit significant inefficiency of sharecroppers (Bell, Shaban), landlords only gave short-term leases in order to protect themselves against the potential loss of land made possible by the land-to-the-tiller legislation. In the Bangladesh cases of inefficient sharecropping, strict prohibition of fixed-rent contracts had forced even absentee landlords to use share tenancy contracts, despite the obvious impossibility of properly monitoring their tenants (Otsuka, Chuma, and Hayami). And, in a recent analysis of the evolution of yields in the Philippines, lower yields for sharecroppers were attributed to tenancy regulations that prohibited eviction of tenants, even if they shirked on effort (Otsuka, Gascon, and Asano).

While these explanations of efficiency or inefficiency are useful in suggesting causal factors, tests of causality have generally been inadequate because they focused on contrasting efficiency levels between sharecroppers and owner-operators or fixed-rent tenants. A rigorous test of causality would instead require comparisons among sharetenants, for instance with short- and long-term contracts in the Indian case referred to above, with absentee and resident landlords in the Pakistan study, and with tenants that landlords would like to evict in the Philippine study. Following this approach, we show in this paper that sharetenants who have family ties with their landlord are not influenced by the terms of the contract, while the other sharecroppers respond negatively to a lower output share and higher input share as Marshallian theory predicts. We give a rigorous specification of the equations to be estimated and conduct the test directly on the terms of the contract as opposed to testing for the significance of some institutional dummies as is generally done in empirical tests of efficiency.

Sharecropping in the Philippines and the Meaning of Kinship

Land reform has produced major changes in the Philippines's land rental patterns. Under the 1971 Agrarian Reform Code, which applied to the entire country, sharecropping was declared illegal. Lands that remained rented were converted, in principle, from share tenancy to fixed-rent contracts, with regulated levels of rent. However, despite official reports, land reform was very unequally implemented across regions, allowing sharecropping to persist in the areas more remote from government control and with weak peasant organizations. In addition, share tenancy remains widespread among family members because it is less vulnerable to disclosure. This explains why sharecropping remained widely practiced, as we observe in our survey.

We conducted a household survey of three villages in 1992. Village Tu is in the lowland area of the island of Luzon commonly called "the rice bowl of the Philippines." This is a rich area, almost entirely irrigated, with high population density and well-developed infrastructure. Villages Du and Aq are in the state of Aklan in Panay Island. This area always had mostly small-scale farming and was not subject to extensive land transfers under the land reform. Village Du is connected with good roads. Village Aq is the poorest, least irrigated, and most isolated of the three villages. Table 1 shows that sharecropping was still practiced on 22% of the plots in Tu, 27% in Du, and 50% in Aq. This supports the general observation that implementation of the land reform has been very uneven, more strictly enforced in areas of greater government control or where peasant movements had been stronger, and less respected in poorer and more isolated areas. Another contrast between villages is that sharecropping is exclusively practiced with kin landlords in Tu, while other sharecropping arrangements increase in importance as one moves further away from tight government control in Du and Aq.

When landlords participate in the cost of purchased inputs, the output share which they extract is, in general, higher. As can be seen in table 2, the most prevalent sharing formula is a 50% split on both fertilizer and product. However, the landlord's product share ranges from 20% to 33% with no contribution to fertilizer, and it does not exceed 50% even when he or she contributes 100% of fertilizer costs.

We attempted to elucidate the meaning of kinship in contractual relations through a survey of tenants' perceptions. The hypotheses to check were whether kinship relations induce altruism and relations of trust, offer longer expected contractual relationships and greater security, and give access to insurance or other types of interlinked transactions. Getting tenants to reveal their true perceptions on some of these issues, particularly altruism and trust, turned out to be quite difficult, and no contrasts across tenants were uncovered by questions on the quality of the relationship with the landlord. Similarly, given the illegality of sharecropping, we could not capture the perception of expected contract length or contract security, which we expected to be greater with family ties.

We found, however, interesting results on the extent of insurance given by landlords and the nature of reciprocity in maintaining good relationships. These are summarized in table 3. Kin landlords help, or are expected to help, in case of emergency more often than other landlords. This difference is significant for sharecroppers, where 82.8% of the kin landlords provide help against 63.6% of the non-kin landlords. Sharecroppers also receive insurance from their landlords more frequently than fixed-rent tenants. Tenants were asked under what forms they receive help, with a choice between decreased rent, gifts in grain or in cash, or credit, and were given the possibility of selecting several of these responses. The contrast between the two types of sharecroppers shows that kin landlords who help their tenants use more instruments than do other landlords. Because of fungibility between rent and grain for the sharecroppers, and possibly between cash gift and credit for all tenants, these categories cannot be contrasted too strictly. However, only kin landlords use rent reduction or gifts in grain in case of emergency. Non-kin landlords use exclusively cash transfers or credit.

All tenants answered that they had good relationships with their landlords. However, when asked how they contribute to maintaining this relationship, tenants with kinship ties showed a

Table 1. Village Characteristics

Village Names	Luzon Tu	Panay Island Du	Aq
Tenancy distribution (percentage)			
Owners	22.0	28.8	28.1
Fixed-rent tenants	55.9	44.1	21.9
Sharecroppers with kin	22.0	16.9	25.0
Other sharecroppers	0	10.2	25.0
Total number of plots	59	59	32
Area distribution by tenancy (percentage)			
Owners	10	24	26
Fixed-rent tenants	60	42	26
Sharecroppers with kin	30	16	20
Other sharecroppers	0	18	28
Irrigation			
Percentage of plots	100.0	62.7	25.0

Table 2. Distribution of Sharecropping Contract Terms

Landlord's Share of Fertilizer Cost	Landlord's Share of Output	Number of Cases
0	0.20	1
0	0.25	5
0	0.33	10
0.5	0.50	26
1	0.50	3

Table 3. The Meaning of Kinship

	Sharecropper with Kin Landlord	Other Sharecropper	Fixed-Rent Tenant with Kin Landlord	Other Fixed-Rent Tenant
Number of observations	31	14	13	47
Relationship with landlord				
Landlord helps in emergency (%)	82.8*	63.6	12.1	53.2
with limited liability on rent (%)	3.4	0.0	0.0	4.3
with gift in grain (%)	31.0**	0.0	30.8	31.9
with gift in cash (%)	37.9	18.3	30.8**	8.5
with credit (%)	44.8	36.4	46.2	42.6
Tenant cooperates (%)	75.9*	54.5	76.9	72.3
by working hard (%)	41.4**	0.0	n.a.	n.a.
with gifts (%)	41.4	45.5	23.1	23.4
with help in case of needs (%)	41.4**	9.1	53.8	48.9
Only source of insurance (%)	35.7**	90.0	7.6	38.3
Rich landlord (%)	24.1**	54.5	4.5**	61.7

Notes: For six fixed-rent contracts, the family relationship is not known. n.a. = not applicable. ** (*) = significantly larger than the value for the same contract with non-kinship tenants at a 95% (90%) level of significance.

more active participation than the other tenants, with 75.9% acknowledging explicit actions to please their landlords, compared to 54.5% for the other sharecroppers. Gift giving from tenant to landlord is common for all sharecroppers, but hard work on the plots and reciprocal insurance is almost exclusively practiced by tenants with kinship ties with their landlords. The reciprocity of insurance between tenant and landlord is also observed with fixed-rent tenants, but there are no significant differences between kin and other tenants under this contract.

Sharecroppers who take contracts with nonkin landlords rely more frequently on their landlord as their sole source of insurance, and take contracts more frequently with landlords whom they perceive as rich. Information on whether the landlord was rich, average, or poor was obtained from the tenant to capture his or her own perception of the matter since this is what matters in his or her decision. This suggests that, when there is a family link, more frequent help and a wider range of coverage compensate for the eventual lesser wealth of the landlords.

Test of Efficiency of Kinship Share Tenancy

The general tenancy contract is defined by (r, r'), where r $(0 \leq r \leq 1)$ is the landlord's share of output and r' $(0 \leq r' \leq 1)$ is his or her share of the purchased input x.[1] A fixed-rent contract is obtained with $r = 0$ and a sharecropping contract is obtained with $r > 0$. The tenant contributes all labor L, and there is a perfect labor market. Assuming that plot size is exogenous to the input decision under consideration, the problem is written for a unit of area, with production q a function of L, x, fixed factors z, and the realization of a positive random variable θ distributed with mean 1 and variance σ^2. If $\theta q(L, x; z)$ is output at harvest time, the tenant's income y is $y = (1 - r)p\theta q(L, x; z) - wL - (1 - r')p_x x + T$, where p, p_x, and w are prices of output, purchased inputs, and labor, respectively, and T is nonfarm income.

The tenant chooses the levels of labor and purchased inputs that maximize his expected utility W: $\max_{L,x} W = EU[(1 - r)p\theta q - wL - (1 - r')p_x x + T]$.

The first-order conditions are

$$(1 - r)\, pq'_L = wEU'/EU'\theta$$
$$(1 - r)\, pq'_x = (1 - r')p_x EU'/EU'\theta.$$

These expressions identify two potential sources of inefficiency: the standard Marshallian disincentive effect of the contract term $(1 - r)$ on both labor and purchased input, unless, for

[1] Full mathematical derivations of the sharecropping model used here are available in the first author's web page on the Internet (http://are.berkeley.edu/~sadoulet).

the latter, sharing in factor cost $(1 - r')$ is equal to sharing in the product; and risk aversion $EU'/EU'\theta$, when there is not a perfect insurance market.

Taking a first-order Taylor expansion of the utility function around $\theta = 1$ and denoting by ρ the coefficient of relative risk aversion, the optimal labor and fertilizer use by the sharecropper are given by the solution to the following system of equations:

$$(1) \quad (1 - r)pq'_L = w \Big/ \left[1 - \rho \frac{(1 - r)pq}{y} \sigma^2\right],$$

$$(1 - r)pq'_x = (1 - r')p_x \Big/ \left[1 - \rho \frac{(1 - r)pq}{y} \sigma^2\right].$$

A cooperating sharecropper accepts the input level which the landlord would want him or her to apply. This level is the solution to the enforceable contract, where the landlord maximizes his or her expected utility V with respect to L, x, r, and r':

$$\max_{L,x,r,r'} EV(rp\theta q - r'p_x x + Z), \quad \text{s.t. } EU = \overline{W}$$

where Z is the landlord's other income and $\overline{W}$ is the tenant's reservation utility. Solution to this problem gives the optimal labor use as the solution to

$$(2) \quad pq'_L = w \Big/ \left[1 - \rho \frac{(1 - r)pq}{y} \sigma^2\right]$$

with a similar expression for input x.

Finally, a fixed-rent tenant or an owner-operator chooses the optimal labor input as a noncooperating sharecropper with $r = 0$, which gives

$$(3) \quad pq'_L = w \Big/ \left[1 - \rho \frac{pq}{y} \sigma^2\right]$$

with a similar expression for input x.

Similar expressions are derived for input use x. In equation (1), the left-hand side indicates the direct disincentive effect of the sharecropping contract for the noncooperative sharecropper. The negative term in the right-hand side bracket accounts for the disincentive effect due to risk. This effect is greater with greater risk aversion ρ, greater risk σ, and a greater share of the expected value of risky income in total income $s_\theta = (1 - r)pq/y$, which itself depends on the terms of the contract.[2]

The income strategy of the tenant also can be endogenized in the model. The expressions above are derived from a simple tenant's optimization model, with endogenous choice of inputs in agricultural activity but exogenous off-farm income and plot size. In a broader context, the portfolio choice between agricultural activity and nonagricultural activity is obviously endogenous and a function of many aspects not considered here, such as availability of credit or insurance mechanisms. For the empirical analysis, we thus will consider the following system explaining both the share of expected risky income in total income, s_θ, and the input choices in agriculture, L and x:

$$s_\theta = s_\theta(r, p, r', p_x, w, z, \rho, \sigma^2)$$

and

$$\left.\begin{aligned} (1 - r)pq'_L &= w/[1 - \rho s_\theta \sigma^2] \\ (1 - r)pq'_x &= (1 - r')p_x/[1 - \rho s_\theta \sigma^2] \end{aligned}\right\}$$

for the noncooperating sharecroppers;

$$\left.\begin{aligned} pq'_L &= w/[1 - \rho s_\theta \sigma^2] \\ pq'_x &= (1 - r')p_x/[1 - \rho s_\theta \sigma^2] \end{aligned}\right\}$$

for the cooperating sharecroppers and the nonsharecroppers.

A log-linearization of the optimal labor input that derives from this system of structural equations is written as follows:

$$(4) \quad \begin{aligned} \ln L &= a_0 + a_p[\ln p + \delta_{nc} \ln (1 - r)] \\ &\quad + a_x[\ln p_x + \delta_{nc} \ln(1 - r')] + a_w \ln w \\ &\quad + \sum_k a_k \ln z_k + a_\rho \ln \rho + a_s \ln s_0 + a_\sigma \ln \sigma^2 \end{aligned}$$

where δ_{nc} is a dummy variable for the noncooperating sharecroppers.

We construct a test of efficiency of a share-

[2] An alternative specification of the role of kinship in sharecropper behavior would consist in explicitly including the gains from kinship in the utility function, conditional on cooperative behavior. The first-order conditions would remain unaffected since this is a lump-sum gain. However, this would impose an additional condition on cooperative behavior in that the loss from not shirking must be inferior to the gain from kinship.

cropping contract with a kin landlord by estimating

$$\ln L = a_0 + a_p \ln p + a'_p\delta_{nf}\ln(1-r) + a''_p\delta_f \ln(1-r) + a_x \ln p_x + a'_x\delta_{nf}\ln(1-r') + a''_x\delta_f \ln(1-r') + a_w \ln w + \sum_k a_k \ln z_k + a_\rho \ln \rho + a_s \ln s_\theta + a_\sigma \ln \sigma^2 \quad (5)$$

where δ_{nf} and δ_f are dummy variables for the tenants under sharecropping contract with a non-kin landlord and a kin landlord, respectively, while the reference group is composed of owner-operators and fixed-rent tenants. A similar equation holds for fertilizer.

A test of the null hypothesis of efficiency of sharecropping under kinship is thus done directly on the impact of the contract shares $(1-r)$ and $(1-r')$ on factor use as opposed to the usual test on tenancy dummies. The test consists of the following propositions:

	Labor Equation	Fertilizer Equation
Tenant output share		
Non-kin sharecroppers	$a'_p > 0$	$a'_p > 0$
Kin sharecroppers	$a''_p = 0$	$a''_p = 0$
Tenant fertilizer share		
Non-kin sharecroppers	$a'_x > 0$	$a'_x < 0$
Kin sharecroppers	$a''_x = 0$	$a''_x = 0$
Parameter constraints in equation (5)	$a'_p = a_p$ $a'_x = a_x$	$a'_p = a_p$ $a'_x = a_x$.[3]

Since these shares are endogenous, they need to satisfy a Hausman specification test to proceed with ordinary least squares.

Alternative Specifications of the Labor Input

Up to this point, the labor input L was not discriminated by source. However, sharecroppers, as well as fixed-rent tenants and owner-operators, use both family labor and hired workers; therefore, it is important to specify how these two categories of labor contribute to L. As the payment schemes of these two categories of workers differ, their incentives to effort also differ. This can lead to various work organizations with specialization of tasks (leaving those tasks which are easier to monitor to hired workers) and/or use of supervision. Depending upon whether family and hired labor are considered perfect or imperfect substitutes in production, the disaggregation of the labor input is conceptualized in two alternative models:

(*i*) *Model 1.* Family labor F and hired labor H are perfect substitutes. Production is thus a function of total labor, $L = F + H$. If hired labor needs to be supervised, the opportunity cost of family labor is $w_F = (1-\alpha)w_H$, where αw_H, $0 \le \alpha \le 1$, is the difference in effective cost between family and hired labor. In this case, what is the marginal cost w of an additional worker when there is hired labor? If family labor is limited in number and considered a fixed factor, the marginal cost of a worker is the cost of a hired worker, and $w \equiv w_H$. Alternatively, if the ratio of family labor to total labor, s_F, is exogenous due to supervision requirements, the marginal cost of labor is equal to the average wage: $w \equiv \overline{w} = (1-s_F)w_H + s_F w_F = (1-\alpha s_F)w_H$. The logarithm of this marginal cost can be approximated by $\ln w = \ln(1-\alpha s_F)w_H \approx \ln w_H - \alpha s_F$.[4] These two alternatives lead to the following specification for the optimal factor levels:

[Model 1]

$$L = L\left[(1-r)p, (1-r')p_x, w_H, s_F, z, \rho, s_\theta, \sigma^2\right]$$

and

$$x = x\left[(1-r)p, (1-r')p_x, w_H, s_F, z, \rho, s_\theta, \sigma^2\right],$$

where w_H and s_F are exogenous variables and the parameter of s_F is equal to zero in the first alternative.

(*ii*) *Model 2.* Family labor and hired workers are imperfect substitutes and hence are considered as different factors of production. The tenant's maximization problem is

$$\max_{x,F,H} EU\left[(1-r)p\theta q - (1-r')p_x x - w_F F - w_H H + T\right].$$

Pseudo-reduced-form equations for the

[3] We mentioned that sharecropping had become illegal under the Philippine land reform law. This could reinforce the bargaining power of tenants. In a principal-agent model, the tenant's bargaining power changes his or her reservation wage $\overline{W}$. This, in turn, changes the terms of the contract (r, r'). However, the relation between L and r is unaffected. The test of efficiency of sharecropping is on whether L is a function of r. Hence this test is unaffected by $\overline{W}$. The land reform legislation should thus leave unaffected whether sharecropping is efficient or not, as long as it exists.

[4] Using a Taylor series expansion around $\alpha s_F = 0$, $\ln(1-\alpha s_F) = -\alpha s_F - (\alpha s_F)^2/2 - \ldots$. The quadratic and higher-order terms are negligible since both α and s_F are shares.

choice of purchased inputs and hired labor, where F is endogenous, can be written as

[Model 2]

$$H = H[(1 - r)p, (1 - r')p_x, w_H, F, z, \rho, s_0, \sigma^2]$$

and

$$x = x[(1 - r)p, (1 - r')p_x, w_H, F, z, \rho, s_0, \sigma^2].$$

To estimate these equations by ordinary least-squares, F will need to satisfy a Hausman specification test.

Since we do not know a priori which model applies, both models will be estimated in the empirical analysis that follows.

Data and Empirical Results

The farm household survey contains information on rice production activity by plot (technology, labor input, fertilizer use, and use of machinery or animal power), the household's general economic conditions (family size, family labor force, education, land assets, ownership of machinery, off-farm income, and debt), and wages and fertilizer prices. We also collected the average rice price received for sales at the household level. However, since the National Food Authority intervenes in the rice market to support and stabilize prices to farmers, all farmers expect approximately the same forward price when planting decisions are made. As a result, the parameter a_p in the above model cannot be estimated since there is no variation in expected price.

Table 4 reports descriptive statistics on the variables that were found to be significant in the analysis. The distribution of plot size indicates a high level of fragmentation. Plot size varies from 0.16 to 10 hectares, with 93% of the plots less than four hectares. There is a large variability in fertilizer prices and wages, both across and within villages, which permits estimation of the response of factor demand to these prices.

Simple examination of the reported averages unveils few differences between tenancies. One is that the non-kin sharecropper households seem somewhat less well off than the other categories. On average, they have less land assets, they own less machinery, a smaller percentage of them have off-farm income, and their off-farm income is substantially lower. Their average education is also lower than that of other groups. What could appear to be a tenancy characteristic is, however, a village characteristic. Recall that the incidence of non-kin tenancy is higher in village Aq of Panay Island, the poorest of the three villages. However, within the two villages, Aq and Du, there is no systematic difference in assets among the two types of sharecroppers, except in education, where non-kin sharecroppers have 3.5 and 4.5 years of schooling compared to 5.3 and 7.8 for the kin sharecroppers. This location bias also explains why the percentage of irrigated plots among the non-kin sharecroppers is much lower than in the other tenancies. That kin sharecroppers have, on average, a larger rice plot, and, consequently, a lower family share in labor, is not a systematic characteristic across villages. This solely comes from the land distribution within village Tu, which moreover has larger plots than the other two villages.

Average levels of input by tenancy suggest that kin sharecroppers are not very different from owners and fixed-rent tenants in terms of labor, fertilizer, and machine or animal power use per hectare, while non-kin sharecroppers use less inputs. We need, however, to test whether these average observations correspond to differential behavior, as hypothesized in the model above, and not simply to differential asset characteristics. This is done by estimating input demand functions for labor time and fertilizer, as reported in table 5.

In the case of labor, the effective input is labor effort, which combines labor time and effort intensity. As effort intensity is not easily observable, it is usually assumed that workers who have a contract over labor time would adjust their effort intensity in accordance to incentives. However, when the contract does not regulate time, as in an unenforceable sharecropping contract, there is no reason to expect a downward adjustment of effort intensity differentially from a downward adjustment of labor time.[5] Hence, observed labor time is, in that case, a good indicator of labor effort. Another point of debate is whether or not labor time itself is observable by enumerators. The incentive for a sharecropper not to reveal the true time worked only arises *vis-à-vis* the landlord

[5] Production is function of labor effort $L = Te$, where T is labor time and e effort intensity. For a worker, the disincentive effect comes from the fact that wage payments are function of T, which is monitored, while disutility of labor is function of labor effort Te, where e is unobservable. In this case, shirking must be observed indirectly through its consequence on output or profits. For a sharecropper, the disincentive effect comes from the fact that payment is a share of output, while disutility of labor is function of Te, where neither T nor e are monitored. He or she consequently has no reason to shirk on effort intensity, but can do it directly on time.

Table 4. Descriptive Statistics by Tenancy

	Sharecroppers with Kin Landlord		Other Sharecroppers		Fixed-Rent Tenants		Owner-Operators		All Households			
	Avg.	Std. Dev.	Avg.	Std. Dev.	Avg.	Std. Dev.	Avg.	Std. Dev.	Avg.	Std. Dev.	Min.	Max.
Number of observations	31		14		66		39		150			
Prices												
Fertilizer (pesos/sack)	202.9	21.7	229.7	48.8	217.0	38.8	203.2	50.3	211.6	45.1	89	330
Wage (pesos/day)	43.6	46.9	44.7	20.6	57.4	22.3	59.7	24.3	54.0	23.3	13	125
Household characteristics												
Land asset (ha)	3.28	4.1	2.22	2.5	2.60	2.6	2.00	2.2	2.58	2.9	0.2	16.0
Owned machinery (% of households)	16.1		0.0		16.7		17.9		15.3			
Off-farm income												
% with off-farm income	87.1		71.4		90.9		82.1		86.0			
Average (1,000 pesos)	15.7	29.1	3.0	3.1	21.8	34.1	35.0	53.9	22.2	38.8	0	253
Debt												
% with debt	83.9		92.9		87.9		69.2		82.7			
Average (1,000 pesos)	6.3	10.5	2.1	2.5	7.3	14.8	9.4	14.9	7.1	13.4	0	100
Education of household head (years)	6.9	3.5	3.9	2.5	5.8	3.1	8.1	3.5	6.4	3.4	0	14
Women in family labor force (%)	27.9	30.0	13.7	23.9	27.0	28.8	26.8	32.0	25.9	29.5	0	100
Rice plots												
Area (ha)	2.11	2.1	1.50	1.8	1.98	1.7	1.03	0.8	1.71	1.7	0.16	10.0
Irrigated plots (% of plots)	64.5		35.7		77.3		69.2		68.7			
Manual weeding (% of plots)	3.2		14.3		1.5		5.1		4.0			
Share of family in total labor (%)	17.3	14.3	29.7	20.2	28.1	24.6	20.4	22.1	24.0	22.1	0	84
Labor use (man-day/ha)	82	38	57	24	75	33	67	41	74	36	23	232
Fertilizer use (sacks/ha)	5.80	3.0	3.80	3.0	5.40	2.1	5.44	3.0	5.40	2.6	1.5	16.0
Machine/animal power (pesos/ha)	1,497	751	1,201	397	1,504	590	1,514	1,108	1,479	774	189	6,390

Table 5. Input Demand with Different Contracts and under Alternative Specifications of the Labor Model

Endogenous Variables Labor Model[a] Equations		Hired Labor/Ha (Model 2) –1–		Hired Labor/Ha (Model 2) –2–		Hired Labor/Ha (Model 2) –3–		Labor/Ha (Model 1) –4–		Fertilizer Use/Ha (Model 1) –5–		Fertilizer Use/Ha (Model 2) –6–	
Exogenous Variables	Notation	Parameter	T-Stat	Parameter	T-Stat	Parameter	T-Stat	Parameter	T-Stat	Parameter	T-Stat	Parameter	T-Stat
Prices and shares													
ln(tenant output share), non kin[b]	a_p'	0.84	1.6	0.65	2.9			0.39	2.4	0.35	1.9	0.39	2.0
ln(tenant output share), kin[b]	a_p''	–0.15	–0.5	–0.03	–0.2			–0.04	–0.4	–0.03	–0.2	–0.06	–0.4
ln(p fertilizer)	a_x	0.34	2.2	0.34	2.2	0.31	2.1	0.29	2.7	–0.36	–2.8	–0.33	–2.5
ln(tenant fertilizer share), non kin[b]	a_x'	–0.22	–0.4			0.61	2.4						
ln(tenant fertilizer share), kin[b]	a_x''	0.16	0.5			0.01	0.0						
ln(hired worker wage)	a_w	–0.42	–4.8	–0.41	–4.7	–0.41	–4.7	–0.23	–3.7	0.09	1.2	0.03	0.4
Family share in labor	a_F	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	–0.09	–0.7	–0.71	–4.7	n.a.	n.a.
ln(family labor/ha)[b]	a_F	–0.17	–5.8	–0.17	–5.9	–0.17	–5.9	n.a.	n.a.	n.a.	n.a.	–0.08	–3.0
Technology and productive assets	a_z												
ln(plot area)								–0.11	–3.7				
Manual weeding[b]		0.84	4.6	0.84	4.6	0.82	4.4	0.60	4.5	0.38	2.4	0.48	3.0
Rainfed										–0.17	–2.2	–0.21	–2.7
ln(traction power/ha)[b]		0.37	5.2	0.37	5.2	0.36	5.1	0.21	4.1				
Share women in labor force										–0.36	–3.3	–0.34	–2.9
Credit constraint and risk aversion	a_p												
Dummy off-farm income		0.47	1.6	0.50	1.7	0.53	1.8			0.80	3.1	0.85	3.0
ln(off-farm income)		–0.05	–1.8	–0.06	–1.9	–0.06	–1.9			–0.08	–2.8	–0.09	–2.8
Dummy debt										0.59	2.5	0.56	2.3
ln(debt)										–0.04	–1.5	–0.04	–1.3
Household income portfolio													
Predicted risky income share	a_s									–0.52	–2.1	–0.55	–2.1
Risk: Village dummies	a_σ												
Aq		–0.31	–3.2	–0.31	–3.3	–0.31	–3.2	–0.38	–5.5				
Tu										–0.29	–2.5	–0.29	–2.4
Constant term	a_0	1.62	1.5	1.61	1.5	1.69	1.5	2.26	2.9	3.76	4.6	3.91	4.6
Test of equality of coefficients (t-stat)	$a_x' = a_x$		0.92				–1.03						
Adjusted R^2 (150 observations)		0.51		0.51		0.50		0.49		0.29		0.23	

Notes: n.a. = variable not in the model. Blank means that the plot, household, or village characteristic was eliminated from the regression, after its coefficient was found not significantly different from 0.
[a] Family and hired labor are perfect substitutes in model 1 and imperfect substitutes in model 2. In model 2, only hired labor is introduced as family labor is considered a quasi-fixed factor.
[b] Hausman specification tests were performed on these variables and coefficients of predicted values were found not significantly different from 0.

and when the contract specifies labor time. This is the essence of the enforcement problem in sharecropping. Hence, there is no reason to suspect that enumerators cannot obtain reliable information on labor input when the contract does not specify labor time, even from sharecroppers in kinship contracts since cooperation is incentive compatible. To avoid these problems of observability, indirect inference on input use is sometimes done from estimation of yield or residual profits equations, rather than estimation of input demand. The problem with this approach is that the impact of input use on output or profit is mediated by random shocks. This can substantially reduce the quality of the econometric results when samples are small, as in our case. As a consequence, we use declared labor time as the endogenous variable in the labor demand equation. As discussed above, we consider two alternative formulations: in model 1, the endogenous variable is total labor and family share is considered exogenous; in model 2, the endogenous variable is hired labor and family labor is considered a quasi-fixed input.

As machinery and animals are both owned and rented, their marginal costs vary greatly across households and are difficult to evaluate. Hence, the variable machinery and animal power use, which is an aggregation of rented services and imputed value for use of owned equipment, is always considered a quasi-fixed input. The choice of performing weeding manually is considered a technological choice predetermined to the amount of factor use. To take into account a possible simultaneity problem, Hausman specification tests were performed on these variables and exogeneity could not be rejected. The product and fertilizer shares are exogenous for a noncooperating sharecropper but endogenous in the cooperating sharecropper's input choice equations since he or she behaves according to the landlord's interest. We also performed Hausman specification tests for these shares when they apply to kins. Since these tests are satisfied, we proceed with simple OLS estimations. Finally, we tested for selectivity bias in the choice of sharecropping versus other forms of tenancy, but found that the resulting Inverse Mills Ratios in the factor demand equations were never significant.

In table 5, the hired labor demand equation (model 2) gives the best adjusted R^2, so we discuss estimation of this equation more exhaustively. Because of limited variability in the observed combinations of output and fertilizer shares (table 2), the full model [equation (1), in table 5] gives significant share effects for output for non-kins, but not for fertilizer shares. For this reason, we specialize the model alternatively toward product sharing [equation (2)] and fertilizer sharing [equation (3)]. In both cases, the results show that non-kin sharecroppers are affected by the terms of the contract (a'_p, a'_x significantly positive), but not kin sharecroppers (a''_p, a''_x not significantly different from zero). In addition, the hypothesis of parameter equality constraint, $a'_x = a_x$, cannot be rejected in equations (1) and (3). The cross-price elasticity with fertilizer price shows that fertilizer is a labor substitute, an effect also observed by Quizon and Binswanger for India. With the model specialized toward product sharing [equation (4)], the model with family and hired labor as perfect substitutes shows the same contrast between kin and non-kin.

In the fertilizer use equations [equation (5) for model 1; equation (6) for model 2], best fits are obtained by specializing the model toward product sharing. In this case again, the tests of cooperative behavior among kin (a'_p significantly positive) but not among non-kin (a''_p not significantly different from zero) are satisfied.

Among the technology and productive assets variables, manual weeding and use of machine or animal power are found to lead to higher fertilizer and labor use; availability of women in the family lowers fertilizer use, showing again that fertilizer and labor are substitutes, and particularly so for female labor; and irrigation increases fertilizer use. We also find that the classical inverse relationship between labor intensity and area holds [equation (4)].

The presence of off-farm income and debt (access to credit), which reflects the availability of liquidity to the household essential for off-season expenditures and for income smoothing across years, captures elements of credit constraint and risk aversion. As expected, these sources of liquidity facilitate the use of purchased inputs, i.e., fertilizer and hired workers. With both a dummy and a level variable, the influence of these external sources of income, y, when they are positive, is equal to $a_y - a'_y \ln y$. With the estimated values for the parameters a_y and a'_y, both off-farm income and debt have a positive but decreasing influence on input use.[6]

The level of riskiness of the household income is measured by the ratio of the expected value of the risky income (expected value of agricultural production) in total income. This

[6] The value e^{a_y/a'_y} beyond which the total effect would be negative is several orders of magnitude above the observed values of farm income or debt.

ratio is first estimated using all the agricultural and nonagricultural assets and the prices that we observed. Of these variables only total land assets, value of owned machinery, and a dummy variable for village Tu contribute to predicting the household portfolio choice. This predicted riskiness of the household income is then used as an explanatory variable of input use on each plot. The results suggest that income risk reduces fertilizer use but not labor use.

Finally, the village dummy variables capture a number of factors affecting input use, including different transactions costs and the weather element of production risk.

Conclusions

The principal controversy in the debate on efficiency of sharecropping concerns the problem of contract enforceability. Enforceability of a single short-term contract is admittedly almost impossible at low cost in the spatially dispersed and uncertain environment that is characteristic of agriculture. Theory suggests, however, that cooperation can be sustained when links exist among the partners that induce some "moral" behavior encompassing altruism and preventing cheating, or when the contract is embedded in a long-term relationship and interlinked with reciprocal credit and insurance agreements. Kinship networks typically provide this environment conducive to cooperation. We therefore hypothesized that sharecroppers who have a kinship relationship with their landlord behave efficiently in applying the socially optimum level of inputs and effort on their land, despite the disincentive effects that the sharing of output and purchased inputs create for them.

Analysis of a household survey from the Philippines supports this hypothesis. We find that the behavior of sharecroppers with a kinship relation with their landlord is not affected by the terms of the contract, while behavior of the other sharecroppers responds to the contract terms. We characterized the meaning of this family tie through a survey of opinion conducted among tenants. It shows that kin landlords help, or are expected to help, more frequently in case of emergency than the other landlords, and they do so with a wider range of instruments, providing the incentive for cooperative behavior in sharecropping contracts among kin.

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