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[THE MEANING OF KINSHIP IN SHARECROPPING CONTRACTS

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Abstract:

Analysis of a household survey from the Philippines shows that the behavior of sharecroppers with a kinship relationship with their landlord is not affected by the terms of the contract, while the 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 indeed 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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I. Introduction

Theoretical analyses of sharecropping have called upon several arguments to justify that this contract could be no less efficient than direct cultivation or fixed rent contracts, despite the incentive bias given by the terms of the contract. These arguments range from assuming that the landlord can specify the level of resource use in the contract and enforce it with supervision, to considering the sharecropping contract as embedded in a long-term multi-purpose relationship with the landlord that serves as an enforcement mechanism, to invoking altruism or social norms rather than personal benefit as the determinants of individual behavior. 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 among contracts and others observing clear under-use of inputs and lower yields for sharecroppers. However, whatever conclusion they reach, inefficiency or not, none of these empirical studies has enlightened the theoretical debate on the potential reasons why sharecroppers would be efficient despite their presumed self-interest behavior. To respond to this question, the design of our analysis is to contrast sharecroppers among themselves as well as with non-sharecroppers, and to identify essential characteristics that determine why some sharecroppers behave efficiently and others not. The survey that we conducted in three villages of the Philippines identifies family ties with the landlord as a key determinant of cooperative behavior by sharecroppers and hence of efficiency.

To elucidate the significance of family ties for efficiency, we first review the theories and empirical evidence on efficiency in sharecropping (section 2). Our survey directed at identifying what family ties entail for the sharecroppers shows that kin landlords provide insurance more often than other landlords do, despite being generally of lesser wealth (section 3). We establish the behavioral contrast between kin and other sharecropping contracts by showing that the terms of the contract affect negatively the input decisions of non-kin sharecroppers but not those of kin sharecroppers (sections 4 and 5).

II. Debate on Inefficiency of Sharecropping

The Marshallian argument for the inefficiency of sharecropping is usually analyzed as a typical 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 only receives a fraction of the product of his effort) and the "social" optimum (which measures the total benefit).

The argument can be briefly summarized as follows (Otsuka and Hayami, 1988). Consider first the case where the contract can specify input levels, including the tenant's effort, and be enforced. The optimal contract chosen by the landlord stipulates a level of effort that equates its expected marginal product to the marginal rate of substitution between effort and expected income. 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 reservation level. Under these conditions, the expected marginal productivity of labor is equal on the tenant's and the landlord's plots, which is the condition for socially efficient resource allocation. If the level of effort is not enforceable, its choice is left to the tenant. Since the tenant receives only a fraction of the product, his optimal choice is such that the expected marginal product of effort is higher than the marginal rate of substitution between effort and expected income. Furthermore, in the optimal contract offered by the landlord, the tenant bear more risk than the landlord. Hence, output and labor per unit of land are lower under share contract than the socially optimal level. Inefficiency of sharecropping thus includes two elements. The first element 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 element is the risk bearing effect, where, under non-enforceability, risk sharing in sharecropping 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. Sharetenancy has been treated as an agency problem by assuming that the landlord is able to appropriate all the surplus that the socially optimum solution would generate, and that he will not default on the contract terms himself. The first assumption, which is determinant for the definition of the contractual terms and the distribution of the rent, may be debated (Bell, 1989). However, even with different rules about the choice of the contract terms, as long as the tenant receives only a share of output, there will be a difference between the sharetenant's short-term individual optimum (the non-cooperative solution) and the social optimum (the cooperative solution). Hence, although the cooperative solution will be best for both partners (at least if some of the benefits accrue to both), there is an incentive to cheat on the contract; this is the standard prisoner's dilemma. We can thus draw on the general theory of cooperation to establish the conditions under which landlord and tenant can be expected to behave cooperatively, which means for the tenant to choose the efficient level of labor use, and for the landlord to respect payment of whatever compensating settlement has been agreed upon.

Cooperative solutions are obtained under four types of conditions:

i) The easiest case is when it so happens that individual non-cooperative behavior is identical to the cooperative choice. This may be due to pure technological constraints, for example when there is little scope for product and factor substitution (Rao, 1971), or when the landlord controls the plot size and the elasticity of substitution between land and labor is equal to 1 (Otsuka and Hayami, 1988). This concordance also occurs when partners are altruistic and have internalized the social optimum in their own objective (Arrow, 1968; Simon, 1991). In an earlier paper, we also identified a case of individual choice of efficient labor input when the tenant is highly risk averse, behaving according to the safety-first rather than the expected utility rule (Sadoulet, Fukui, and de Janvry, 1993). Variations in the contract terms can also induce efficiency, such as cost sharing which eliminates the disincentive effect when the sharing rules on all inputs and output are identical (Bliss and Stern, 1982; Nabi, 1986). Critics contend that the cost of the tenant's effort cannot really be observed and shared, and that, even for purchased inputs like fertilizers, the possibility of resale cancels out the expected corrective effect of cost sharing (Bardhan, 1984, ch. 7). Furthermore, as Braverman and Stiglitz (1986) have argued, the equal sharing rule is not optimum so long as the levels of use of some other inputs are not enforceable.

ii) The oldest argument for the efficiency of sharecropping relies on the assertion that the tenant's work effort can be costlessly enforced by landlords (Johnson, 1950; Cheung, 1969). 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 contract, and that there exist sufficiently high penalties that can be imposed cheaply on the tenant. These requirements have been criticized as unrealistic, at least in one-time contracts. In particular, when one assumes that the tenant remains at his reservation utility, even termination of the contract would do him no harm.

iii) 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, 1989). This is the thrust of a gift exchange model in which we derive the minimum level of benefit and the range of sharing that can sustain cooperation and hence efficiency (Sadoulet, Fukui, and de Janvry, 1993). The problem of observability, which remains a condition for deciding when to terminate the contract, is due to uncertainty of production which prevents the landlord from inducting the level of effort from the observed output. Indirect "observability" of the tenant is easier for simpler technology and in a less uncertain environment, where the landlord should be able to better ascertain *ex-post* the effect of weather and to estimate reasonably well the tenant's labor effort from his knowledge of the production function (Kotwal, 1985). If the landlord has several tenants in similar agroclimatic conditions, he can also infer individual work effort by comparing the outcomes across tenants. Alternatively, the landlord may have to rely on a statistical method to detect cheating (Radner, 1981).

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, 1992). In some situations, interlinkage changes the incentive structure for the tenant. For instance, Subramanian (1993) shows that a landlord who is the source of credit for his tenant can raise interest rates to lower borrowing in the lean season, thus reducing indebtedness in the agricultural season, which in turn raises the tenant's welfare in that season and reduces his aversion to risk. This induces higher work on the rented plot, partially compensating for the Marshallian disincentive. In other situations, interlinkage acts as a threat that induces cooperative behavior, for instance when the punishment for cheating on one contract cancels the possibility of other transactions. The threat is credible if termination of the contracts is not too costly for the punisher, and it is efficient in preventing cheating if termination of the contracts is costly to the punished partner. These are very particular asymmetrical conditions that suppose unequal opportunities if the transactions take place among two partners only. With a sharecropping contract embedded in a larger network of contracts (like mutual insurance, credit group, etc.), eviction of one member is clearly far more costly to this member than it is to the rest of the group.

The family and social networks incorporate several of these dimensions. Some elements of altruism among kinship 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, and commonly sources of mutual assistance and insurance. In the particular context of the Philippines, where sharecropping is illegal, the risk of being denounced and hence of contract termination is probably lower among kin than it is among non-related partners.

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 (1988) record the results of 217 comparisons of output between sharetenants and owner-operators and 53 between sharetenants and fixed-rent tenants, 12 and 18 comparisons of labor use, and 55 and 11 comparisons of fertilizer use, respectively. They conclude that, while there is some dispersion in the results, with some analyses exhibiting significant differences among tenancies, on average there is no systematic bias of lower yield or input use by sharecroppers. Their interpretation does not negate the Marshallian inefficiency, but it advocates that only landlords who do have access to a relatively efficient and cheap mechanism to monitor the tenant choose sharecropping. Hence, a natural selection of contracts will mostly leave the efficient sharecropping contracts to be observed (Otsuka, Chuma, and Hayami, 1992). Considering the theories that we have reviewed above, the important question would be to sort out the mechanisms by which sharecropping efficiency is achieved, when it is observed, and to check that these mechanisms are indeed all missing when inefficient sharecropping is observed.

In the studies that support efficiency of sharecropping, authors report that contracts are made between family members (Cohen, 1983), in patron-client relationships (Hayami and Kikuchi, 1981; Bardhan and Rudra, 1980), or that tenants are closely supervised (Nabi, 1986). In two studies from India that exhibit significant inefficiency of sharecroppers (Bell, 1977; Shaban, 1987), 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 several Bangladesh cases of inefficient sharecropping, strict prohibition of fixed-rent contracts forced even absentee landlords to use share tenancy contracts, despite the obvious impossibility to properly monitor their tenants (Otsuka, Chuma, and Hayami, 1992). In a recent analysis of the evolution of yields in Central Luzon, lower yields for sharecroppers are attributed to tenancy regulations that prohibit eviction of tenants even if they shirk (Otsuka, Gascon, and Asano, 1994).

While these explanations of efficiency or inefficiency are enlightening, none of these studies explicitly test for the reason which they claim is decisive in achieving the efficiency result that they observe. Such a test would require comparison of sharetenants with short and long term contracts in the Indian case, and with absentee and resident landlords in the Pakistan and Philippine cases. This is the approach which we have taken in a previous analysis of sharetenancy in Thailand, where we test alternative theories through the comparative level of efficiency induced by a gift-exchange contract in one village, and by extreme risk aversion in another village (Sadoulet, Fukui, and de Janvry, 1993). In the first village, we show that input use by sharetenants with gift-exchange contracts is not different from that by owner-operators, but significantly higher than that by the other sharecroppers. In the second village, we show that poor sharecroppers with extreme risk aversion behave no differently than owners with the same characteristics, while the other sharecroppers use less input than comparable owner-operators. In this paper, we adopt the same approach and show 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 as Marshallian theory predicts.

A different question, also raised in the literature, is why is sharecropping prevalent even when inefficient? Legal restrictions were found to be compelling reasons for this in India and Bangladesh. In both countries, fixed-rent tenancy was prohibited at the time of the studies. In Bangladesh, sharecropping was allowed as a form of labor contract, while in India it was not explicitly allowed but easily disguised as a labor contract (Otsuka, Chuma, and Hayami, 1992). In theory, however, there are reasons to find inefficient sharecropping contracts, even as unconstrained first choice. Sharecropping contracts have many advantages (such as risk sharing, overcoming market imperfections, and compensating for the incentive bias of limited liability), and can be proven superior to fixed-rent contracts or direct farming, despite their inefficiency costs. This remark justifies why we can observe and should be looking for concurrence of efficient and inefficient sharecroppers to document the mechanisms of inducement/enforcement that lead to efficiency.

III. Sharecropping in the Philippines

The land reform produced major changes in the Philippines' tenancy patterns. Under the 1971 Agrarian Reform Code, which applied to the entire country, landlords were not allowed to retain more than 7 hectares of rice or corn under tenancy, and sharecropping was declared illegal. Tenants whose landlord held more than 7 ha in tenancy were entitled to purchase the land they tilled in plots of not more than 7 ha, with payment in installments (Operation Land Transfer). Those who chose this option received a Certificate of Land Transfer (CLT), promising the land title upon completion of the payments and restricting meanwhile rights of transfer to their heirs only. Lands that remained rented under the 7 hectares ceiling were converted from share tenancy to fixed rent contracts, with regulated levels of rent (Operation Leasehold).

Before the land reform of 1971, tenancy had been pervasive in the Philippines, particularly in the islands of Luzon and Panay where our study takes place. In these islands, tenancy covered 80% of the land under rice production in the irrigated and favorable rainfed areas, and 54% in the unfavorable rainfed areas (Hayami, Quisumbing, and Adriano, Table 20). This choice of tenancy stemmed mainly from the difficulty of monitoring the work of hired workers on large areas, which made it more profitable for landlords to rent out their land in small parcels. Sharetenancy was the dominant tenancy arrangement, characterizing 90% of contracted land in irrigated and favorable rainfed areas, and more than 75% in unfavorable areas. Implementation of the land reform has apparently been quite successful. According to the Department of Agrarian Reform, more than 100% of the targeted area for tenancy conversion had been covered by 1987, and Certificates of Land Transfer had been issued on 92% of the area targeted for land transfer (Hayami, Quisumbing, and Adriano, Table 13). This apparent complete success, however, does not inform on the many ways in which landlords could evade the land transfer law, nor on the subsequent resurgence of illegal contracts and surrogate legal contracts that can still be widely observed.

A new wave of protest, debates, and bills reopened the land reform issue at the inception of the Aquino presidency. This culminated in the Comprehensive Agrarian Reform Law of 1988. This legislation offers a comprehensive land reform program covering all agricultural land regardless of tenurial systems and crops produced, but does not alter the tenancy rules in rice and corn land. The only element of the new law that affects rice cultivation is a review and adjustment of the regulated land rent. Hence, for the purpose of our analysis, the 1972 legislation remains the reference point.

The limit imposed on tenancy, and particularly the prohibition of sharetenancy, was bound to induce major adjustments in the incidence of contractual arrangements. These came under several forms, particularly: i) a number of mechanisms by which the landlords could evade the limits; ii) very unequal implementation of the land reform across regions, despite the official report; iii) maintenance of the less vulnerable form of sharetenancy with family members; and iv) resurgence of alternative contracts, particularly land pawning and *katsupong* (Hayami, Quisumbig, and Adriano, 1990). The last three clearly bear on the efficiency of land cultivation that remains under contractual arrangements.

We conducted a survey in three villages in July-August 1992. Village Tu is approximately 90 km to the East of Manila, in the state of Laguna, which is part of 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 hence was not subject to extensive land transfers under the land reform. Village Du is 18 km West of the State capital and connected with good roads. Village Aq is the poorest, least irrigated, and most isolated of the three villages. Table 1 shows that, despite its illegality, sharecropping is still practiced, particularly in the villages of Panay island, with 22% of the plots in Tu, 27% in Du, and 50% in Aq. This confirms the general finding that implementation of land reforms has been very uneven, more strictly enforced in the areas closer to government control or where peasant movements had been stronger, and less respected in more isolated areas. Implementation has also been more vigorously fought for and is hence more complete in the richer areas of Central Luzon, where the benefits of the reform were larger for the former sharecroppers (Otsuka, 1991). For the new owners, large economic gains came with the Green Revolution as compensation for land transfers was based on pre-Green Revolution yields and profits. Benefits of switching from share tenancy to fixed rent tenancy came from rent regulation that set rent at a level roughly equal to 25% of pre-Green Revolution yield, rather than the 33 to 50% commonly found in sharecropping contracts. While the Green Revolution and rent regulations have tilted the balance in favor of fixed rent for the tenant, the standard benefits of sharecropping remain sufficient for sharecropping to prevail in 28% of the tenanted plots in Tu, 38% in Du, and 70% in Aq.

The other 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 to Du and Aq. This is likely because, given illegality of the contract, the risk of being denounced is less with tenants related by family ties.

The restriction on land transactions has also given way to the emergence or resurgence of alternative contracts. Contracts of particular importance are land pawning, and the *gama* and *katsupong* contracts. Land pawning (called *sangla* in Central Luzon) is a land-credit interlinked contract, by which the pawnee exchanges cultivation right over some land against credit. There is neither rent for the land nor interest payment on the loan. Nagarajan, Quisumbig, and Otsuka (1991) convincingly argue that the pawning contract responds to the need for a credit transaction rather than a land transaction, by observing that land is transferred from small farmers to large owners or merchants. They justify emergence of this contract by the prohibition to transfer CLT land, which prevents its use as collateral and cuts off land reform beneficiaries from access to other sources of credit. The production incentive under land pawning should be similar to those of a fixed rent contract.

The *gama* contract is a new contractual arrangement in which the workers weed without receiving wages for a right to participate in harvesting and threshing the plot and to receive a share, usually one-sixth, of the harvest. Although the contract applies to a subset of the tasks, the incentive scheme is very similar to a sharetenancy contract. The *katsupong* is a permanent worker who performs certain pre-assigned tasks. The extent of his responsibility and its autonomy in decision varies widely, reaching in certain cases almost all the agricultural tasks normally filled by a tenant. Under the older contractual arrangements of *katsupong*, the worker had few tasks and was paid a fixed wage. A new *katsupong* contract (*porsientuhan*) recently developed in response to the restriction on tenancy which prevents the land reform beneficiaries from leasing out their land. The *porsientuhan* worker assumes most of the agricultural tasks and is paid a share of output (usually 10%). This labor contract hence resembles a very inefficient tenancy contract (Otsuka, Chuma, and Hayami, 1993).

In the villages that we surveyed, we did not observe any land pawning or *porsientuhan* contracts. But *gama* contracts were observed in village Tu where they are commonly used by tenants and owners alike. Some farmers from village Tu acknowledge that *gama* workers did not weed as well as daily wage or family workers. This contract seems to be disappearing in the region. We will take the presence of *gama* workers into account when analyzing the relative efficiency of different tenurial arrangements.

We attempted to elucidate the content of kinship relations through a survey of tenants' perceptions. The hypotheses to check were that 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 perception on some of these issues, altruism or trust for instance, turned out to be quite difficult, and no contrasts were uncovered by questions on the quality of the relationship with the landlord. Similarly, given 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, some interesting results on the extent of insurance given by landlords and the nature of reciprocity in maintaining good relationships. These are summarized in Table 2. 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 more frequently insurance from their landlords than do 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 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, with an average of 1.4 instruments compared to 1 for the other landlords. Because of fungibility between rent and grain for the sharecroppers, and possibly between cash gift and credit for all, 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 family ties showed a more active participation than the other tenants, with 75.9% acknowledging explicit action to please their landlords, as 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 family 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.

Sharecroppers who take contracts with non-kin landlords rely more frequently on their landlord as their sole source of insurance, and take contracts more frequently with landlords which they perceive as rich. (The information on whether the landlord was rich, average, or poor, was asked to the tenant to capture his perception, which is what matters in his decision.) By contrast, 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.

IV. Test of Efficiency of Kinship Sharetenancy

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 a fixed payment per unit of area. The fixed rent contract is obtained with $r = 0$, and sharecropping with $r > 0$. Assuming that plot size is exogenous to the input decision under consideration, the problem is written for a unit of area, with production q function of labor L, purchased inputs x, fixed factors z, and the realization of a random variable θ, distributed with mean 1 and variance σ^2. If θ q(x, L; z) is output at harvest time, the tenant's income y is:

$$y = (1 - r)\, p\, \theta\, q(L, x; z) - wL - p_x x - R + T,$$

where p, p_x, and w are prices of output, purchased inputs, and labor, and T is non-farm income.

We assume that the tenant chooses the levels of labor and inputs that maximize his expected utility:

$$\underset{L,x}{\text{Max}}\ EU[(1-r)p\theta q - wL - p_x x - R + T].$$

We show in Appendix that optimal labor use is the solution of the following equations:

i) Non-cooperating sharecropper:

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

ii) Cooperating sharecropper:

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

iii) Fixed-rent tenant or owner-operator:

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

where ρ is the coefficient of relative risk aversion. Similar expressions can be derived for input use x. The left hand sides indicate the direct disincentive effect of the sharecropping contract for the non-cooperative 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 greater share of the expected value of risky income in total income (1-r)pq/y.

Two elements can be further endogenized in this model: the contract terms and off-farm income. Endogeneity of the contract terms is usually modeled as the choice of the optimum contract by the landlord in a principal-agent framework. We show in Appendix that, under enforceability, the optimal contract ensures perfect risk sharing between landlord and sharecropper, while, under non-enforceability, the tenant is left to bear higher risk. This would reinforce the difference in input use between the two types of sharecroppers. The comparison between non-cooperating sharecroppers and fixed-rent tenant or owner-operator is, however, ambiguous. Sharecroppers bear the negative incentive of contract terms, but enjoy more risk sharing than fixed-rent tenant or owner-operators. Unfortunately, in the empirical analysis that follows, we do not have enough information on landlords to consider the endogeneization of the contract. Therefore, we restrict ourselves to the analysis of the tenant's decision making, at given contract terms.

The second element that can be endogenize is the income strategy of the tenant. 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 risk management or portfolio choice between agricultural activity and non-agricultural activity is obviously endogenous, and function of many aspects not considered here, such as availability of credit or insurance mechanisms. For the empirical analysis, we will thus consider the following system explaining both the share of expected risky income in total income, s_θ, and the input choice in agriculture, L and x:

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

$$\text{and} \quad \begin{cases} (1-r)pq'_L = w/\left[1-\rho\, s_\theta\, \sigma^2\right] & \text{for the non-cooperating sharecroppers} \\ \quad pq'_L = w/\left[1-\rho\, s_\theta\, \sigma^2\right] & \text{for the other producers} \end{cases}$$

with similar expressions for input x.

A log-linearization of the labor demand function is written as:

$$\ln L = a_0 + a_p[\ln p + \delta_{nc}\ln(1-r)] + a_x \ln p_x + a_w \ln w + \sum_k a_k \ln z_k + a_\rho \ln \rho + a_s \ln s_\theta + a_\sigma \ln \sigma$$

where δ_{nc} is a dummy variable for the non-cooperating sharecroppers.

We construct a test of efficiency of a sharecropping contract with a kin landlord by estimating:

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

where δ_{nf} and δ_f are dummy variables for the plots under sharecropping contract with a non-kin landlord and a kin landlord, respectively, and by testing for the following constraints:

$$a'_p = a_p \quad \text{and} \quad a''_p = 0.$$

Alternative specifications of labor input

Sharecroppers, as well as fixed-rent tenants and owner-operators, use both family labor and hired workers. 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 ways:

i) Family labor F and hired labor H are assumed perfect substitutes. Production is function of total labor, $L = F + H$. If family labor has the same opportunity cost than hired labor, $w_F = w_H$, then the imputed cost of L is their common value. The model defined above is applied with:

$$w \equiv w_F = w_H.$$

If hired labor needs to be supervised or, equivalently, family labor has a lower opportunity cost, then the average labor cost is:

$$\overline{w} = w_H(1 - \alpha F / (F + H)),$$

where αw_H is the difference in effective cost between family and hired labor. What is the marginal cost of an additional worker? If the cheaper family labor is limited in number and considered a fixed factor, the marginal cost of a worker is the cost of a hired worker, $w \equiv w_H$. If the ratio of family labor to hired worker, s_F, is exogenous, the marginal cost of labor is equal to the average wage:

$$w \equiv \overline{w} = w_H(1 - \alpha s_F).$$

The logarithm of this marginal cost can be approximated by:

$$\ln w = \ln w_H(1 - \alpha s_F) \approx \ln w_H - \alpha s_F.$$

These two models lead to the same empirical specification, with w_H and s_F as exogenous variables:

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

and $$L = L[(1-r)p, p_x, w_H, s_F, z, \rho, s_\theta, \sigma] \qquad \text{[Model 1]}$$

ii) Family labor and hired workers are imperfect substitutes, and hence are considered as different factors of production. The maximization problem can be written:

$$\max_{x,F,H} EU[(1-r)p\theta q - p_x x - w_F F - w_H H - R + T]$$
$$= \max_{F} \{\max_{x,H} EU[(1-r)p\theta q - p_x x - w_H H - w_F F - R + T]\}$$

The choice of purchased inputs and hired labor are determined by the internal maximization. This gives:

$$x = x[(1-r)p, p_x, w_H, F, z, \rho, s_\theta, \sigma]$$

and $$H = H[(1-r)p, p_x, w_H, F, z, \rho, s_\theta, \sigma]. \qquad \text{[Model 2]}$$

In the empirical analysis that follows, we estimate these two models.

V. Data and Empirical Results

The farm household survey contains information on the rice production activity by plot (technology, labor input, fertilizer use, and use of machinery or animal power), on the household's general economic conditions (family size, family labor force, education, land assets, ownership of machinery, off-farm income, and debt), and on wages and fertilizer prices. We also collected the average rice prices 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, this realized price does not inform on the expected price anticipated when farming decisions are made. This can explain why the rice price was never a statistically significant variable in the empirical analysis. Lacking information on what farmers knew about the National Food Authority program ahead of time, and what they could expect with its coverage, we could not build and adequate model of price anticipation. Hence, we were unable to estimate the parameter a_p of the models above.

Table 3 reports descriptive statistics on the variables that were found significant in the analysis. The distribution of plot size indicates a high level of minifundization. Plot size varies from 0.16 to 10 ha, with 93% of them below 4 ha, and 77% between 0.5 and 4 ha. Most households cultivate only one plot in rice, 16 households have 2 plots, and 4 have 3 plots. Hence plot size itself captures most of the variability in land asset. There is a surprisingly large variability in fertilizer price and wage. Fertilizer prices exhibit a systematic difference across villages, increasing as one move further away from commercial centers, from Village Tu in Central Luzon where fertilizer price is 191 pesos per sack, to Aq where it is 207 pesos, and Du where it reaches 234 pesos. By contrast, there is less village difference in wages, which average 50 pesos per day in Du, 54 pesos in Aq, and 57 in the better-off village Tu. In both cases, the great variability within village, however, will allow us to capture the response to fertilizer price and wage, independently of a potential village effect.

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 has off-farm income, and their off-farm income is substantially lower. Their average education is also lower than in the 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 amongst 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 either. This solely comes from the land distribution within village Tu, which moreover has larger plots than the other two villages.

In contrast to these asset distribution disparities, a genuine difference between tenancies appears in the wage that they pay to hired workers. Systematically in all three villages, sharecroppers hire workers at lower wages than do fixed-rent tenants and owners. Daily wages paid by sharecroppers are 40 pesos versus 67 in village Aq, 42 pesos versus 52 in village Du, and 49 pesos versus 60 in village Tu. There are no noticeable differences, however, among the two categories of sharecroppers. This is quite essential for our analysis in which we contrast the two categories of sharecroppers in terms of their labor use.

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 4.

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 but at most labor effort, as for producers in some sharecropping contracts, there is no reason for downward adjustment of effort intensity differentially from downward adjustment of labor time[1]. Hence, observed labor time is, in that case, a good indicator of labor effort. Another point of debate is whether labor time itself is observable or not. The incentive for a sharecropper not to reveal the true time worked only arises vis-à-vis his landlord <u>and</u> 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, even from sharecroppers in kinship contracts where labor is regulated. To avoid these problems of observability, indirect inference on input use is sometimes done from estimation of yield or residual profits equations, rather than input demand. The problem with this approach is that the impact of input use is mediated by random shocks. This can substantially reduce the quality of the econometric results when samples are small like in our case.

As discussed above, we consider two alternative formulations of labor input demand. 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-fix input. The choice of performing weeding manually

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[1] Production is function of labor effort $L = Te$, where T is labor time and e effort intensity. The disincentive effect to workers comes from the fact that wage payments are function of T while disutility of labor is function of labor effort Te. For sharecroppers working their land, both payment, which is a share of output, and disutility of labor are function of Te.

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. The null hypothesis of absence of correlation between these two variables and the residual could not be rejected, and hence simple OLS estimates are reported.

The results for the different factor demand equations are remarkably consistent (Table 4). Input demand is influenced by the share of output received by the tenant when the contract is with a non-kin landlord ($a'_p > 0$), and it is not influenced by the retained share when the contract is with a kin landlord ($a''_p \approx 0$). The parameter a'_p, expected to be equal to the price elasticity a_p which could not be estimated, is at least in the order of magnitude of an elasticity. These empirical results suggest that, indeed, sharecroppers in kin contracts behave cooperatively, while sharecroppers in non-kin contracts have the standard Marshallian inefficient behavior.

We find that greater availability of family labor leads to lower fertilizer and hired labor use, as expected. The impact of family share on fertilizer use is of the expected negative sign, but the implied value for α is not of a meaningful order of magnitude. We experimented with two variables to capture the importance of the *gama* contracts, a dummy variable and a share of total pre-harvest work performed by *gama* workers. Neither one of them came out significantly. This is somewhat at odds with our expectation that *gama* workers would have low efficiency in response to low incentives in weeding. Our experience is that farmers often hire casual workers to complement the weeding operation when *gama* workers do not perform well.

Among the technological and productive asset 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 lower fertilizer use; irrigation increases fertilizer uses; We also find that the inverse relationship between labor intensity and area holds.

The availability of off-farm income and presence of a debt, which reflect the availability of cash in the household essential for off-season expenditures and for income smoothing across years, capture elements of credit constraint and risk aversion. As expected, these sources of cash facilitate the use of purchased inputs: fertilizer and hired workers. With both a dummy and a level variable, the influence of these external sources of income, when they are positive, is equal to:

$$a_y - a'_y \ln y.$$

This indicates that this income has a positive but decreasing influence on input use (the value e^{a_y/a'_y} beyond which the total effect would be negative is several orders of magnitude above the observed values). For the observed average values, off-farm income and debt lead to increases of 25% and 40% in fertilizer use, respectively, and off-farm income to an increase of 5% in hired labor.

The riskiness of the household income is the ratio of the expected value of the risky income (expected value of agricultural production) in total income. This ratio is first estimated using all the agricultural and non-agricultural 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 (with an adjusted R^2 of 0.14). This predicted riskiness of the household income is then used as an explanatory variable of input use on each plot. Our results suggest that riskiness reduces fertilizer use but not labor use.

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

VI. Conclusion

The principal controversy in the debate on efficiency of sharecropping has been about the problem of enforceability of the contract. 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 close 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. Family networks typically provide this environment conducive to cooperation. We therefore hypothesize 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 effect that the sharing of output gives them.

Analysis of a household survey from the Philippines confirms this hypothesis. We find that the behavior of sharecroppers with a kinship relationship with their landlord is not affected by the terms of the contract, while the 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 indeed 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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Table 1 - Village characteristics

	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	100.00	62.7	25.00

Table 2 - 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

Note: For 6 fixed rent contracts, the family relationship link is not known
n.a. = not applicable
* (**) significantly larger than the corresponding value for non-kinship tenants at a 5% (10%) level of significance.

Table 3 - Descriptive Statistics by Tenancy

	Sharecropper with kin landlord		Other sharecropper		Fixed rent tenant		Owner-operator		All			
	(average)	(st.dev.)	(average)	(st.dev.)	(average)	(st.dev.)	(average)	(st.dev.)	(average)	(st.dev.)	(minimum)	(maximum)
Number of observations	31		14		66		39		150			
Prices												
Fertilizer (pesos per 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 per 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	.2	16.0
Owned machinery (% of hh))	16.1		0.0		16.7		17.9		15.3			
Off-farm income												
- (% with off-farm inc.)	87.1		71.4		90.9		82.1		86.0			
- (average, in 1000 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, in 1000 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 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	.8	1.71	1.7	.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 per ha)	82	38	57	24	75	33	67	41	74	36	23	232
Fertilizer use (sack per 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 per ha)	1497	751	1201	397	1504	590	1514	1108	1479	774	189	6390

Table 4 - Input Demand with Different Contracts, under Different Specifications of the Labor Model

Endogenous variables Labor model*		Fertilizer use (model 1)		Fertilizer use (model 2)		Labor (model 1)		Hired Labor (model 2)	
Exogenous variables		parameter	t-stat	parameter	t-stat	parameter	t-stat	parameter	t-stat
Prices and shares									
ln(p rice)	a_n								
ln share rice (non rel)	a'_p	.34	1.8	.39	2.0	.39	2.3	.65	2.9
ln share rice (relative)	a''_p	-.03	-.3	-.06	-.5	-.04	-.4	-.03	-.2
ln(p fertilizer)	a_v	-.34	-2.7	-.32	-2.4	.29	2.7	.34	2.2
ln(hired worker wage)	a_w	.07	1.0	-.01	-.2	-.23	-3.7	-.41	4.7
Family share in labor	$-\alpha a_w$	-.72	-4.7	n.a.	n.a.	-.09	-.7	n.a.	n.a.
ln(family labor/ha)	a_F	n.a.	n.a.	-.09	-3.1	n.a.	n.a.	-.17	-5.9
Technology and productive assets	a_z								
ln(plot area)						-.11	-3.7		
Manual weeding°		.37	2.4	.47	2.9	.60	4.5	.84	4.6
Rainfed		-.16	-2.1	.20	-2.5				
ln(power/ha)°						.21	4.1	.37	5.2
Share women in labor force		-.37	-3.4	-.35	-3.0				
Credit constraint and risk aversion	a_p								
Dummy off farm income		.75	2.9	.80	2.8			.50	1.7
ln(off farm income)		-.07	-2.6	-.08	-2.7			-.06	-1.9
Dummy debt		.55	2.3	.52	2.1				
ln(debt)		-.03	-1.3	-.03	-1.1				
Household income portfolio	a_s								
Predicted risky income share		-.24	-2.1	-.26	-2.2				
Risk: Village dummies	a_σ								
Aq						-.38	-5.5	-.31	-3.3
Tu		-.21	-2.1	-.21	-2.0				
Adjusted R2		.29		.23		.49		.51	

* Family and hired labor are perfect substitute in model 1, and imperfect substitute in model 2. In model 2, hired labor only is estimated as family labor is considered a quasi-fixed factor.

°Hausman specification tests were performed on these variables and coefficients of predicted values found not significantly different from 0.

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.

APPENDIX
(optional)

Tenant Behavior under an Unenforceable Contract

The general tenancy contract is defined as (r, R), where r ($0 \leq r \leq 1$) is the landlord's share of output and R is a fixed payment per unit of area. The fixed rent contract is obtained with r = 0, the wage contract with r = 1, and pure sharecropping with R = 0. Assuming that plot size is exogenous to the input decision under consideration, production is function of labor input L and the realization of a random variable θ, distributed with mean 1 and variance σ^2. If $\theta q(L)$ is output at harvest time, the tenant's income y is:

$$y = (1-r)\, p\, \theta\, q(L) - wL - R + T,$$

where p is output price, w wage, and T non-farm income.

We assume that the tenant chooses the level of labor that maximizes his expected utility:

$$\underset{L}{\mathrm{Max}}\; EU[(1-r)p\theta q(L) - wL - R + T].$$

The first order condition gives:

$$(1-r)p\, q'(L) = w\, EU'/EU'\theta, \tag{A-1}$$

which indicates that resource allocation will be inefficient since the expected marginal productivity of labor ($pq'(L)$) will not be equal across holdings. This expression identifies two potential sources of inefficiency: the standard Marshallian incentive effect of the contract term r, and variation of the risk factor ($EU'/EU'\theta$) when there is not a perfect insurance market.

Taking a first-order Taylor expansion of the utility function around $\theta = 1$, and noting $\overline{U'} = U'(\theta = 1)$ and $\overline{U''} = U''(\theta = 1)$, we obtain:

$$U' = \overline{U'} + (\theta - 1)\overline{U''}(1-r)pq(L)$$

which gives:

$$EU' = \overline{U'}$$

and $$EU'\theta = \overline{U'} + \overline{U''}(1-r)pq(L)\sigma^2 = \overline{U'}\left[1 - \rho\frac{(1-r)pq(L)}{y}\sigma^2\right].$$

where ρ is the coefficient of relative risk aversion $-y\overline{U}'' / \overline{U}'$. Substituting this expression into (A-1) gives the tenant's choice of labor input L as:

$$(1-r)\,pq'(L) = w \Big/ \left[1-\rho\ \frac{(1-r)pq(L)}{y}\ \sigma^2\right]. \qquad \text{(A-2)}$$

This expression shows that the risk factor is function of risk aversion ρ, the level of risk σ^2, and the share of risky income in total income $[(1-r)pq(L) / y]$, which itself depends on the terms of the contract.

The Optimal Unenforceable Contract

Consider now the landlord's choice of optimal contract. The landlord's is assumed to maximize his own expected utility, subject to maintaining the tenant at his reservation utility:

$$\underset{r,R}{\text{Max}}\ EV(rp\theta q(L) + R + \overline{Z}) \qquad \text{(A-3)}$$
$$\text{s.t. Max } EU = \overline{W},$$

where $\overline{Z}$ is the landlord's other income, and $\overline{W}$ the tenant's reservation utility.

The tenant's reservation utility constraint imposes a relationship between the contract terms r and R. This is found by total differentiation of the constraint at the optimal level of L chosen by the tenant:

$$- EU'\,dR - EU'\theta\ p\ q(L)\ dr = 0 \qquad \text{(A-4)}$$

Expressions (A-1) and (A-4) jointly determine L and R as functions of r only. Substituting these functions into (A-3), the landlord maximizes his expected utility with respect to r only, and the first order condition is written:

$$EV'\theta\ pq(L) + EV'\theta\ rp\ q'(L)\frac{dL}{dr} - EV'\ \frac{EU'\theta}{EU'} pq(L) = 0$$

or:

$$\left[\frac{EU'\theta}{EU'} - \frac{EV'\theta}{EV'}\right] pq(L) = \frac{EV'\theta}{EV'}\, rp\ q'(L)\frac{dL}{dr}. \qquad \text{(A-5)}$$

Using first-order Taylor expansions, the optimal contract can be written:

$$r = \varphi(r)\frac{1}{1-\rho_L\sigma^2 rq(L)/y_L}[(1-r)\rho_T / y_T - r\rho_L / y_L]$$

where ρ_T and ρ_L are the tenant's and landlord's coefficients of relative risk aversion, y_T and y_L their incomes, and $\varphi(r) > 0$ if $dL/dr < 0$ (Singh, 1989).

This establishes that the optimal contract varies according to the degrees of risk aversion of landlord and tenant, with a fixed rent contract for risk neutral tenant and a share contract for risk averse tenant. A wage contract is never optimal when there is no supervision.

Expression (A-5) also shows that the optimal contract will not provide the socially efficient risk sharing arrangement between landlord and tenant if $dL/dr \neq 0$. The reason is the trade-off between incentive and risk sharing. High r protects the tenant against risk but provides low incentive. If $dL/dr < 0$, $(EU'\theta/EU') < (EV'\theta/EV')$, which indicates that the tenant bears more risk than the landlord.

The Enforceable Contract

We define the cooperating sharecropper as a sharecropper who accepts to use the level of input which the landlord would want him to use. This level is hence the solution of the enforceable contract, where the landlord maximizes his expected utility with respect to L, r, and R:

$$\max_{L,r,R} \; EV(rp\theta q(L) + R + \overline{Z})$$

$$\text{s.t.} \;\; EU = \overline{W}.$$

The first order conditions give:

(a) the tenant's labor input $\qquad p\,q'(L) = w\,EU'/EU'\theta \qquad$ (A-6)

and

(b) the optimal risk-sharing condition between landlord and tenant:

$$\left[\frac{EU'\theta}{EU'} - \frac{EV'\theta}{EV'}\right] = 0.$$

The optimal contract is socially efficient for this pair of partners, since the marginal productivity of labor is equal on the tenant's and landlord's land.

Comparing Labor Use by Sharecroppers, Tenants, and Owner-operators

Let us compare the expressions defining the optimal labor input for the three types of tenants that we consider: a non-cooperating sharecropper ((A-2), with $r > 0$), a cooperating sharecropper (A-6), and a fixed-rent tenant ((A-2), with $r = 0$). Note that owner-operators behave like fixed-rent tenants.

i) Non-cooperating sharecropper:

$$(1-r)\,pq'(L) = w \Big/ \left[1-\rho\ \frac{(1-r)pq(L)}{y}\ \sigma^2\right] = w \Big/ \left[\frac{EU'\theta}{EU'}\right] > w \Big/ \left[\frac{EV'\theta}{EV'}\right]$$

ii) Cooperating sharecropper:

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

iii) Fixed-rent tenant or owner-operator:

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

This shows that:

a) For given riskiness of income, the cooperating sharecropper applies more labor to production than the non-cooperating sharecropper.

b) Furthermore, the contract terms themselves will be chosen differently in these two cases, and since the contract terms given to the cooperating tenant insure a higher level of risk sharing with the landlord, the tenant will use even more input.

c) The cooperating sharecropper applies more labor than the fixed rent tenant. This difference is due to a difference in income risk.