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CENTER DISCUSSION PAPER NO. 501

AGENCY COSTS AND THE AGRICULTURAL FIRM

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ABSTRACT

Agency Costs and The Agricultural Firm

The form of institutions used to organize resources for production and distribution is an area which has received increased attention from economists in the last decade. Two theories have evolved which share the comparative institutions perspective first discussed by Coase (1937, 1960), the principal agency theory (a mathematical formulation of contractual choice) and the positive agency theory (a non-mathematical explanation of patterns of industrial organization). The theory of organizational form in agriculture has generally centered around tenure choice in which different tenancy arrangements are viewed as types of employment contracts.

In this paper, an alternative model developed by Eswaran and Kotwal (1985) in which share tenancy is seen as a partnership between a landowner and a tenant is elucidated. Tenure choice is also investigated as part of a general study of the nature and causes of the agricultural firm. In order to do this, agricultural firms are first classified according to the degree of specialization. When this is done, a number of apparently diverse observations about tenure choice seem to fit a more general pattern; the higher the land productivity, the higher the degree of specialization. A principal-agency framework is used to construct a theory of the relationship between the degree of separation between labor and management and land quality, and data from a sample of Philippine sugarcane farms are used to verify this hypothesis.

AGENCY COSTS AND THE AGRICULTURAL FIRM

James Roumasset and Marilou Uy*

In the last decade, there has been a major rekindling of interest among economists in the form of institutions used to organize resources for production and distribution. Jensen (1983) distinguishes two "agency literatures" that share the comparative institutions perspective introduced by Coase (1937, 1960). Principal agency theory (e.g. Stiglitz, 1975; Harris and Raviv, 1978; Shavell, 1979; Holmström, 1979; Lewis, 1980) provides a mathematical formulation of contractual choice and has been primarily directed to the trade-off between risk-sharing and incentives against labor shirking. Positive agency theory (pioneered by Coase, 1937; resurrected by Alchian and Demsetz, 1972; and currently represented e.g. by Fama and Jensen, 1983) is non-mathematical and places relatively more emphasis on explaining actual patterns that characterize industrial organization.

In agriculture, the theory of organizational form has centered largely around tenure choice. The theory of tenure choice has an illustrious history in the economics literature (e.g., Smith, 1922; Marshall, 1920; Heady, 1947; Day, 1967; Cheung, 1969; Rao, 1971; Stiglitz, 1974; Reid, 1976; Newbery and Stiglitz, 1979; Binswanger and Rosenzweig, 1982). In recent years, alternative tenancy arrangements

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are commonly viewed as types of employment contracts (e.g. Newbery and Stiglitz, 1979; Braverman and Stiglitz, 1975; Harris and Raviv, 1978; Shavell, 1979; Holmström, 1979; Lewis, 1980). In an innovative departure from the view of tenancy as an employment contract, Eswaran and Kotwal (1985) have modelled share tenancy as a partnership between a landowner who specializes in decision-making and a tenant who specializes in labor supervision. More generally, questions of tenure choice, employment contracts, management systems, and farm size can all be usefully viewed as aspects of the agricultural organization. The purpose of the present paper is to elucidate this view and to investigate tenure choice as a part of the general study of the nature and causes of the agricultural firm.

The paper is organized to highlight the inductive approach employed. Section 2 classifies agricultural firms according to the degree of specialization and who gets the residual payment. The classification is combined with previously documented patterns of tenure choice in order to posit a preliminary hypothesis about the relationship between the economic environment and the nature of the agricultural firm. Section 3 uses a principal-agency framework to construct a theory of the hypothesized relationship between the degree of separation between labor and management and land quality. Section 4 provides an illustrative statistical verification of the hypothesis based on a sample of Philippine sugarcane farms. Section 5 summarizes the paper and discusses two implications of the transaction cost approach for institutional design.

2. Classification of the agricultural firm

(a) Classification

The literature on optimal tenure choice deals mainly with three types of contracts--share tenancy, lease and wage arrangements. Often, these contracts are considered as alternative payment mechanisms for labor (Stiglitz, 1975; Holmström, 1979; Shavell, 1979). Rigid classification of agricultural contracts into three types of labor arrangements may be misleading, however. Various forms of share-tenancy, lease and wage systems as well as combinations thereof pervade agriculture. Such diversity may be better dealt with by viewing tenure forms not as mere labor payment mechanisms but as organizations or agricultural firms.

In the spirit of Frank Knight and Ronald Coase (1937), the firm can be viewed as an alternative to market organization. Both Knight and Coase stressed the role of the entrepreneur as a coordinator of resources. Knight portrayed the firm as an entrepreneur with an authority relationship over the other factors. Coase extended this view by stressing the cost of using the market, i.e., of contracting the other factors from outside the firm. In the words of Douglas North (1981),

"according to Coase, the advantage of the firm over transacting in the market is a gain as a result of a reduction in transactions costs . . . (presumably at least partly in consequence of the authority)."

Several authors have elaborated on this theme, focusing on the nature and sources of the transaction costs of using the market. Barzel (1982) stresses the measurement costs involved in monitoring contract performance. Williamson (1975) and Klein, Crawford, and Alchian (1979)

discuss the role of opportunism in increasing the costs of contract enforcement. Arrow.(1974) discusses conditions under which abandoning the invisible hand of the market in favor of the visible fist of authority may reduce the costs of communicating decisions and coordinating production.

These observations help explain the existence of firms. They also contain the rudiments of a theory of the boundaries of the firm, i.e., of what will be purchased from the market and what activities will be coordinated with the firm. What is inside and what is outside the firm depends on the relative advantages of the specialization afforded by markets vs. the reduction in transaction costs facilitated by relationships among the firm's principals. These relationships are governed both by bonding or "F-connections" (cf. Yoram Ben Porath, 1980) and by an explicit or implicit agreement among principals that can be characterized as a contract prescribing rights and duties of the parties, decision-making mechanisms, and rewards and/or sanctions for good and bad citizenship. This "constitution" and the institutions for prescribing and enforcing future activities constitute the governance structure of the organization (Williamson, e.g. 1985).¹

In agricultural organization, share contracts can be classified according to whether they are essentially labor contracts or relationships among firm principals. There are two distinct types of

¹ See also Goldberg (1979) for a discussion of "relational exchange".

share contracts in agriculture. One is primarily a labor contract such as the gama or ceblokan arrangements in Asian rice production whereby the worker receives a small share of the output for harvesting and other specified tasks.¹ The other is more of a partnership wherein the tenant receives a larger share, typically 1/3 to 2/3, for assuming the responsibility for most of the work (including supervision) and day-to-day decision-making (e.g. about the composition and timing of inputs). Most of the principal-agency literature, by modelling share tenancy as an employment contract, fails to make this distinction. Eswaran and Kotwal (1985) model share tenancy as a partnership, but, unlike previous partnership interpretations (Reid, 1976, 1978; Hallagan, 1978; and Murrel, 1981), they abstract from decision-making by the tenant. In what follows, we reserve the term "share-tenancy" for medium or long term relationships where the tenant is a principal in the agricultural firm and participates in decision-making, as well as worker supervision. Short-term hiring arrangements wherein workers are paid a percentage of the gross are viewed as a special case of piece rate labor contracts.²

1 Gama or Ilani, as practiced in the Philippines, is an arrangement whereby the worker contracts to weed and harvest a specified parcel for typically 1/6 of the rice harvested for that parcel; ceblokan practiced in Indonesia, typically requires transplanting, in addition to harvesting and weeding, for the same 1/6 share (Roumasset, 1978; Hayami and Kikuchi, 1981). Remarkably, a similar arrangement was documented in the The Constitution of Athens almost 3,000 years ago. Workers contracted under a sharing arrangement in ancient Greece were called Hectomori or "sixth partners".

2 For a discussion of the advantages and disadvantages of piece rates vs. wage contracts, see Stiglitz (1978) and Roumasset and Uy (1980).

Both Coase and Knight identified the firm with the set of resources organized by a single entrepreneur. But since both the landlord and tenant are principals in the typical share tenancy arrangement in Asia, we require a broader definition to facilitate analysis of agricultural organization. Accordingly, we regard the firm as an organization oriented towards production and under the control of its principals. Entrepreneurship may be shared among multiple agents with diverse interests.

In their "Separation of Ownership and Control", Fama and Jensen (1983) propose "a spectrum of organizations" distinguished by the degree of separation of management and risk-bearing functions. They emphasize that separation of management (the initiation and implementation of decisions) does not imply a loss of control (the ratification and monitoring functions). Reminiscent of Coase, Fama and Jensen note that the benefit of "separate" management is the greater degree of specialization that it affords. While such specialization comes at greater agency costs, these costs are mitigated by the control mechanisms retained by the principals.

In agriculture, separation of the management and labor functions is a more useful characteristic for distinguishing common types of agricultural firms. Figure 1 illustrates a spectrum of agricultural firms with specialization and separation of work, management, and control increasing from left to right. The most unspecialized firm is the owner operated firm with no hired labor. We call this the owner-worker firm since labor comes from the owner's household. The middle of the spectrum represents various forms of tenancy with the tenant's responsibility for

management increasing from left-to-right. The two forms at the far right correspond to the Fama and Jensen distinction regarding separation of ownership and control. Both arrangements are owner controlled and rely primarily on hired workers for labor but in the most specialized case, some of the management, for worker supervision and day-to-day operational decisions, is also hired.

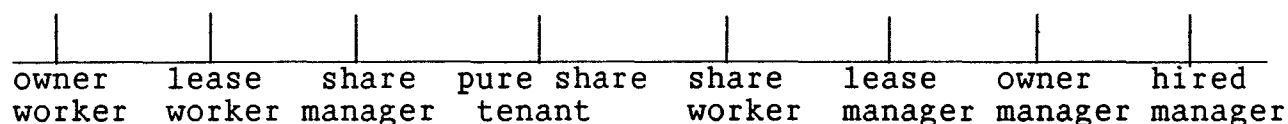


Figure 1: A spectrum of agricultural firms

As the degree of specialization between labor and management increases from left to right in figure 1, management is increasingly compensated by receiving a share of the residual and labor increasingly so. Thus in the owner-worker firm, the farm family provides the labor and is paid a 100% share of the returns net of operating costs. The owner-manager hires the labor and receives the returns net of operating and labor costs as a return to his land and managerial inputs.¹

Similarly, the lease-worker receives the residual as payment for his work and the lease-manager receives the residual, net of the wage bill, as compensation for management. For example, leasehold

¹ Clearly, intermediate cases can be observed. Theoretically, these could be ranked by specialization in management according to the value added by management related to the value added by hired labor. Since this statistic is usually not readily available, proxies may be needed for empirical analysis.

contracts held by relatively high income whites in the post-bellum American South compensated the leasehold primarily for management and capital inputs. Lease contracts held by blacks and poor whites, however, were essentially incentive arrangements for labor. Poor leaseholders tended to follow established cultivation practices and obtain credit from merchants (see e.g. Reid, 1979).

Figure 1 also illustrates different forms of share tenancy according to the degree of separation between labor and management and the share of output going to the land and the landowner's contribution to management. The share-manager is defined as a share tenant who provides all of the non-land inputs. A share-worker provides only labor and perhaps some minimal equipment. The landowner makes the productive decisions and provides most of the variable non-labor inputs. A piece share tenant provides most of the labor, shares the cost of other variable inputs with the landowner, and typically makes most of the production decisions. The landowner's share also increases as one moves from left to right on the spectrum. Thus the share-worker, commonly known as a "sharecropper" in literature on the post-bellum American South, is somewhere between a wage worker and a share tenant. The share-manager is somewhere between a share tenant and lease-worker.¹

In summary, the tenure choice literature has traditionally focused on the employment contract between the landowner and the worker, who may

¹ Several authors have regarded the constancy of tenant shares, typically said to equal 50%, as one of the stylized facts of share tenancy (Newberg & Stiglitz, 1979; Bell & Zusman, 1976; Hurwicz & Shapiro, 1978; Allen, 1985; Eswaran & Kotwal, 1985). These authors have failed to recognize the great variations in tenancy shares across space, time, and crop (Cheung, 1969; Roumasset, 1981; Datta, et. al., 1984; Bardhan, 1984).

be paid a wage, a share or the residual profits after deducting a fixed rent. We propose a broader view in which agricultural firms are distinguished according to the extent to which management and labor are provided by separate economic agents and the extent to which the landowner receives the residual payment. In this view, the residual payment is, at least in part, the rent paid to organization-specific assets.¹ Thus a tenant's receipt of part or all of the residual is compensation not only for his labor, but also for his equity in the land,² his draft animals and farm equipment, and his farm specific managerial skills.

b) Patterns, Synthesis, and a Preliminary Hypothesis

Despite the large literature on tenancy, few stylized facts about tenure choice on different environments have emerged which a theory should be expected to explain. In this section we attempt to combine apparently diverse observations about the incidence and forms of share tenancy across land types of varying productivity to suggest a possible relationship between the extent of specialization in the agricultural firm and the value added by land and management. We do this neither to place inordinate emphasis on land quality nor on technological determinism but to illustrate how describing and explaining general relationships between contracts and the environment may help to elucidate the determinant of economic organization.

1 Organization-specific assets include fixed plant and equipment, institutionalized procedures, skills and other assets that have lower value to other organizations (Fama and Jensen, 1983b, p. 31)

2 In the Philippines, for example, tenants can sell cultivation rights for as much as 50 percent of the market value of the land (Hayami and Kikuchi, 1981).

We begin with the observation that the incidence of share tenancy relative to the owner-worker increases with land productivity. In the Bicol region of the Philippines, the two predominant types of agricultural firms at the beginning of the Green Revolution (i.e. up to at least 1970) were share tenancy and owner-operated family farms with little or no hired labor. The Bicol region is comprised of three "rice-bowl" provinces containing the Bicol River Basin, two island provinces with severe weather problems, poor soil quality and high transportation costs, and one "intermediate" province contiguous with the rice bowl but with uneven topography and a relatively high proportion of upland rice. Statistics on tenure form show a strikingly higher incidence of share tenancy in the more productive areas. In the rice-bowl provinces, 56% of the sample farms were operated by share tenants vs. 22% owner-operated family farms. In the intermediate province, there were 24% share tenants and 25% owner operators, and in the Island provinces there were less than 5% share tenants and 72% owner-operated family farms.¹

On the other hand, there is evidence to suggest that the incidence of share tenancy decreases with land quality relative to the owner-managed firm, which relies on hired labor. For example, Datta et. al. found, in a large sample of farms in India, that the incidence of wage

¹ These statistics were computed from the 1970 Bureau of Agricultural Economics Integrated Agricultural Survey of 1013 Bicol farms as reported in Roumasset (1976). Only 13 sample farms were operated on leasehold arrangements. Most of the remaining sample farms were operated by part-owners.

contracts relative to share contracts, increased with irrigation. This suggests the importance of distinguishing different types of owner operator, lease, and share arrangements. Since owner-operated firms can be more or less specialized than tenanted farms, depending on the degree of separation between management and labor, the search for general patterns regarding the relative incidence of share tenanted and owner operated farms may be a futile one.

In an extensive analysis of Indian data, Bardhan (1984) also finds that the incidence of share tenancy increases with land quality factors such as irrigation and rainfall relative to owner-operated family farms. His statistics also suggest a rough correlation between the ratio of share tenancy to lease-worker tenancy and indicators of land productivity, with share tenancy dominating in the eastern and northwestern parts of India and fixed-rent tenancy predominant in the southern states. While evidence is consistent with the land productivity-specialization hypothesis, this should not be taken as verification in lieu of better proxies for land quality and an indicator of specialization within forms of fixed-lease tenancy.

More direct evidence on the land quality-specialization hypothesis is available on the different forms of share tenancy. Several previous studies have shown that locational differences appear to affect both the terms and the form of share-tenancy arrangements. Roumasset (1976) found that a sample of rice farms in Laguna, Philippines, with high rents per hectare and favorable soil conditions, were typically operated under a "supportive" contract ("pure share tenant" in figure 1) where the landlords received 50 percent of the gross harvest and paid 50 percent of

the cost of seeds and fertilizer. For the sample farms in Albay province, where soil and weather conditions are worse, share-lease or "nonsupportive" contracts were used under which landowners received only 1/3 of the harvest but did not share in the costs.¹ These findings were later generalized for both rice and non-rice tenants. Both output and input shares of landowners were found to be positively correlated with land quality in the Philippines, Java (Indonesia), and Bangladesh (Roumasset and James, 1979; Roumasset, 1981; Hayami and Kikuchi, 1981; Ali, 1979). Bardhan (1984) also found a strong association between the incidence of cost sharing by the landowner and the landowner's share and between landowner's share and land quality.

Both the landlord and the tenant do more management in pure share tenancy (supportive) arrangements. At least in the Philippine case, there also appeared to be substantially more hired labor under pure share tenancy, with the tenant providing supervision, input decisions, and day-to-day management. In summary, relatively unspecialized share-operator arrangements tend to be more common on poorer quality land; on better land the share tenant specializes more on management and cost sharing is used to help induce efficient input use.

Thus a number of disparate observations about the incidence and forms of share tenancy are suggestive of a general pattern between land productivity and specialization in agricultural organization. In the

1 In share-worker arrangements, such as the sharecropper in the post-bellum American South, landowners commonly received more than 50% but also provided the inputs and made most of the production decisions. These arrangements are relatively rare in Asian agriculture.

next sections we explore a possible theoretical explanation for this relationship and then illustrate a more direct method of verification.

3. Conceptual Framework and Theoretical Development of the Hypothesis

a) A principal-agency approach to positive agency theory

In this section, we attempt to model efficient contract choice in the presence of information and enforcement costs about input use. Most of the principal-agency literature in economics has focused on labor shirking. But investments in land improvements may also be "shirked" by "mining" the land or, more generally, by failing to maintain the optimal level of fertility and productive capacity. Managerial inputs, both for decision-making and supervision, may also be shirked.

The model that follows uses the principal agency framework to make explicit just what is being optimized but borrows from positive agency theory the notion that more than one input is susceptible to shirking. This allows the optimal organizational form to vary according to the environment without requiring large differences in risk-bearing abilities. The model also incorporates an important disadvantage of fixed lease contracts that helps to explain the unpopularity of such contracts in many environments.

We first extend the principal-agency model (see e.g. Stiglitz, 1974; Newbery and Stiglitz, 1979; and Lewis, 1980) to allow for two sources of shirking. Represent the value of output as a function of both labor, x , and land maintenance/improvement, z . For simplicity assume two periods such that the present value of output can be expressed as:

$$D = D_1(x_1, \theta_1) + D_2(x_2, z, \theta_2, r)$$

where D_1 and D_2 are the discounted value of output functions for periods 1 and 2, 0_1 and 0_2 are the two stochastic variables and r is the real discount rate. Investment in land, z , is made in the first period and increases output in the second period. Positive investments such as improving or maintaining the irrigation ditches increase z . Negative investments, e.g. allowing noxious weeds to propagate or intensive cultivation practices that "mine" the soil fertility, decrease z . In order to clarify the meaning of efficient contract choice, we abstract from "managerial shirking" in the mathematical version of the model.

The agent (e.g. tenant) chooses the level of investment in land and labor in the two periods so as to maximize the expected utility, u . The principal (landowner) chooses a payment schedule, P_i , which relates the agent's income to D and the principal's (imperfect) monitoring of the inputs. The agent's income can thus be expressed as $P = P_i(D, X_1, X_2, Z)$ where the principal chooses i from the set of possible contracts, C , and the principal's income as $v = D - P - m$, where m is monitoring costs. The principal's profit maximization problem is

$$\text{Max}_{i \in C, m} v_i = D - p - m \quad (1)$$

subject to $U \geq \bar{U}$

$$\text{where } U = \text{Max}_{x_1, x_2, z} u(P, x_1, x_2, z)$$

and where m is monitoring expenditures by the principal and U is the utility level available to the agent in his best alternative.

The principal agency formulation provides a convenient measure of the efficiency of contracts. Define maximum unconstrained¹ expected profits as:

$$\bar{\pi}^* = \bar{\pi}(x_1, x_2, z^*) \quad (2)$$

where x_1^* , x_2^* , and z^* are optimum inputs under the assumption of costless measurement and enforcement of input levels.

The inefficiency or agency cost of the i th contract can be expressed as:

$$A_i = \bar{\pi}^* - V_i \quad (3)$$

where V_i is the solution of (1) for a given i . Since $\bar{\pi}^*$ is a constant, finding the highest V_i yields the same contract as solving for the lowest A_j , i.e.,

$$\{i \mid V=V_i\} = \{j \mid A^*=A_j\} \quad (4)$$

$$\text{where } V=\max_{i \in C} V_i \quad \text{and} \quad A^*=\min_{j \in C} A_j.$$

Equations 1-4 provide a sense in which the assumption of positive agency theory, that contracts evolve so as to minimize agency costs, is equivalent to the assumption of principal agency theory, that equilibrium contracts maximize the constrained objective function of the

1 The terms "constrained" and "unconstrained" are used here, in the sense of constrained pareto optimality (e.g. Newbery and Stiglitz, 1981), to distinguish models that incorporate transaction costs from models that abstract from transaction costs. Unconstrained profits are also equivalent to "first-best" profits and constrained profits are equivalent to "second-best" profits in the sense of Lewis (1980).

principal.¹ The framework also provides a clarification of the meaning of agency costs, defined by Fama and Jensen (1984) as:

"Agency costs include the costs of structuring, monitoring, and bonding a set of contracts among agents with conflicting interests, plus a residual loss incurred because the cost of full enforcement of contracts exceeds the benefits."

In the principal-agent framework, the costs of structuring, monitoring and bonding are represented by m_i^* , and the residual loss is $\pi^* - (D_i^* - P_i^*)$ where $D_i^* - P_i^*$ is the maximum constrained profits to the principal, before accounting for m_i^* .

The proposition that "efficient" contracts minimize agency costs" obscures a 3-level hierarchy of optimization problems. Since "minimize" refers to the choice across contracts, "agency costs" must be interpreted to mean the least cost combination of measurement and enforcement activities associated with a particular contract, i.e., m_i^* . Moreover, the optimal m is chosen subject to optimal shirking by the agent. These levels of optimization are transparent in the graphical exposition of agency theory employed below (figure 2).

b) A Theory of Specialization and Tenure Choice

We can now use the agency cost framework to explain the apparent association between land productivity and the degree of specialization in the agricultural firm. In particular, we wish to illustrate why a landowner might employ a tenant on a fixed lease

¹ To maintain this correspondence where the principal is not risk neutral, then V must be defined to be net of a risk premium.

basis to provide the labor and supervision for land of low productivity but would be more likely to hire wage workers if there were substantial potential benefits from investing in land maintenance and improvements. Following Eswaran and Kotwal, since we wish to develop alternative explanations for agricultural contracts to the conventional moral hazard theory, we abstract from differences in ability to bear risk between landlord and worker.

The advantage of fixed-rent tenancy is well-known. By paying labor the residual, incentives for labor shirking are eliminated. An important disadvantage of fixed-rent tenancy, aside from possible risk-bearing problems, is the possibility of "mining the land" (Marshall) or what we term as "land shirking". If the fixed lease contract is only for one-period or if enforcement costs make collection of period-2 rent difficult, the tenant may choose to deplete the productivity of the farm in period 1 and abandon the farm in period 2. That is, if farming techniques are available that sufficiently enhance first period output at the expense of maintaining the productive value of the land, then the utility maximizing strategy may be to maximize his income in the first period, break (or not renew) his lease and rejoin the labor force in the second period.¹ This model clearly has relevance beyond two

1 We assume that there is sufficient labor mobility that period 1 performance will not markedly affect the wage received in period 2. Alternatively, the second period wage penalty for poor performance in period one may be incorporated into the enforcement technology for the lease contract.

periods. So long as the landowner's rights to collect future rents are attenuated (e.g. by flight of the tenant or the threat of land reform laws by the state), then the tendency to stint land improvement inputs will discourage landowners from renting their land out on a fixed fee basis. Moreover, since the prospects of technological change and other forces outside the control of the contracting parties render the competitive rental value of land uncertain in the future, fixed-rent contracts will tend to be of limited duration.

The cost of land shirking will depend primarily on the marginal efficiency of investment in land maintenance and land improvement. Land with low natural productivity and artificial improvements tends to be less vulnerable to depreciation than land with high natural productivity (e.g. fertility and low pest population) and improvements (e.g. land levelling, terracing, irrigation). While land shirking may be a minimal problem in some environments, in others it may be the predominant determinant of agricultural organization. In contrast, labor shirking is less environmentally determined and more related to the amount of monitoring. It is therefore plausible that in environments with little predisposition for land shirking, contracts will be chosen to mitigate labor shirking and thereby save on costly monitoring. Where land shirking is potentially a major problem, however, contracts may be chosen for their incentive for investment. In these cases, direct monitoring of labor can be used to manage labor shirking.

The theory of environmentally determined contractual choice sketched above is presented in terms of agency costs in figure 1. In each of the four quadrants, agency costs are the sum of shirking costs

(SC) and monitoring costs (MC). Each graph corresponds to a particular contract in a particular environment. The two graphs on the top represent "invulnerable" land and the bottom two represent vulnerable land. The graphs on the left correspond to rent contracts; those on the right, to wage contracts. Following the assumptions proposed in the previous paragraph, shirking costs under wage contracts are shown as being relatively responsive to monitoring and relatively unresponsive to environment.

Relative contractual efficiency can be seen by comparing the point of minimum agency cost (MAC) for the two contracts under each environment. The assumptions implicit in the shapes of the shirking curves imply that the relative efficiency of wage contracts increases with the vulnerability to land shirking. Figure 1 illustrates the case wherein one type of land is sufficiently invulnerable to shirking such that rent contracts dominate and another type sufficiently vulnerable that wage contracts dominate. The graphs thus illustrate how different contracts may be preferred in different environments.

Factors other than the marginal efficiency of investment may also influence vulnerability. Greater attenuation of property rights and more uncertainty about equilibrium rents in future periods render the landowner vulnerable to losses in the value of land relative to the first-best optimum. Another determinant of agricultural organization is the share of value added attributable to land (including capital improvements), labor, and management. Where management contributes a substantial proportion to value added, organizational forms that reward

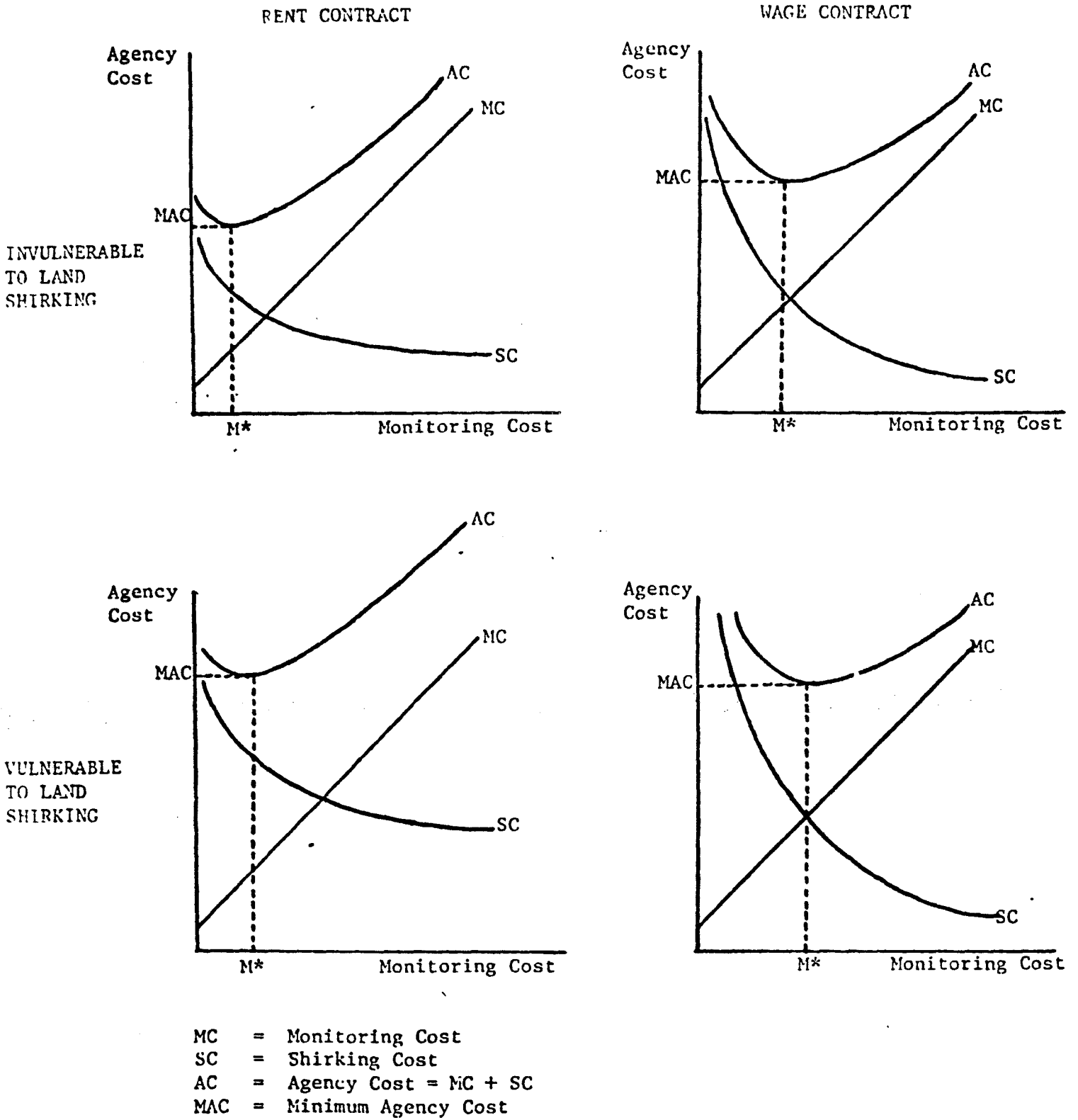


Figure 2. Contractual Choice in Two Environments

specialized management will tend to be favored. We hypothesize that management is relatively more important on better quality land. This provides a complementary explanation of the association between the degree of specialization and land productivity.

4. Statistical Verification: An Illustration

As we observed in Section 2, most existing data is not suitable to provide direct verification of the specialization and quality hypothesis. This section reports on a sample of Philippine sugarcane farms wherein the different forms of owner-operated farms are distinguished and ranked according to the degree of specialization. Philippine sugarcane farms show a large diversity in contractual forms--from the subsistence owner-operated to owner-controlled farms with hired labor and management. The sample of sixty sugarcane farms described below exhibits a wide range of contractual forms, facilitating a more complete illustration of how contracts respond to locational factors that affect the vulnerability of land and management to shirking.

Owner-managed farms seem to have better land, large farm sizes, and more intensive application of cash inputs such as fertilizer and chemicals than share-tenants. A larger portion of their cultivation is also done by tractors. Owner operated farms or subsistence farms tend to have poor land and less intensive application of fertilizers than share tenants. A ranking of contracts based on the extent of application of inputs shows a positive relationship between factor intensity and extent of specialization.

The more specialized forms of organization tend to predominate in the highly productive "sugarbowl" province. In the Laguna and Tarlac areas, which are less suitable for sugarcane production, share-tenancy and owner-operated farms are more common. Several leased farms were observed but they were characterized by hired agricultural workers and a lessee-manager. Since the contracts are classified here on the basis of specialization of management, these leased farms were ranked as a more specialized contractual form, the lease-manager.

The task of econometrically documenting the relationship between contractual choice and environmental characteristics is rather awkward. Both the environment and the contractual arrangement are multiattributed entities and most of the attributes defy accurate measurement. It is presumably these difficulties that largely account for the tendency to ignore the role of environment in contractual choice.

For purposes of illustration we focus on the degree of separation between labor and management as the primary characteristic of tenure choice. However, what we observe is not the degree of separation but the category of tenure choice. Accordingly, we rank tenure choice according to the degree of specialization as shown in table 1. Owner operators manage and cultivate their own farms¹, and have the least specialization. Share tenanted farms are largely managed and partly cultivated by the tenants.² Harvesting the cane of share tenanted

1 Specialization within the family is not considered here. The family is considered as one unit, rather than as a group of factor owners.

2 Since all share tenants in the sample receive 50 percent of the output we do not distinguish here between share tenants and share managers.

Table 1: Average farm size, average yield per hectare, and average inputs per hectare by tenure status.

Tenure Status	Special-ization rank	# of obs.	Average yield/ha. (piculs/ha.)		Average farm size (ha.)		Average fertilizer expense/ha. (pesos/ha.)		Average Chemical expense/ha. (pesos/ha.)	
			C*	R	C	R	C	R		
Owner-operator	5	9							--	--
Share-tenancy	4	26	89	82	2.9	553	448		--	---
Lease-managed	3	3	85	112	16.0	710	470	23.3		0
Owner-managed	2	7	97	88	12.1	605	729	15.1		15.1
Owner-controlled (hired manager)	1	15	113	97	148.0	1075	1003	152.2		154.7

*

C is cane crop, while R is ratoon crop.

Source: Uy (1979)

farms is done primarily by hired labor. In the owner-managed farms in the sample, all labor is hired, i.e., provided by separate agents thereby involving a greater degree of specialization than the share tenanted and leased-managed farms. On sugar plantations, even the plantation manager and the supervisory personnel are hired.

One important characteristic of the farming environment is the vulnerability of the farms to what we have called land shirking. The more vulnerable lands are those with potential for fertility reduction and those that continually practice control of potentially destructive weeds, insects and diseases in order to keep the pest population low.

Farms that continually cope with high pest populations (e.g., because of high populations on nearby farms) and have inherently low fertility are less vulnerable to land shirking. High productivity farms are more prone to land shirking than low productivity lands that are incapable of generating large rents. Accordingly, a land quality index, measured as expected revenue per hectare minus production costs, is used as a proxy for vulnerability to land shirking.¹

For simplicity, we have assumed a linear relationship between tenure choice and land quality. OLS regression will not provide either unbiased or efficient estimates of their relationship. The error terms of the linear model do not conform to Gauss-Markov assumptions; moreover, the OLS estimates of the ordinal dependent variable may fall outside the specified range. The alternative estimation procedure used here is the ordinal probit model developed by McKelvey and Zavoina (1975; see also Madalla, 1983, p. 46-49).

The results of the maximum likelihood estimation show a positive relationship between tenure choice and land quality. The land quality coefficient yielded a t-ratio of 2.45, which is significant at the 1 percent level (using a z-test). The conventional F-test to test the significance of the multiple correlation is not appropriate with the ordinal probit model. Significance of regression equation can be tested by computing minus twice the log likelihood ratio, in this case 6.10.

¹ See Roumasset and James (1979) for a discussion of the relationship between land quality and rent. Not only are rents higher on high quality land but, under profit maximization, the output elasticity of land is also higher, implying a higher landlord's share on tenant farms.

This statistic is distributed as chi-square and is significant at the 5% level. Despite the rough nature of our proxy and the use of only one independent variable, the results are consistent with our hypothesis that the type of land has a significant influence on tenure choice. Where land quality is low and land shirking relatively unimportant, there is a tendency to give the residual payment to labor and thereby control labor shirking. Where land shirking is relatively important, labor shirking tends to be controlled directly by supervision; landowners retain most of the residual, thus providing incentive for land maintenance.

The empirical results do not prove that land productivity is inordinately influential in shaping agricultural organization. The results do help to illustrate, through the example of land quality, how physical and economic factors that influence production technique may also shape the mode of production. Since production technique and tenure choice are determined simultaneously, this view clarifies the futility of attributing productivity differences to tenure choice. It also highlights the possible danger of government efforts to "reform" agricultural institutions and to force farmers to conform to the "best" tenure arrangements. On the other hand, where government attempts to design better institutions are inevitable, e.g., for some aspects of public land management, then the efficiency view may help planners to learn from the rich variety of indigenous institutions.

5. Summary and Conclusions

Tenure arrangements are usually modelled as alternative modes of employment. We suggest an alternative view of agricultural organization

here in which agricultural firms are classified according to the degree of separation between labor, land and management. While the conceptual framework used descends from positive agency theory (e.g., Jensen and Meckling; Fama and Jensen, 1983), we have shown how a principle agency framework can be used to clarify the meaning of "minimum agency cost".

Classifying agricultural firms by separation between labor and management requires distinguishing different forms of owner operated, share, and lease arrangements. In the unspecialized owner operated firm, the labor is provided by the farm owner's household. In the owner managed farm, most of the labor is hired. There are two main types of share tenancy, one with cost sharing and one without, where cost-sharing arrangements are combined with higher landowner shares. Employment contracts, where workers receive a small share of the output in return for performing particular tasks, e.g., harvesting and weeding, are essentially piece rate arrangements for hiring labor and do not constitute share tenancy firms.

Once firms are arrayed according to the degree of separation or specialization, a number of apparently diverse observations about tenure choice seem to fit a more general pattern--the higher the land productivity, the higher the degree of specialization. A method was developed for obtaining a more direct verification of this pattern and illustrated using a sample of sugarcane farms in the Philippines.

Two determinants of specialization were identified which are likely to be related to land quality--vulnerability to land shirking and the importance of management. Where land shirking is a potential problem and

the scope for management errors large, then the firm's incentives are more likely to be oriented towards efficient management, with labor shirking controlled by direct monitoring. Where production and asset management is less important, then organizations geared to minimizing labor shirking are more likely to be chosen.

Land quality is one of presumably several determinants of tenure choice. Other economic and environmental determinants need to be identified and measured. The productivity-specialization hypothesis illustrates how patterns in contractual choices may be documented, verified and how to operationalize comparative institutional analysis.

The efficiency model helps to explain the diversity of organizational forms found in different agricultural environments. This provides an operational alternative to the view that some institutions are inherently more efficient than others and that certain stylized facts about agricultural organization stand as prima facie evidence of the inefficiency of agriculture in developing countries.¹ To the extent that the agency cost approach² helps to infer lessons from indigenous institutions, these lessons can be applied in the design of new institutions in both the public and private sectors.

1 For example, several authors have cited the inverse relationship between farm size and yield per hectare as evidence of dualism in the agricultural sector and have concluded that Robin Hood land reform would increase agricultural production.

2 The agency or transaction cost approach is an integral part of the New Institutional Economics (Williamson, 1975; 1985; Rousset, 1978).

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