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THE NEW INSTITUTIONAL ECONOMICS AND AGRICULTURAL ORGANIZATION

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The institutional economics if John Commons (1934) contained two related objectives. The first was to explain the evolution of economics. The second was to analyze the effects of institutions on resource allocation and the distribution of income. The method of explaining the evolution of institutions was historical. In explaining resource allocation, Commons used institutional considerations such as interest groups and bargaining power largely as an alternative to neoclassical economics.

Common's brand of institutional economics has been practically extinct in the evolution of economic methodology. The reason for this is that historical explanations tend to be arbitrary and fail to identify alternative causes of change. At the time, "institutional" explanations of economic events and patterns tend to be *ad hoc* and irrefutable

A body of literature has now been developed from somewhat diverse sources, however, which may provide a new paradigm for achieving Common's objectives. Without claim to originality, we call this paradigm the new institutional economics.[1] In explaining the existence and evolution of institutions, the new institutional economics uses conventional economic tools such as benefits, costs, and equilibrium. In explaining resource allocation and income distribution, the new approach uses institutions in conjunction with rather than as an alternative to neoclassical theory.

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1. See e.g. Dolan (1977) for a previous use and description of the "new institutional economics." The term has also been attributed to some of the work of Armen Alchain and Harold Demsetz (see, e.g., Alchain and Demsetz 1972)

One of the primary concerns of the new institutional economics is explaining nonmarket resource allocation. This is an especially important area of research for helping to describe the organization of agriculture in developing countries. Since the cost of market operation is characterized by economies of scale, markets for agricultural products in isolated regions of developing countries are often poorly developed or nonexistent. Factors of production are often contracted for by nonmarket devices. Similarly, agricultural products are typically disposed of (e.g., for and by an individual household). It is therefore important for understanding the prospects and potential for agricultural development to improve both our empirical and theoretical knowledge of these institutional arrangements.

The purpose of the present paper is to provide a methodology for investigating institutional arrangements in agriculture and to illustrate the methodology by explaining selected patterns in agricultural contracts. The paper is organized as follows. In section I, we review the literature which makes up the new institutional economics. By integrating and extending the literature, a new method for explaining the organization of production emerges. This methodology is developed and described in section II. In section III, certain stylized facts about agricultural organization are presented, developed and explained using the principles discussed in section II.

I. Development of the Efficiency Principles

In one of the most celebrated and controversial articles in the recent history of economic thought, Coase (1960) introduced the idea that, even when spillover effects which are external to strictly market exchange are present, the invisible hand does not necessarily fail. Specifically, private contracting may act as a substitute for the nonexistent market in the spillover activity. Cheung (1969) applied an equivalent proposition to sharecropping and argued persuasively that under competitive conditions private contracting between landowner and tenant would lead to the same resource allocation as if there had been competitive factor markets for labor and/or land. Roumasset (1978) has shown that the Coase-Cheung proposition that contracts can act as perfect substitutes for markets can be proved using the concept of core. This gives rise to what we shall call the principle of first best efficiency, to wit:

> If property rights are well established, contracts are easily enforced, information costs are negligible, and numbers are sufficient to make attempts to monopolize unstable, then factors of production will be allocated efficiently and receive their competitive factor payments, whether market conditions exist or not.[2]

While the first-best efficiency principle helps to explain a variety of patterns in agricultural contracts, it tends to be a deficient in situations where enforcement and information costs are important. Several authors have written about the evolution of property rights, contracts, and institutions in a world with imperfect information and enforcement. Hayami and Ruttan (1971) following a paradigm developed by Davis and North (1971) for explaining economic history, have proposed the induced innovation hypothesis which states:

> …institutional innovations occur because it appears profitable for individuals or groups in society to undertake the costs. It is unlikely that institutional change will prove viable unless the benefits to society exceed the cost. Changes in market prices and technological opportunities introduce disequilibrium in existing institutional arrangements by creating profitable new opportunities for the institutional innovations.

Demsetz (1967, 1969, 1972) develops a similar principle which can be paraphrased as follows:

> Property rights and institutions in general will evolve so as to minimize excess burden. This is equivalent to saying that the set of institutions which maximizes the differences between benefits and costs will evolve.[3]

In what follows, we refer to this proposition as the principle of second-best efficiency. The distinction drawn here between second-best and first-best models is the traditional one found, for example, in the optimal taxation literature (Baumol and Bradford 1970, Mirrlees 1971). In the first-best world, efficiency implies no excess burden to be costless. In the second-best world where these same things are costly, efficiency or "constrained Pareto optimality" implies that excess burden exists but it is at a minimum.[4]

2. "Market" is used in its conventional neoclassical sense, i.e. buyers and sellers only interact via prices that are exogenous to the agents.

3. For a more detailed exposition of this literature, see Roumasset (1974).

4. The locus of constrained Pareto optimal points is Samuelson's (1950) feasibility frontier.

A related literature is called the economics of internal organization. In this literature, internal modes of organization including hierarchies of various kinds and team organization are examined. Second-best or "comparative institutions" (Demsetz 1972; Arrow 1969, 1974; Spence 1975; and Williamson 1977). This literature is also concerned with transactions which are handled by organizational structures within the firm and which are external to the firm. In this way, for example, the degree of vertical integration becomes an endogenous variable.[5]

II. A Methodology for the New Institutional Economics

The conventional format for empirical analysis begins with deriving hypotheses from theoretical considerations, in particular as implications of particular models. Information is then collected using an appropriate sampling procedure and the hypotheses are subjected to statistical tests. Given the difficulty of including the relevant institutional content in abstract models and our limited knowledge of institutional arrangements, this approach may not be particularly fruitful in the context of agricultural development. Furthermore, in order to understand the role of institutions in agricultural development, it is important not only to test hypotheses, but also to learn the details of the institutional arrangements in place and how these arrangements change over time. A more fruitful approach therefore may be to reverse the order of conventional analysis and to do the empirical work first. The approach then is to first document institutional arrangements of agricultural contracts, then to inductively identify patterns in those arrangements, and finally to explain the patterns observed, using the efficiency principles or other propositions.

A question remains of how to combine the various explanatory principles. It is natural in this regard to apply the best-developed principle first. Since the first-best principle is based in a well-defined theorem, it should be applied first to see what patterns it can explain. The second-best principle is very close to being well-defined but contains a minor point of ambiguity related to the index

5. See Williamson (1977) and the references cited therein.

number problem.[6] More importantly, it is difficult to quantify excess burden in order to compare the efficiency of alternate institutions. In lieu of that, we can discuss the determinants of excess burden and see under what conditions these factors will lead to a large or small amount of economic waste. Despite these difficulties, the second-best principle is probably also the second most powerful concept for explaining patterns in agricultural contracts.

A set of less developed, but doubtless important, propositions can be found in the political economy area. These principles can be called third-best in the sense that additional constraints are added to the second-best problem. In the third-best world, not only do enforcement and information costs act as constraints, but so do political considerations. In other words, the feasibility frontier is pushed further toward the origin because of the constraint that a viable economic system must be consistent with the given structure of interest groups and the distribution of political power. Since models describing the effects of political constraints on resource allocation are even less developed than the transactions cost considerations of the second-best, political economy considerations should only be applied to patterns which cannot be explained by the efficiency principles.

The methodology of successive application of various explanatory principles may be faulted on the grounds that the theory cannot be refuted. We must bear in mind, however, that this analysis is not to verify a particular theory, but to explain nonmarket resource allocation. The methodology outlined above is not a theory in the usual sense. It is a taxonomy and a method of explanation.

On the other hand, theory may be inductively generated by the new institutional economics. The empirical work generates certain patterns that are subsequently explained by the appropriate model. The theory in this paradigm is the explanatory model itself. While the theory formally must stand or fall on the model's internal consistency, the usefulness of the behavioral postulates and consistency with additional information, it has the great advantage of having evolved out of actual experience instead of armchair

6. Measuring excess burden runs afoul of the question "Which set of prices should be used to measure national income?" or "Which of the many measures of consumer surplus should be employed.

empiricism. At the same time, this approach makes maximal use of limited evidence. That is, inference is theoretical, not statistical.

An example of this approach is the "Alchain-Allen theorem" that the average quality of apples and oranges sold in a market is directly related to the distance of that market from the point of production. This pattern was derived from casual empiricism, but real empiricism nonetheless. Subsequently, Borcherding and Silberberg (1978) showed that the postulate of utility maximization and reasonable restrictions on the cross elasticities leads to the Alchain-Allen result.[7] That is, by building reasonable restrictions into conventional economic models, one is able to construct explanatory models of particular patterns observed.

III. Some Illustrations

In this section, we describe various patterns that have been observed n agricultural contracts in Southeast Asia and use the methodology developed above to explain why these patterns exist.

First-Best Patterns and Explanation

We begin with relationships between characteristics of share tenancy contracts and land quality. In rice production in the Philippines for example, it has been observed that higher quality land is inversely related to the size of the farms under share tenancy contracts and directly related to the landowner's percentage share.[8]

The explanation of these patterns requiring the first-best efficiency principle with a reasonable, but restrictive,[9] definition of land quality. Specifically, land type *I* is said to be better quality than land type *j* if:

7. The restrictive assumptions should be "…in principle at least, capable of independent confirmation…" (Borcherding and Silberberg 1978, p. 137).

8. Land quality here refers to a composite measure of all location-specific factors that influence expected profits. Thus, land quality includes not only soil fertility and topography, but also adequacy of irrigation and predisposition to damage from pests and weather. The patterns noted refer mainly to share tenancy before the most recent round of land reform initiated by Presidential Decree No. 27 of November 1972 was widely implemented. For details of this pattern, see Roumasset (1976) and Roumasset and James (1978). This quality-share relationship has also been documented for rice farms in India (Rudra 1975) and Indonesia (Geertz 1965) and for coconuts in the Philippines (Bernal-Torres and Sandoval 1967).

9. Economists often have an aversion to making models less general by incorporating restrictive conditions. This is peculiar since it is essential that good

1. $f'_i(l) > f'_j(l)$ where $f'_i(l)$ is output per hectare, q, as a function of labor per hectare, l, in land type i.
2. $\boldsymbol{l}_i \leq \boldsymbol{l}_j$ where $\boldsymbol{l}_i$ is defined as the greatest l_i such that $f'_i(l) = 0$.

In other words, land type I is said to be better quality if its marginal product of labor is higher, for the same labor intensity, and does not become zero at a higher labor intensity than the corresponding marginal product for land type i.

From these assumptions, it follows that equilibrium labor intensity on better quality land, l^*_i, will be greater than l^*_j. Furthermore, rent per worker $R/L = r/l$, is higher for better quality land.[10]

Now if a family farm is the amount of land farmed by one family and family size is independent of land quality, then a higher labor intensity on better quality farms implies that better quality land will be divided into smaller farm units. Furthermore, the higher rent per worker condition implies that the tenant's percentage share must be lower (and the landowner share higher) on better quality land.

Another pattern in share contracts that has been documented is that the landowner's share varies directly with his contribution of percentage of fixed and variable capital inputs (e.g., equipment for land preparation and harvesting, chemicals, and seeds), the higher will be his share. This is a direct implication of the first-best principle. That principle requires that all factors be paid their marginal products. The payment to the landowner must therefore be the sum of the marginal product of the capital times the amount of capital contributed by the landowner. All other things equal, the greater amount of capital contributed by the landowner, the greater will be his share.

A related observation is that landowner shares for coconut production are higher than landowner shares for abaca production. The most common coconut share is two-thirds and the most common share for abaca farms is one-third. (The most common share for rice farms before 1973 was one-half.)

theory abstract from reality in a useful way (Friedman 1935). It is more surprising since almost no useful predictions (including downward sloping demand curves) can be made without restrictive assumptions.

10. See Roumasset (1976) and James (1978). The following notation is used. R is rent that is equal to rent per hectare, r, times the number of hectares, H. Total labor, L, is l H. Therefore, rent per worker R/L can be written as r/l.

This phenomenon is explained by two factors. First, the landowner's percentage contribution to capital is higher on coconut farms because the coconut trees themselves, which are owned by the landowner, constitute almost the entire capital stock and variable capital inputs such as fertilizer are almost never used. In abaca production, however, the tenant usually owns implements for planting, cutting, and processing the abaca and the abaca plants themselves represent the tenant's embodied labor, since the tenant does the planting and provides the planting material (which are cheap in comparison to coconuts). Furthermore, the output elasticity of capital is small and the output elasticity of labor is large for abaca relative to coconut. That is, the coconut production the most important input is the trees. The tenant simply has to gather the nuts (and, in some cases, prepare copra). Abaca, in contrast, is relatively labor intensive. In harvesting a load, the tenant must cut, haul, strip, and dry the abaca and sometimes make it into rope as well.

Output shares also vary according to physiological density. In Bangladesh[11] and the heavily populated parts of Indonesia (Geertz 1965) landowner shares in rice production range from 50 to 67 percent. In the Philippines, however, which has a lower ratio of population to arable land, landowner shares greater than 50 percent have been almost unheard of even before land reform.

To explain the relationship between high physiological density and high landowner's share, we postulate that production of rice can be represented by the CES production function:

$$Q = A\left[\delta \prod^{-\rho} + (1-\delta)L^{-\rho}\right]^{-1/\rho}$$

Following available empirical evidence, we further postulate that $\tilde{n} > 0$ even in the long run, i.e.,, the elasticity of substitution, ó, is less than one.[12]

Since, according to our hypothesis, factors are paid their marginal products, landowner share can be written as

$$\frac{H}{Q}\frac{\partial Q}{\partial H} = \frac{\delta}{A^{\rho}}\left(\frac{Q}{H}\right)^{\rho}$$

11. Bangladesh Rice Research Institute Sharecropping Survey, 1977.

12. For example, Yotopoulos et al. (1970) using the Indian farm management data for 1957-62 estimated $\tilde{n}$ to be equal to .349, i.e. ó =.74. Yotopoulos and Nugent (1976)

Now a higher physiological density will be reflected (via factor prices) in a higher labor per hectare in rice production. This implies in turn a higher output per hectare,[13] (Q/H), and therefore a higher landowner share. This explains the cross-sectional relationship between physiological density and landowner's share.

The same model explains the observation that landowner shares have gradually increased as real wages have fallen. In the decade following the release of high-yielding rice varieties in Bangladesh, there has been a substantial increase in the proportion of share tenants who only receive only one-third of the output and a corresponding decrease in those receiving one-half.[14] Ruttan (1978), citing evidence from White (1974), noted a similar trend in Java, Indonesia, another area with a high and rising physiological density:

> A sequence to induced institutional change in response to changes in land-labor price ratios similar to that observed by North and Thomas in Europe has also reported in contemporary developing countries. In Indonesia between 1868 and 1928, a period of generally rapid growth, changes in patron-client obligations were modified in favor of tenants and landless laborers. Since the late 1920's as land prices have again risen against wage rates, the balance has again shifted in favor of landowners relative to tenants and laborers.

In the Philippines, however, landowner shares have fallen since the introduction of HYVs, despite increasing population pressure on the land. There are two major factors that help account for this apparent paradox. First, the new rice technology developed at the International Rice Research Institute near Manila has been more suitable to Philippine conditions than to conditions in Indonesia or Bangladesh (Herdt and Barker 1977). Second, the land reform program in the Philippines has been successful in forcing landowners to pay higher tenant shares. Until very recently, landowners have been successful in avoiding a substantial loss of income by reducing farm size and curtailing capital contributions.[15] Returning to the first point, technological change has been more appropriate for the

cite evidence that, with the advent of the high-yielding varieties, the elasticity of substitution in agriculture is presently lower than during the 1957 to 1962 period. See also Rande (1977) for supporting evidence of rice production in the Philippines

13. Since we are actually using "land" here as a synonym for "nonlabor inputs", the prediction of a higher output per hectare should be interpreted as a higher output per unit of nonlabor input or as a lower output per worker.

14. Preliminary results of a survey conducted in cooperation with the Bangladesh Rice Research Institute.

15. See, for example, Roumasset and James (1978).

Philippines partly because, until recently, the HYVs have been developed and tested in Philippine soils and environmental conditions. The HYVs are also more appropriate for Philippine factor prices, given that the HYVs are not only land saving but chemical using. With the high cost of fertilizer and insecticide relative to the cost of labor in Indonesia and Bangladesh, the potential gains from adopting the new technology are much lower for these countries (Hayami and Ruttan 1971).

The fact that the new rice technology has been a major technological change for the Philippines but only a minor one for Indonesia and Bangladesh helps explain the different trend of landowner shares in the Philippines. For one thing, the substantial, land-saving technology change in the Philippines has ameliorated the rice of land prices against wages. Even more importantly, because of the substantial technological change, the Philippines has been moving along a metaproduction function, whose elasticity of substitution is one or more (Hayami and Ruttan 1971).[16] Returning to the expression above, we see that since ó $\geq$ 1 corresponds to ñ $\leq$ 0, landowner's share will remain constant or fall slightly with increases in $^{Q}/_{H}$ induced by the rising rent-wage ratio.

Even if the elasticity of substitution is only one, land-saving technological change will result in a decrease in landowner's share. To see this, consider the Cobb-Douglas function:

$$Q = H^{\alpha} L^{\beta} F^{(1-\alpha-\beta)}$$

where F stands for fertilizer and other chemicals. Now land-saving, fertilizer-using technological change implies that á falls and (1-á-â) rises. Therefore the landowner's share falls and the share of fertilizer and other chemicals rises. Indeed, this effect of land-saving technological change on the respective shares of landowners and chemicals occurred even before land reform legislation was aggressively implemented (Herdt and Ranade 1975, Ranade 1977).

16. A meta production function is one that is for the very long run, i.e., given sufficient time to develop new technology in response to new factor prices. Such technological change is not automatic, however, since it must be funded from the public sector. Due to the substantial technological change in the Philippine case, we can regard the Philippines as moving along the meta production function and using the elasticity of substitution estimated from a cross section of countries.

Second Best Patterns

Another pattern observed in share contracts in Southeast Asia is that the extent to which the landowner shares the costs of variable inputs is directly related to the landowner's output share. In premarital law Philippines, there were two main types of tenancy contracts. In regions where land quality was good and landowners usually lived in the same municipalities as the tenants, landowners' shares tended to be 50 percent, but they also had a share of 50 percent of the fertilizer costs and some of the other input expenses. In poorer quality regions, especially where landowners were absentee, landowner shares were typically in the neighborhood of one-third and tenants bore all of the expenses. Similar patterns can be found in Indonesia and Bangladesh except that landowner shares are higher. In those countries where the landowner's share is 50 percent, the tenant usually bears all of the costs. Where the landowner's share is two-thirds, the landowner also shares the cost of fertilizer and some other inputs (Roumasset and James 1978, Rudra 1975, Takahashi 1969).

If the tenant's cost share is set equal to his output share, then his first-order conditions for a profit maximum imply that he will choose the efficient levels of nonlabor variable inputs (Schickele 1941, Heady 1947). But in a first-best world, the efficient levels of inputs can also be guaranteed simply by contractually stipulating those input levels. That is, a contract with fifty-fifty sharing of both output and inputs is equivalent in a first-best sense to a contract wherein efficient input levels are contractually stipulated, the tenant pays for all of the inputs, but the tenants output share is sufficiently above 50 percent so that he receives exactly the same income as in the fifty-fifty contract. Therefore, even though cost sharing provides an additional mechanism by which rewards to factors of production can be adjusted to their competitive levels, the mechanism is superfluous. In order to explain the institution of cost sharing, then, we must introduce second-best considerations.

The key to explaining the incidence of cost sharing lies in relaxing the "first-best" assumptions of perfect information and zero costs of enforcement. If enforcement is costly and production responses are not known by both landowner and tenant, it will not necessarily be optimal to prescribe the inputs in advance and enforce the contractual provisions dealing with contributions of these inputs. Suppose, for

example, that the tenant has a comparative advantage in making the fertilization decision. By requiring the tenant to pay for the same fraction of fertilization as his output share, the landowner can give the tenant the incentive to use the efficient level of fertilizer.[17]

There is still an enforcement problem left with cost sharing, however, since the unsupervised tenant has some incentive to report using more fertilizer than he actually did. This incentive will be especially great for tenants with high output shares. In addition, since tenants with higher shares tend to have lower quality land, the marginal product of modern inputs will generally be lower as well. Thus, the loss that a landowner of poor quality land bears by not giving his tenant the cost sharing incentive to use efficient levels of fertilizer and pesticides is likely to be less than the supervision costs to him of insuring these inputs are actually applied.

The introduction of information and enforcement costs helps explain why we generally observe a rather limited number of agricultural contracts rather than the infinite number of possible combinations of output shares, contributions of factors, and cost sharing. There are two such predominant patterns found in share tenancy for rice. The first type occurs on relatively good land and is characterized by higher landowner shares, higher incidence of cost sharing, and greater involvement by the landowner in management and supervision. The owner's share of output is usually fifty-fifty for this type of contract in the Philippines. The second type occurs more frequently on farms with lower potential productivity and is characterized by lower landowner shares, no cost sharing, and minimal landowner involvement in decision-making and supervision. Typically, the landowners are "absentee." The Philippine landowner's share in this type of arrangement is usually in the neighborhood of one-third.[18]

The second best explanation for the incidence of cost sharing also serves to explain the increase in cost sharing following the introduction of HYVs in the Philippines, Bangladesh, and India.[19]

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17. Mangahas et al. (1976) show that this is roughly the case for share tenants on a fifty-fifty sharing system in NuevaEcija.

18. This difference was confirmed in the Camarines Sur survey of rice farms conducted by the senior author in 1977.

19. Roumasset (1976), Bangladesh Rice Research Institute Survey, and Kessinger (1974)

The excess burden associated with not sharing expenses for fertilizer and other variable inputs will be low (especially since tenants without cost sharing provisions get a higher share of the output). Now since the introduction of HYVs raises the marginal product of fertilizer, the excess burden of not providing cost sharing increases. Thus, the introduction of HYVs causes cost sharing to be an economically viable institution in some of the situations here it was previously dominated by an alternative contract.

The first- and second- best efficiency principles can also be used to explain patterns in harvesters' shares. The harvesters are the third parties in contractual agreements for rice production. In share contracts, the landowners and tenants typically divide the crop after deducting a percentage share for harvesters. Like output shares, differences in harvesters' shares reflect differences in land quality, factor prices, and relative contributions.

Hayami (1978b) has documented the tendency for the percentage of output given to harvesters to adjust so that the implicit wage is close to the equilibrium wage for similar work. This tendency of harvesters' shares to adjust to equilibrium wages is a special case of the first-best efficiency principle.

In densely populated rice areas of Central Java and Bali, Indonesia, harvesters receive only one-tenth of the crop (Geertz 1963). In the Philippines, harvesters' shares range from one-fifth to one-eighth in most lowland areas.[20] The lower harvesters' shares in Indonesia are due to the lower real wages compared to the Philippines.

Within the Philippines, harvesters' shares also vary according to physiological densities and real wages. Prior to 1960, harvesters received as little as one-twentieth of the crop in densely settled Ilocos Norte, while in recently pioneered Isabella they got up to one-half of the crop (Lewis 1971).[21] Currently harvesters' shares in the Philippines range from one-fifth of the crop in low density areas of Mindanao, Palawan, and Northern Luzon to between one-sixth and one-eighth of the crop in densely settled central and Southern Luzon and the Visayas.[22]

20. Information received from V. Cordova, Agricultural economics Department, International Rice Research Institute.

21. The one-half share was partly due to the higher wages in Isabella and partly due to the low yields received in the early years when the rice fields were just being est ablished.

22. Information for the densely populated provinces is from the senior author's survey of rice farms in Bicol in 1977 and recent field studies in Luzon by the International Rice Research Institute. For Mindanao and other less densely populated areas, the information derives from preliminary findings reported to the junior author by the Development Academy of the Philippines doing work in these areas.

In upland areas and in relatively poor quality rain fed areas, harvesters' percentage shares in the Philippines are higher than in the better quality lowland areas. For example, in some of the low productivity areas of Daraga, Albay, harvesters get three thirteenths of the gross and seven twenty-sixths if they do the weeding.[23]

While the first-best principle explains differences in harvesters' shares across location and through time, it does not explain the existence of harvesters' shares in the first place, i.e., why harvesters are paid a share of the crop instead of a wage. For this we need to invoke the well-known principle that sharing provides some incentive to do the job well (Stiglitz 1974). If harvesters were paid a wage it would be necessary to expand substantial effort in supervision to guard against "shirking" (Alchain and Demsetz 1972). If, on the other hand, workers were paid on a piece rate basis, i.e., by the amount of rice harvested, then they would try to maximize the amount harvested per hour and this would inevitably lead to an incomplete harvesting job. Again, this could be offset by supervision, but only at some cost.

Another observation that cannot be explained by first-best theory is the finding that harvesters' shares adjust to changes in factor prices and technology in quite different ways, even in nearby villages. For example, in one village in Laguna, Philippines, harvesters' shares were simply lowered from one-sixth to one-eighth in response to excess supply of harvesters (Kikuchi et al. 1978). In another village close-by, farm operators responded to the same excess supply condition by requiring harvesters to do the weeding without additional compensation (Kikuchi et al. 1977). Hayami has constructed a political economy explanation for this observation. In the village where harvesters' shares were lowered to one-eighth, there are only two large farmers. While these farmers did suffer some threats and intentional damages, they were strong enough to make the change from one-sixth to one-eighth stick. In contrast, in the village where harvester's share remained at one-sixth, there were several small landowners. No one landowner had the power to become a leader and successfully innovate a change to one-eighth. Also, the transaction costs of all the landowners getting together to enforce a change to one-eighth would have been high (Hayami 1978a, 1978b).

23. Camarines Sur/Albay survey, 1977. More precisely, harvesters get three kerosene cans of rice for every ten cans to the farm operator. But if the harvesters have also done weeding, then their three cans are "ubong" or rounded.

While this political economy argument has some appeal, it appears not to apply in similar situations. In the Bicol provinces of Albay and Camarines Sur, for example, the most common change in the harvesting system has been that harvesters' have been required to do the weeding. This institutional arrangement, called "ilani," has been adopted rather quickly, even in villages where ownership of land is widely dispersed.[24]

The gama or ilani system is now beginning to spread to other operations especially land preparation and transplanting. This trend coincides with the trend toward increased hired labor. In high productivity regions in the Philippines where the new technology has been particularly successful, labor inputs per hectare are increasing faster than average farm size is decreasing. At the same time, farm families are actually putting in less labor per hectare. These factors together imply a substantial increase in hired labor; tying the hired labor to harvesting and paying the percentage share is an efficient way to contract for labor, for the reasons discussed above.[25]

As a final puzzle, consider the question "Why, as documented by Day (1967) did the incidence of sharecropping in America diminish rapidly as harvesting operations became more and more mechanized?" As mechanization increased the size of the minimum efficient farm unit, the tenant was unable to provide all of the preharvest labor and generally did not have the skills required for supervision of additional hired labor. Furthermore, since it is efficient for the owner of farm equipment to either operate it or be in a position to closely supervise this operation (Jensen and Meckling 1976), mist tenants would have been at a comparative disadvantage since the could not afford to buy expensive farm equipment and were not able to get the loans to do so.

IV. Summary and Conclusions

In sections I and II, a methodology has been outlined which may be suitable for explaining patterns in institutional arrangements found in agricultural production. This methodology is illustrated in section III. The first-best efficiency principle explains the following patterns. Farm size and tenant share are inversely related with land quality.

Landowner shares vary directly with the rent-wage ratio if the elasticity of substitution is less than one. But where the elasticity of substitution is near one and technological change has been land saving, landowner shares tend to fall even as the rent-wage ratio increases. Landowner shares also vary directly with the percentage of capital and management provided by the landowner and with the production elasticity of capital. First-best efficiency also explains the direct relationship between landowner shares and variable inputs and landowner share in output but does not explain why cost sharing should exist at all. For that we invoked the second-best efficiency principle. Specifically, since the benefit of cost sharing increases with the marginal products of various inputs, cost sharing will be more frequent on better quality land and more frequent after technological innovations that increase the marginal productivity of inputs. The tendency to pay harvesters with the share of produce and the trend toward linking harvesting with other labor operations were also explained with the second-best principle.

Just as using the postulate of rationality to explain individual behavior does not prove that individuals are rational, using the principles of efficiency to explain institutions does not prove that those institutions are efficient. Indeed, we have not tried to determine to what extent agricultural institutions are efficient. However, the framework used to explain such patterns in agricultural contracts could also be used for such a test. To the extent that one can find patterns in agricultural institutions which cannot be explained with the efficiency principle and which can be explained by other considerations (e.g. monopoly power), then one has established a *prima facie* case for inefficiency.[26] However, the success of the efficiency principles in explaining certain observed patterns does invalidate any *a priori* conclusions about the inefficiency of particular contracts such as share tenancy and similarly invalidates the theory that institutions necessarily act as constraints to development.

24. This was gathered from a survey of rice farming practices in Albay and Camarines Sur conducted in cooperation with the Institute of Philippine Culture, 1977.

25. These observations were made by R. Barker based on studies conducted by the Economics Department at the International Rice Research Institute and by L. Darra based on studies conducted by the Special Studies Division of the Department of Agriculture, Philippines.

26. This still does not imply that government is warranted, however. For that, one must weight the benefits associated with the government reducing inefficiency against the cost of the government action itself.

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