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The Efficiency of the Permanent Labor Contract: A Case Study in the Philippine Rice Bowl

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1. Introduction

The new economics of agrarian institutions has achieved some striking developments.[1] Among these, the interests of economists have been focusing on the modeling of land tenancy. However, except for the following studies, existing models remain incomplete in the sense that agricultural labor contracts have not been considered, although they are close substitutes for land tenancy contracts.

Bardhan [3] analyzed a permanent labor contract which has a high degree of substitutability with a tenancy contract. He explained the choice of the fixed-wage permanent labor contract in terms of risk sharing between the risk-averse laborer and the risk-neutral landholder who faces an uncertain spot market. In another paper, Bardhan [2] proposed an alternative explanation for the choice of the fixed-wage permanent labor contract from the viewpoint of saving recruitment costs. In both papers, he assumed that the work efforts of laborers are enforceable without any incentive scheme.

Bardhan's papers focused on the longer duration of the permanent labor contract and did not explain why the employment relationship between the landholder and laborers is highly personalized and involves patronage premium in return for loyalty.

Eswaran and Kotwal [10] showed how the fixed-wage permanent labor contract could elicit loyal work effort from a permanent laborer if the employer would pay more than the laborer's opportunity income. Their model assumed that the contract was unenforceable ex ante and that only the fixed-wage contracts were offered to laborers.

But as Binswanger and Rosenzweig [7] pointed out, the fixed-wage contract would not be chosen if a tenancy contract was an available option to laborers. This is because such a labor

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contract would not derive any work incentive from the laborer.

In keeping with this insight, Chuma, Otsuka, and Hayami [9] showed that the fixed-tenancy contract would be chosen if the choice of contract was endogenous. Why then was a fixed-wage permanent labor contract chosen?

From their theoretical analysis, Otsuka, Chuma, and Hayami [28] postulated that the fixed-wage permanent labor contract would not be chosen, unless land tenancy were socially or legally prohibited. For example, they alleged that permanent labor could be observed where land tenancy was prohibited by institutional constraints, such as the caste system in India, feudalistic regulations in pre-modern Japan, or the tenancy regulations of the Agrarian Land Reform Law in the Philippines.

However, a number of cases do not conform to their analysis. First, it has been reported that the fixed-wage permanent labor contract in the Philippines, called *kasugpong*, had been widely observed even before Presidential Decree No. 27 (the Agrarian Land Reform Law) came into effect. Therefore, we cannot conclude that the fixed-wage permanent labor contract had been spreading as a substitute for tenancy because of the legal restrictions on the choice of tenancy contract.[2] Second, it is argued that during the Tokugawa era in Japan, the conversion of permanent laborers to tenants became common not only because agrarian laws were losing their effect, but also because owner cultivation became unprofitable due to the rise in the cost of hired labor brought about by the increase in off-farm employment opportunities.[3] Third, there is insufficient evidence to prove that permanent laborers who belong to lower castes in India were prevented from leasing land. According to the statistical data from the Indian Ministry of Labor, the changes in occupation from an agricultural laborer to a tenant, and vice versa, occurred frequently.[4] These facts indicate that there is inconsistency in the hypothesis by Otsuka, Chuma, and Hayami. Finally, Otsuka, Chuma, and Hayami insisted that the evolution of land tenancy contracts in Java, where there did not exist strict regulations on land tenancy, supported their hypothesis. But in the alleged land tenancy contract, the landowner conducts the tasks requiring decision making and the supervision of permanent laborer, and shoulders all the production costs, although the sharing arrangement of output is the remarkable feature of the contract. In this respect, the contract is similar to the sharecropping permanent labor contract (mentioned below) but quite different from share tenancy contracts, such as *kasama* in the Philippines under which the tenant conducts all the managerial tasks.[5]

Furthermore, fixed-wage permanent labor contracts had been widely observed in the pre-agrarian-reform Philippines, and in prewar China, Japan, and the Republic of Korea.[6] In these cases, the contracts usually had structures that made them enforceable through a patron-

client relationship, a debtor-creditor relationship, or suretyship. As is well known, if the contract is enforceable and the landowner is risk-neutral, the optimality of the fixed-wage labor contract can be proved using the Cheung-Stiglitz-Newbery framework [8] [33] [26]. Therefore, the existence of the fixed-wage permanent labor contract is not so mysterious.

The question is why a permanent labor contract is chosen without contract enforceability, such as for the cases in Central Luzon in the Philippines and in Java, Indonesia.[7]

In the Philippines, the sharecropping permanent labor contract, known as *porsiyentuhan*, became common in the 1980s among rice farmers in Central Luzon and Iloilo where agrarian land reform had been smoothly implemented and dramatic increases in rice yields had been achieved due to the introduction of modern rice technology. In this contract, the laborer has the obligation of performing certain preassigned tasks (land preparation, plant care, water management, fertilizer application, supervision of casual laborers), while he is allowed to work outside his landowner's farm as a casual worker in order to supplement the permanent labor income that is paid as a share of output (usually 10 or 12 per cent). The landowner is engaged in managerial work requiring judgment (timing farm operations, deciding on the amount of farm inputs, confirmation of performance of permanent laborers, etc.), while he shoulders all the expenditures for farming.

As shown in Eswaran and Kotwal [11] and Otsuka, Chuma, and Hayami [28], in the principal-agency framework, a sharing arrangement is chosen when the landowner provides management input by himself. Their models, however, do not intent to prove that the sharecropping labor contract rather than the share tenancy contract would be chosen. Moreover, their models are inconsistent with the fact that in the area examined in this study, the farms with permanent labor have usually obtained a higher factor intensity than those without permanent labor.

The objective of this paper is to elucidate the background of sharecropping permanent labor which has become common in Central Luzon in the Philippines since the 1980s, and to present an alternative hypothesis about the choice of a sharecropping permanent labor contract.

In the next section, it will be shown that the adoption of modern rice technology raised the rice yield during the same period that the permanent labor contract was becoming common. It will also be shown that the landowner who uses permanent labor usually has a higher off-farm job opportunity cost and that the permanent laborer receives a higher income than his opportunity income. Empirical evidence will be presented showing that the managerial ability of the landowner crucially affects profitability if modern technology is adopted.

Based on these four findings, it is postulated in Section 3 that if the contractual arrangements

reduce the transaction cost for inducing the laborer's work efforts and the managerial efforts of the landowner produce a higher profit, then it is more profitable for a landowner whose labor opportunity cost is higher for off-farm work to use a sharecropping permanent labor contract as a substitute for a tenancy contract. This is the reason why the sharecropping permanent labor contract enables the landowner to facilitate the assignment of managerial tasks to hired labor without a high enforcement cost. It also explains why the landowner maintains his reputation by keeping the promise to provide a premium to the laborer, and why the laborer supplies his work effort to obtain high factor intensity and high yield. This hypothesis can be proven theoretically using the repeated game theory [22] [21] [24]. In Section 4 empirical evidence will be presented to support the hypothesis.

2. Land Reform, Technical Progress, and Permanent Labor

The author conducted a field survey between June and August 1991 in Muñoz, Nueva Ecija Province, the Philippines. All village households were stratified into four categories (farmer, permanent laborer, casual laborer, and others) and the households in each group were sampled at random.

The study area is located in Inner Central Luzon approximately 200 km north of Metro Manila, where large-scale rice plantations (hacienda)[8] were dominant before the Agrarian Land Reform Law (PD 27) was enacted.

In 1972, under Martial Law, PD 27 was proclaimed and the large haciendas in Central Luzon were broken up. The land owned by absentee landlords was transferred to the tenants and the land rent was reduced.

Along with the land reform, irrigation infrastructure was constructed and improved, and new rice technologies were introduced. As a result, paddy yields increased drastically from 60 *cavans* (1 *cavan* = 50 kg) per hectare in the mid-1970s to more than 100 *cavans* in 1990 (Table I).

The land reform and the new rice technology brought a significant improvement in income for the ex-share-tenants. A considerable number of these farmers produced large economic surpluses which they invested in education, off-farm business, diversified agriculture, etc.[9]

Tables II and III show that there has been a growing tendency for farmers facing high off-farm labor opportunity costs to employ permanent laborers for rice farming.[10]

Table IV shows the statistical difference in annual income and working days between permanent laborers and casual laborers. It indicates that the difference in annual income was significant, but that of working days was not. These findings support my hypothesis that the landowner provides a premium to the permanent laborer.

To test the profitability of good management and that of the permanent labor contract, an estimation will be made of the effect of technical efficiency and employment of permanent labor on profitability.

In general, the effect of technical efficiency on profitability is significant, particularly where new rice technology has been adopted.[11] For a test of the significance of the effect, an estimation will be made of technical efficiency and regress technical efficiency on profit. For this purpose, an estimate will be made of the stochastic frontier production function of Aigner, Lovell, and Schmidt [1] and Jondrow et al. [19].

The stochastic frontier production function is defined as follows:

$$Yt = F(Xt, b)\cdot e^{\varepsilon t}, \ (t = 1, 2, ..., n), \tag{1}$$

where Yt is the annual gross product of rice of the tth rice farmer, Xt is a vector of inputs such as land, labor, fixed capital, and variable capital, b is a vector of parameters, and et is composed of two independent error components; $et = Vt - Ut$, where Vt captures the effects of random shocks outside the farmer's control (observation and measurement error on the dependent variable and other statistical noise) and Ut captures the technical efficiency of the farmer [$Vt \sim N(0, \sigma v^2)$, $Ut \sim N(0, \sigma u^2)$, $0 \leq Ut$].

The technical efficiency of the tth individual producer is defined as:

$$e^{-Ut} = \frac{Yt}{F(Xt, \beta)\cdot e^{Vt}} .$$

The conditional mean of Ut can be shown to be

$$E(Ut \setminus \varepsilon t) = \sigma^*\cdot[\frac{f^*(\varepsilon t\cdot\lambda/\sigma)}{1 - F^*(\varepsilon t\cdot\lambda/\sigma)} - (\frac{\varepsilon t\cdot\lambda}{\sigma})], \tag{2}$$

where f^* and F^* represent the standard normal density and the distribution function respectively, and $\sigma^{*2} = \sigma u^2\cdot\sigma v^2 / \sigma^2$, $\sigma^2 = \sigma u^2 + \sigma v^2$, , and $\lambda = \sigma u/\sigma v$. The estimates of the variances used to solve equation (2) are derived from the maximum likelihood estimation (MLE) of equation (1).

A statistical test was carried out on the functional form to see whether it was closer to Cobb-Douglas or translog. The results of the t test did not reject the null hypothesis, so there is no significant difference between the two [12].

The estimation results of the stochastic frontier production function are shown in Table V. The results were used to estimate the technical efficiency of the individual farmer and a model specified in Table VI was estimated using ordinary least squares (OLS) method [12].

The estimates in Table VI show that planted area, rice price, and technical efficiency affect profitability, positively, and significantly.

Table VI also shows that the permanent labor dummy is significantly negative if the imputed family labor income is not included in profit (profit 1). If it is, the dummy variable shows a significantly positive value (profit 2). This indicates that the farmer who hires permanent labor can obtain a larger household income than if he conducts the tasks assigned to permanent labor by himself and loses a part of off-farm income.

3. A Theoretical Model of a Sharecropping Permanent Labor Contract

This section presents a theoretical explanation for the existence of a sharecropping permanent labor contract, which has been common in the study area. It will also conduct a theoretical analysis of the observed facts concerning the permanent labor contract with emphasis placed on the observations presented earlier in this paper.

The analysis assumes a one-period principal-agency framework in which a landowner household (hereafter referred to as a landowner) maximizes his expected income with respect to the terms of the contract subject to the hired laborer's work efforts and reservation utility.[12] In this framework, the contract is defined by the variable capital or fixed capital m, the landowner's share of output r, and the fixed payment per hectare R, assuming constant returns to scale. The problem is therefore written for a unit of area, with output depending on variable or fixed capital, laborer's work effort (A), and the realization of the random variable (θ). If $F(m, A)\cdot\theta$ is the yield at harvest, the laborer's income is:

$$Y = (1-r)\cdot F(m, A)\cdot\theta - R, \ (\partial^2 F/\partial m\cdot\partial A > 0).$$

Taking account of the disutility of work, the laborer's problem is to choose an A that maximizes his utility, $W = U(Y, A)$. The landowner's optimal behavior can be formulated as follows:

$$\max_{m,r,R,} \quad Z = E[r\cdot F(m, A)\cdot\theta + R - P\cdot m + \bar{I}],$$

$$\text{st.} \quad \max_{A} \quad W = E[U(Y, A)], \quad \max_{A} \quad W \geq \bar{W}.$$

Here, P indicates the unit cost of capital, and $\bar{I}$ indicates off-farm income. They are both assumed to be constant. $\bar{W}$ is the reservation utility of the laborer which is exogenously given.

The next step is to extend this to a multi-period model. The sequential decision-making process considered here is dictated by the intertemporal characteristic of the production process, with the landowner announcing his strategy. If the laborer is cooperative, the

landowner will provide him with $\hat{m}$, the laborer choosing his action $\hat{A}$, and the landowner executing his announcement. Thereafter, this process will be repeated. In general, at the time of the third phase of this contract, two problems may arise. One is caused by the non-observability of the laborer's behavior while the other is caused by the landowner's incentive not to honor his announcement even when the laborer selects $\hat{A}$. Radner [29] dealt with the first problem by assuming that the landowner is bound to respect his announcement, and the noncooperative equilibrium (indicated by *) as well as the cooperative Pareto optimal solution (indicated by $\hat{}$) are determined prior to activating the contract. My theory differs from Radner's information structure by assuming that the landowner can intentionally default on the contract while the tenant's action is observable. The latter hypothesis makes a retroactive calculation of the laborer's work effort by the landowner, based on the effect of weather ex post and the production function. However, when the labor input amount cannot be proven by the third party, the landowner may not be able to punish the laborer for defaulting on the contract. In this paper, it is assumed that such a punishment cannot be carried out by the landowner.

Given this information structure, I will clarify the condition that insures that the cooperative contract will be the equilibrium solution. For this purpose, I will establish a condition for the existence of $(\hat{m}, \hat{A})$ that makes such an efficient contract ($\hat{}$) acceptable. Then I show that if the landowner regards reputation as important, the efficient contract will be chosen.

A. *The Definition of strategy*

In designing the above-mentioned mutual gift contract, two contracts serve as references. The first contract $(\bar{m}, \bar{A}; \bar{r}, \bar{R})$ is of the type presented in Cheung [8], Stiglitz [33], and Newberry [26], which requires the enforceability of the contract. It can achieve noncooperative efficient resource allocation. In this contract, the laborer's expected utility is $\bar{W}$ (reservation utility), while the landowner's expected utility (the maximum utility obtainable) is

$$Z = E[\bar{r} \cdot \bar{F}(\bar{m}, \bar{A}) \cdot \theta + \bar{R} - P \cdot \bar{m} + \bar{I}),$$

where $\bar{Z}$ is assumed to be larger than the utility ($\bar{Z}'$) obtained when the landowner uses family labor and is not engaged in an off-farm job.

The other contract (A^*; m^*, r^*, R^*) is a type that will achieve the well-known noncooperative and nonenforceable Nash equilibrium.[13] The expected utility of the laborer is $W^* = \bar{W}$, and that of the landowner is $Z^* < \bar{Z}$. It is assumed that Z^* is larger than Z' because the landowner might lose his high-salaried off-farm employment opportunity if he himself conducts the farming operations without permanent labor.[14]

The objective of the landowner is to design a cooperative contract $(\hat{A}; \hat{m}, \hat{r}, \hat{R})$ that can achieve a higher utility level than in the case of a noncooperative game while the laborer

spontaneously provides enough work effort to achieve efficiency in production. The case considered here is one where the landowner will subtract $\bar{r}\cdot F(\bar{m}, \bar{A}) - P\cdot\bar{m} - [\bar{r}\cdot F(\hat{m}, \hat{A}) - P\cdot\hat{m}]$ from $\bar{r}\cdot F(\bar{m}. \bar{A}) - P\cdot\bar{m}$ so that the contract can be written as $(\hat{A} > \bar{A};\ \hat{m} > \bar{m},\ \hat{r} = \bar{r},\ \hat{R} = \bar{R})$ to achieve the following utility:

Laborer: $\hat{W} = EU[(1 - \hat{r})\cdot F(\hat{m}, \hat{A}) \cdot \theta - \bar{R},\ \hat{A}] > \bar{W},$

Landowner: $\bar{Z} = E[\hat{r}\cdot F(\hat{m}, \hat{A}) \cdot \theta + \bar{R} - P\cdot\hat{m} + \bar{I}] < \bar{Z}.$

$\hat{Z}$ is larger than Z^*. The next step is to determine the conditions on $\hat{r}\cdot F(\hat{m}, \hat{A}) - \bar{r}\cdot F(\bar{m}, \bar{A})$ under which the mutual gift strategy achieves the equilibrium contract $(\hat{A};\ \hat{m},\ \hat{r},\ \hat{R})$.

The decision-making process in the strategy of the laborer and the landowner is as follows: first, the laborer will decide whether he will accept the cooperative contract $(\hat{A};\ \hat{m},\ \hat{r},\ \hat{R})$ or the noncooperative contract $(A^*;\ m^*,\ r^*,\ R^*)$ If he accepts the noncooperative contract, he will decide whether he will implement it or not. If the laborer implements this contract, and the landowner respects the contract term, the landowner and the laborer will respectively obtain utility $\hat{Z}$ and $\hat{W}$. On the other hand, if the laborer defaults on the contract, he will try to maximize his utility in the contract $(\hat{A}';\ \hat{m},\ \hat{r},\ \hat{R})$ by choosing an action $\hat{A}'$. Since it is assumed that the landowner gives m to the laborer, the utility of the laborer is

$$\hat{W}' = EU[(1 - \hat{r})\cdot F(\hat{m}, \hat{A}')\cdot\theta - \bar{R},\ \hat{A}'],$$

$$\hat{A}' = \text{Arg max } EU[(1 - \hat{r})\cdot F(\hat{m}, \hat{A})\cdot\theta - \bar{R},\ A].$$

Here $\hat{W}' > \hat{W}$ for the laborer and $\hat{Z}' < \hat{Z}$ for the landowner.

In the case of the cooperative contract, if the landowner does not give m even though the laborer implements the contract, it yields $\hat{W}'' < \hat{W}$ for the laborer and $\hat{Z}'' > \hat{Z}$ for the landowner.

All the expected utilities obtained in the above-mentioned game strategies are summarized in Table VII. It is assumed that the game will be infinitely repeated in the following manner so as to make such a mutual gift exchange contract an equilibrium strategy. In other words, there is the possibility that the landowner might make a contract with a laborer in every one-period game through the repeated games. However, in such a case, the landowner and laborer are provided with complete information of all the strategies through the previous games.

B. *Equilibrium Contract*

In this contract, if the discount rates of both players are small enough, the following strategies will yield perfect equilibrium. That is, as long as the laborer has chosen the contract $(\hat{A};\ \hat{m},\ \hat{r},\ \hat{R})$ and implements it until period $t-1$, the landowner will implement the contract in period t. However, if the laborer defaults on the contract before period t, the landowner will not implement the contract. Consequently, he will not give m even if the laborer choose the contract. On the other hand, when given a contract in period t, the laborer will implement the contract only if the landowner continues to implement the contract through the games

until period $t-1$. If the landowner defaults on the contract prior to period t, the laborer will not implement the contract even if he were to choose it. In this case, for an entire sequence of equilibria, a cooperative contract $(\hat{A};\ \hat{m},\ \hat{r},\ \hat{R})$ will be chosen, and the landowner and the laborer will obtain utility $(\hat{Z},\ \hat{W})$ respectively.[15] Therefore, as long as the landowner provides the laborer with m that satisfies the conditions shown in the Appendix, an efficient sharecropping permanent labor contract will continue to be maintained.

Such a strategic combination can be interpreted as follows. When the landowner has a reputation of being trustworthy, he can obtain utility $\hat{Z}$ every time he provides a contract by maintaining such a reputation. The landowner could gain in the short run by defaulting on the contract. However, if he defaults and loses his reputation, the laborer will not trust him thereafter, and he will lose potential gains. Therefore, to obtain a long-term benefit, a landowner will not mistreat his laborers and thereby suppress myopic incentives to default.

4. The Efficiency of Sharecropping Permanent Labor Contract in Inner Central Luzon

This section will present evidence for the efficiency of the sharecropping permanent labor contract using the data collected in the study area. The results will clarify that evidence of Marshallian inefficiency cannot be found under the permanent labor contract.

Investigation of Marshallian allocative inefficiency under the permanent labor contract requires a test of the difference in input use with the other tenancy forms. If all the farm households in a selected region face the identical relative price, we only need to conduct a test of the difference in input use and yield. The actual state, however, is that transaction costs for factors and sales of products are not negligible. Thus costs depend upon each family's factor endowment.

As Bell [6] and Shaban [30] have pointed out, past empirical evidence has been inconsistent. A number of studies have reported efficient resource allocation under sharecropping, while several others have reported lower yields and input intensities for sharecroppers. Shaban, who has found Marshallian inefficiency in sharecropping, points out that the existing studies which support the efficiency hypothesis do not take irrigation or soil conditions into consideration.

The present study carries out a statistical test of allocative efficiency by regressing the variables for factor intensity or yield following Shaban's approach. It is then possible to test efficiency resource allocation under a sharecropping permanent labor contract.

In the study areas, the differences in soil and irrigation conditions are trivial. Since the transaction cost for obtaining inputs depends on asset endowments, such as land and household

income, these factors will be controlled for: "operated area of paddy field," "debt" (as an index for credit), and the "price of rice." Furthermore, I control for human capital (educational background, age), production factor endowments besides labor (agricultural machinery), technology (direct seeding or transplanting), management ability (index of technical efficiency), and factor prices as variables that regulate the factor intensities. Finally, I test the difference in allocative efficiency under the permanent labor contract and other tenancy forms by using a permanent labor dummy. Detailed explanations of each variable are given in Table VIII and noted in Table IX.

The results of the estimation are given in Table IX. The price of rice, debt, and wage positively and significantly affect fixed-capital use per unit area, while planted area and agricultural machinery have negative and significant effects. That is, the lower the transaction cost of the rice price, loan or hired labor and the smaller the land or owned fixed capital, the larger are the factor intensities of fixed capital. For the permanent labor dummy variable, the parameter is positive and significant. For variable capital, the parameter of the planted area shows a significantly negative value. The parameter of the permanent labor dummy shows a positive value, and is significant.

The explanatory variables for labor intensity, the permanent labor dummy, schooling, planted area, wage, and direct seeding are all significant. Of these, the permanent labor dummy has a positive relation to factor intensity.

These results support the hypothesis drawn from the theoretical model that the permanent labor contract draws an excess supply of inputs.

Regarding yield, the parameters of agricultural machinery, rice price, technical efficiency, and debt are significantly positive, while the parameter for the planted area is significantly negative. However, the dummy variable relating to permanent labor is insignificant, although it has a positive value.

The result that the permanent labor contract positively affects all the factor intensities, differs from the Marshallian inefficiency of permanent labor contract which previous works have asserted.

5. Conclusion

The results of this study can be summarized as follows. Through its theoretical and empirical analysis, this study has proved that a high factor intensity is achieved under a sharecropping permanent labor contract in which the landowner maintains his reputation by allowing the laborer to apply a larger amount of factor input while the laborer trusts the landwner and fulfills the contract in order to continuously receive the premium produced by

the higher factor intensity. This contractual arrangement is profitable for a landowner who faces a high opportunity income.

In Indonesia, where the agrarian land reform law was not effective in the 1970s and 1980s, sharecropping permanent labor contracts increased during the same period that new rice technology rapidly expanded. This fact indicates that we need an alternative explanation of the evolution of permanent labor contracts where no institutional constraints exist on land tenancy.

The major thrust of this paper has been to present a contractual choice theory of sharecropping permanent labor under no constraints to land tenancy and to show evidence, based on a Philippine case study, that the contract does not lead to an insufficient resource use like the Marshallian inefficiency. However, to generalize the validity of this theory, further empirical studies need to be conducted.

Note

[1] See Bardhan [4] and Hoff, Braverman, and Stiglitz [18].

[2] Regarding permanent labor in the Philippines, see Hayami and Otsuka [16].

[3] Regarding permanent labor in Tokugawa Japan, see Smith [32].

[4] For changes from agricultural labor to tenancy and vice versa in India, see Koga [20]. An A.N. Shinha Institute (ANSISS)-ILO survey shows that a considerable number of permanent laborers in Bihar, India lease land held by other tenants [27].

[5] For a review of the evolution of permanent labor in Java, see Yonekura [36] and Hart [14]. The *kasama* (a Tagalog word meaning partner) system usually implies a share tenancy system in which landowner and tenant share the output after deducting the production cost, except for the imputed labor cost of the tenant [34]. In this system the landowner entrusts the managerial tasks to the tenant.

[6] For details about permanent labor contracts in prewar China, Japan, and the Republic of Korea, see Minami Manshu Tetsudo Kabushikikaisha [25], Ushiyama [35], and Kuramochi [23].

[7] A similar type of sharecropping permanent labor contract in North India is reported in Fukunaga [13].

[8] For the development of Inner Central Luzon, see Hayami and Kikuchi [15].

[9] For information on the emergence of such new rural elites, see Hayami et al. [17] and Shimizu and Fukui [31].

[10] These off-farm jobs include working as public servants, teachers, drivers, traders, overseas workers, etc.

[11] For the contribution of technical efficiency to rice production using modern technology, see Barker and Herdt [5].

[12] In this paper, a household is regarded as a unit of economic activity, following the precedent-

setting works.

[13] See Radner [29].

[14] Here, a landowner indicates a farm household as mentioned in footnote 12. At least one household member was engaged in an off-farm job with high salary in 90 per cent of my sample households which hired permanent laborers. Therefore, the assumption is not unrealistic that Z^* is larger than Z'.

[15] See the Appendix regarding this point.

References

1. AINGER, D.J.; LOVELL, C.A.K.; and SCHMIDT, P. "Formulation and Estimation of Stochastic Frontier Function Models," *Journal of Econometrics*, Vol. 6, No. 1 (July 1977).
2. BARDHAN, P.K. "Wages and Unemployment in a Poor Agrarian Economy: A Theoretical and Empirical Analysis," *Journal of Political Economy*, Vol. 87, No. 3 (June 1979).
3. _____. "Labor-Tying in a Poor Agrarian Economy: A Theoretical and Empirical Analysis," *Quarterly Journal of Economics*, Vol. 98, No. 3 (August 1983).
4. BARDHAN, P.K., ed. *The Economic Theory of Agrarian Institutions* (Clarendon: Oxford University Press, 1989).
5. BARKER, R., and HERDT, R.W. *The Rice Economy of Asia* (Washington, D.C.: Resources for the Future, 1985).
6. BELL, C. "Alternative Theories of Sharecropping: Some Tests Using Evidence from Northeast India," *Journal of Development Studies*, Vol. 13 No. 4 (July 1977).
7. BINSWANGER, H.P., and ROSENZWEIG, M.R. "Behavioural and Material Determinants of Production Relations in Agriculture," *Journal of Development Studies*, Vol. 22, No. 3 (April 1986).
8. CHEUNG, S.N.S. *The Theory of Share Tenancy: With Special Application to Asian Agriculture and the First Phase of Taiwan Land Reform* (Chicago: University of Chicago Press, 1969).
9. CHUMA, H.; OTSUKA, K.; and HAYAMI, Y. "On the Dominance of Land Tenancy over Permanent Labor Contract in Agrarian Economies," *Journal of the Japanese and International Economies*, Vol. 4, No. 2 (June 1990).
10. ESWARAN, M., and KOTWAL, A. "A Theory of Two-Tier Labor Markets in Agrarian Economies," *American Economic Review*, Vol. 75, No. 1 (March 1985).
11. _____. "A Theory of Contractual Structure in Agriculture," *American Economic Review*, Vol. 75, No. 3 (June 1985).
12. FUKUI, S. "Estimation of Technical Efficiency among Philippine Rice Farmers," *Journal of the Faculty of Agriculture*, Kyushu University, Vol. 37, Nos. 3-4 (March 1993).
13. FUKUNAGA, M. "Kita Indo sonraku ni okeru nogyorodo to bungyo kankei — Thakur shudan o chushin to suru keizai kozo" [Agricultural labor relationship in a North Indian village], *Ajia keizai*, Vol. 32, No. 3 (March 1991).
14. HART, G. *Power, Labor, and Livelihood: Processes of Change in Rural Java* (Berkeley:

University of California Press, 1986).
15. HAYAMI, Y., and KIKUCHI, M. *Asian Village Economy at the Crossroads: An Economic Approach to Institutional Change* (Tokyo: University of Tokyo Press, 1981).
16. HAYAMI, Y., and OTSUKA, K. "*Kasugpong* in the Philippine Rice Bowl: The Emergence of New Labor Institutions after the Land Reform," in *The Economics of Rural Organization: Theory, Practice and Policy*, ed. K. Hoff, A. Braverman, and J.E. Stiglitz (New York: Oxford University Press, 1993).
17. HAYAMI, Y.; QUISUMBING, M.A.R.; and ADRIANO, L.S. *Toward an Alternative Land Reform Paradigm: A Philippine Perspective* (Quezon City: Ateneo de Manila University Press, 1990).
18. HOFF, K.; BRAVERMAN, A.; and STIGLITZ, J.E., eds. *The Economics of Rural Organization: Theory, Practice and Policy* (New York: Oxford University Press 1993).
19. JONDROW, J., et al. "On the Estimation of Technical Inefficiency in Stochastic Frontier Production Function Model," *Journal of Econometrics*, Vol. 9, No. 2 (August 1982).
20. KOGA, M. "Indo no nogyo rodosha" [Agricultural laborers in India], in *Indo no keizai seisaku to shokaiso* [Economic policy and social stratum in India], ed. H. Yamaguchi (Tokyo: Institute of Developing Economies, 1975).
21. KREPS, D.M., and WILSON, R. "Reputation and Imperfect Information," *Journal of Economic Theory*, Vol. 27, No. 2 (August 1982).
22. KREPS, D.M., et al. "Rational Cooperation in the Finitely Repeated Prisoners' Dilemma," *Journal of Economic Theory*, Vol. 27, No. 2 (August 1982).
23. KURAMOCHI, K. "70 nendai Kankoku niokeru nogyorodo kozo no hendo" [Changes in the agricultural labor structure in the Republic of Korea in the 1970s], *Ajia keizai*, Vol. 25, No. 1 (January 1984).
24. MILGROM, P., and ROBERTS, J. "Predation, Reputation, and Entry Deterrence," *Journal of Economic Theory*, Vol. 27, No. 2 (August 1982).
25. Minami Manshu Tetsudo Kabushikikaisha, Chosabu. *Kita Shina no nogyo to keizai* [Agriculture and economy in North China] (Tokyo: Nihon Hyoronsha, 1941).
26. NEWBERY, D.M.G. "The Choice of Rental Contract in Peasant Agriculture," in *Agriculture in Development Theory*, ed. Lloyd G. Reymolds (New Haven and London: Yale University Press, 1975).
27. OSHIKAWA, F. "Indo niokeru 'hinkon' mondai eno apurochi o megutte" [Some aspects of rural poverty in Bihar: a review of the rural survey conducted by the A.N. Shinha Institute and ILO in the early 1980s], *Ajia keizai*, Vol. 32, No. 3 (March 1991).
28. OTSUKA, K.; CHUMA, H.; and HAYAMI, Y. "Land and Labor Contracts in Agrarian Economies: Theories and Facts," *Journal of Economic Literature*, Vol. 30, No. 4 (December 1992).
29. RADNER, R. "Monitoring Cooperative Agreements in a Repeated Principal-Agent Relationship," *Econometrica*, Vol. 49, No. 5 (September 1981).
30. SHABAN, R.A. "Testing between Competing Models of Sharecropping," *Journal of Political*

Economy, Vol. 95, No. 5 (October 1987).
31. SHIMIZU, H., and FUKUI S. "Marukosu nochi kaikaku to beisaku hashenda noson no henbo — sonnai shogyo erito no keisei o megutte" [Agrarian land reform under the Marcos regime and its impact on a hacienda barrio — the formation of a new agrarian elite], *Shakaikagaku ronshu*, No. 33 (March 1993).
32. SMITH, T.C. *Agrarian Origins of Modern Japan* (Stanford: Stanford University Press, 1959)
33. STIGLITZ, J.E. "Incentives and Risk in Sharecropping," *Journal of Economic Studies*, Vol. 41, No. 2 (April 1974).
34. TAKAHASHI, A. *Land and Peasants in Central Luzon: Socio-Economic Structure of Bulacan Village* (Tokyo: Institute of Developing Economies, 1969).
35. USHIYAMA, K. *Nominsobunkai no kozo: senzen ki* [Structure of peasant disintegration in Japan: prewar period] (Tokyo: Ochanomizu Publishing Co., 1975).
36. YONEKURA, H. "Jawa noson niokeru kaiso kosei to nogyorodo kanko" [Stratification and agricultural labor practices in rural Java], *Asia keizai*, Vol. 27, No. 1 (January 1986).

Appendix

Sharecropping Permanent Labor Contract and Reputation as a Perfect Equilibrium

Table VII shows the profit (utility) obtained by the landowner and laborer. I will show how a partial game strategically played by a landowner and a laborer can be used to prove that a cooperative share permanent labor contract can yield a perfect equilibrium.

First, I will consider the case where a cooperative contract is selected one period before $t^0 + k$ and the laborer defaults on the contract at time $t^0 + k$. In this case, when a cooperative contract is chosen at time $t^0 + k$, the laborer knows that the landowner will default on the contract even when the laborer implements the contract after $t^0 + k$; therefore the laborer does not have the incentive to make the work effort A as cited in the contract after $t^0 + k$. The landowner who knows all this information would choose a noncooperative contract.

In this case, the utility that the landowner and the laborer will obtain is

$$\text{Laborer:} \quad T' = \sum_{t=t^0}^{t=t^0+k-1} \alpha^t \hat{W} + \alpha^{t0+k} \hat{W}' + \sum_{t=t^0+k+1}^{t*} \alpha^t W^*$$

$$\text{Landowner:} \quad L' = \sum_{t=t^0}^{t=t^0+k-1} \beta^t \hat{Z} + \beta^{t0+k} \hat{Z}' + \sum_{t=t^0+k+1}^{t*} \beta^t W^*.$$

Here, t^* indicates the contract duration. a and b indicate discount factors.

If both the landowner and the laborer have not defaulted on the contract before contract period $t^0 + k$, the laborer knows that the landowner will implement the contract when the cooperative contract is chosen at time $t^0 + k$, and he will also implement the contract. As

long as both parties repeat this strategy, the utility of the laborer is T,

$$T = \sum_{t=t^0}^{t^*} \alpha^t \hat{W} \; (> \sum_{t=t^0}^{t^*} \alpha^t \hat{W}' \text{ or } \sum_{t=t^0}^{t^*} \alpha^t W^*),$$

while that of the landowner is L.

$$L = \sum_{t=t^0}^{t^*} \beta^t \hat{Z} \; (> \sum_{t=t^0}^{t^*} \beta^t \hat{Z}' \text{ or } \sum_{t=t^0}^{t^*} \beta^t Z^*)$$

On the other hand, if the landowner continues to implement the contract until $t^\circ + k - 1$, but does not do so at time $t^0 + k$, then the landowner who knows that the laborer will not have any incentive to default on the contract can obtain utility $\hat{Z}''$ ($> \hat{Z}$) by defaulting. As a result of this default, after time $t^0 + k + 1$, both parties will choose a noncooperative contract, or a cooperative contract will be chosen and then the laborer will default on the contract. Therefore, in this case, the utility of the laborer is

$$T'' = \sum_{t=t^0}^{t=t^0+k-1} \alpha^t \hat{W} + \alpha^{t0+k} \hat{W}'' + \sum_{t=t^0+k+1}^{t^*} \alpha^t W^*,$$

and that of the landowner is

$$L'' = \sum_{t=t^0}^{t=t^0+k-1} \beta^t \hat{Z} + \beta^{t0+k} \hat{Z}'' + \sum_{t=t^0+k+1}^{t^*} \beta^t Z^*.$$

From this, it can be seen that the laborer's net gain from defaulting at $t^\circ + k$ is

$$\Delta T = T' - T$$

$$= \alpha^{t0+k}(\hat{W}' - \hat{W}) - \sum_{t^0+k}^{t^*} \alpha^t (\hat{W} - W^*)$$

$$= \alpha^{t0+k} \cdot [(\hat{W}' - \hat{W}) - (\hat{W} - W^*) \cdot \alpha \cdot \frac{1 - \alpha^{t^*-t0-k}}{1 - \alpha}]$$

while that for the landowner is

$$\Delta L = L'' - L$$

$$= \beta^{t0+k} [(\hat{Z}'' - \hat{Z}) - (\hat{Z} - Z^*) \cdot \beta \cdot \frac{1 - \beta^{t^*-t0-k}}{1 - \beta}].$$

A bit of algebra shows that if $\alpha > (\hat{W}' - W) / (\hat{W} - W^*)$, and $\beta > (\hat{Z}'' - \hat{Z}) / (\hat{Z} - Z^*)$, both parties do not have an incentive to default before $t^\circ + k$ for all of k.

Therefore, if t^* is infinite and contract (m, A) is determined to fulfill these conditions, the cooperative contract will be the repeated game equilibrium under the strategies explained in this paper.

Table I

Rice Yield in the Study Area

Year	Yield per Ha (*Cavan*/Ha)	
	Wet	Dry
1975	53	63
1983	67	79
1990	83	142

Sources: For 1975, P.S. Coloma, "A Benchmark Study Report: Barrio Bantug, Muñoz, N.E.," (Muñoz: Research Department, Management Information Center, Central Luzon State University, 1977); for 1983 T.S. Bernardo and O.B. Mangalindan, "Transaction and Arragements in Agrarian Reform (Nueva Ecija)," (Muñoz: Rural Development Studies, Research and Development Center, Central Luzon State University, 1984); and for 1990, a field survey by the author.

Table II

Emergence of Permanent Labor Contract in the Study Area

Year	Number of the Farmers Who Started to Use Permanent Laborers	Number of the Permanent Laborers Who Started to Be Employed as Permanent Laborers
~1979	4 (3)	0
1980	1	1
1981	1	1
1982	2 (1)	3
1983	2	2
1984	1	1
1985	1	2
1986	4	4
1987	4	5
1988	5	5 (1)
1989	7	14 (2)
1990	1	4
1991	0	1
Total	33 (4)	43 (3)

Note: Numbers in parentheses refer to *kasugpong* (fixed-wage permanent laborer).

Table III

Non-Rice Income of Farm Households in the Study Area

	Farmer with Permanent Laborers	Farmer without Permanent Laborers	Student *t*-Value
Samples	30	98	—
Annual non-rice income (peso)	81,483.5	41,724.2	3.3[a]

[a] Indicates that the difference in means is significant at the 1 per cent level.

Table IV

Annual Incomes and Workdays of Permanent Laborers and Casual Laborers

	Permanent Laborers	Casual Laborer	Student *t*-Value
Samples	41	44	—
Annual income (peso/year)	17,091.5	11,698	3.10[a]
Workdays (days/year)	200.3	179.3	0.90

[a] Indicates that the difference in means is significant at the 1 per cent level.

Table V

Estimation Results of Stochastic Frontier Production Function

Variable	Estimate	*t*-statistic
Constant	5.15	6.99*
ln (land)	0.32	3.27*
ln (labor)	–0.03	–0.49
ln (fixed capital)	0.49	8.41*
ln (variable capital)	0.20	2.70*
σ	2.86	39.28*
λ	3.45	3.73*
Log of likelihood function		11.11
No. of samples		124

* Significant at the 1 per cent level.

Table VI

Permanent Labor and Profit

Variable	Dependent Variable			
	Profit 1		Profit 2	
Permanent labor	–0.15	(–2.19**)	4.16	(36.03*)
Age	–0.86E–02	(–0.59)	0.21E–01	(0.84)
Schooling	0.12E–01	(1.50)	0.37E–02	(0.28)
Machinery	0.18E–01	(0.29)	–0.52E–02	(–0.50)
Debt	–0.69E–02	(–1.19)	–0.70E–02	(–0.71)
Area	1.00	(23.37*)	1.27	(17.42*)
Rice price	1.60	(5.89*)	1.82	(3.93*)
Fertilizer price	0.52E–01	(1.45)	0.81E–01	(1.32)
Wage	–0.35E–01	(–0.45)	0.86	(6.43*)
Direct seeding	0.48E–01	(0.65)	–0.96E–01	(–0.75)
Technical efficiency	2.36	(4.36*)	2.85	(3.07*)
R^2	0.90		0.97	
Adjusted R^2	0.89		0.96	
F-statistic	91.27*		288.69*	
No. of samples	124		124	

Note: The explanation of each variable is given in Table VIII.

* Significant at the 1 per cent level.

** Significant at the 5 per cent level.

Table VII

Expected Utility Matrix Showing the Game Strategy

Landowner's Strategy	Laborer's Strategy (1)	(2)	(3) Laborer Defects
	A^*	$\hat{A}$	$\hat{A}'$
(1) Noncooperative Nash equilibrium:			
m^*, r^*, R^*	$Z^*, W^* = \overline{W}$		
(2) Cooperative-equivalent:			
$\hat{m}, \hat{r}, \hat{R}$		$\hat{Z}, \hat{W}$	$\hat{Z}', \hat{W}'$
(3) Landowner defects:			
$\overline{m}, \overline{r}, \hat{R}$		$\hat{Z}'', \hat{W}''$	

Notes: 1. Noncooperative (expectedly) enforceable contract: $(\overline{A}; \overline{m}, \overline{r}, \overline{R})$.

Laborer: $\overline{W}$.

Landowner: $\overline{Z} = EV[\overline{r} \cdot F(\overline{m}, \overline{A}) \cdot \theta + \overline{R} - P \cdot \overline{m} + \overline{I}]$.

2. Noncooperative, Nonenforceable Nash equilibrium: $(A^*; m^*, r^*, R^*)$.

Laborer: $W^* = \overline{W}$.

Landowner: $Z^* = EV[r^* \cdot F(m^*, A^*) \cdot \theta - P \cdot m^* + R + \overline{I}] < \overline{Z}$.

3. Cooperative contract, reference strategy: $(\hat{A} > \overline{A}; \hat{m} > \overline{m}, \hat{r} = \overline{r}, R = \overline{R})$.

Laborer: $\hat{W} = EU[(1 - \hat{r}) \cdot F(\hat{m}, \hat{A}) \cdot \theta - \overline{R}, \hat{A}] > \overline{W}$.

Landowner: $\hat{Z} = EV[\hat{r} \cdot F(\hat{m}, \hat{A}) \cdot \theta - P \cdot \hat{m} + \overline{R} + \overline{I}] < \overline{Z}, \hat{Z} > Z^*$.

4. Cooperative contract, laborer defaulting: $(\hat{A}'; \hat{m}, \hat{r}, \hat{R})$.

Laborer: $\hat{W}' = EU[(1 - \hat{r}) \cdot F(\hat{m}, \hat{A}') \cdot \theta - \overline{R}, \hat{A}'] > \hat{W}$.

Landowner: $\hat{Z}' = EV[\overline{r} \cdot F(\hat{m}, \hat{A}') \cdot \theta - P \cdot \hat{m} + \overline{R} + \overline{I}] < \hat{Z}$.

5. Cooperative contract, landownber defaulting: $(A; m, r, R)$.

Laborer: $\hat{W}'' = EU[(1 - \overline{r}) \cdot F(\overline{m}, \hat{A}) \cdot \theta - \overline{R}, \hat{A}] > \overline{W}$.

Landowner: $\hat{Z}'' = EV[\overline{r} \cdot F(\overline{m}, \hat{A}) \cdot \theta - P \cdot \hat{m} + \overline{R} + \overline{I}] > \overline{Z}$.

Table VIII

List of Variables for Estimation

Name of Variables	Description	Unit
Permanent labor	If farmer use permanent labor, = 1; Otherwise = 0	
Family size	Number of household members	Person
Female labor ratio	Ratio of female laborers to family laborers	
Family labor	Number of family laboeres	Person
Age	ln [60 – (age of household head)]^2	Year
Schooling	Total school years of hosehold head	Year
Remittance	ln (remittance from family members living apart)	Peso
Agricultural machinery	ln (owned tractor, thresher, and pump per planted area)	Peso
Rice price	ln (average price of rice traded)	Peso
Planted area	Total area of paddy field planted in one year	Hector
Fertilizer price	ln (normalized price of fertilizer computed as total fertilizer expenditure)	Peso/50 kg
Debt	ln (current outstanding debt)	Peso
Wage	ln (average wage of hired labor)	Peso
Direct seeding	Ratio of area where direct seeding was practiced	
Techinical efficiency	$e^{-E(u)}$: $E(u)$ is the expected value of farm specific inefficiency u	
Profit 1	Annual gross revenue from rice production minus total sum of fixed capital cost,[a] variable capital cost,[b] labor cost,[c] and land rent[d]	Peso
Profit 2	Profit 1 plus imputed income of family labor substituted for permanent labor	Peso

[a] The sum of flow costs of tractors, threshers, pumps, and draft animals.

[b] Total costs of chemical fertilizer, other chemical inputs, and seeds.

[c] The sum of labor costs, including all the payments for hired laborers and imputed family labor costs.

[d] The imputed land rent (in the case of owned land), the actual land rent (in the case of rented land).

Table IX

Estimation Results of Production Efficiency

Variable	Dependent Variable							
	Fixed Capital[a]		Variable Capital[b]		Labor[c]		Yield[d]	
Permanent labor	0.11	(1.72**)	1.22	(3.44*)	0.15	(2.82*)	0.43E–01	(1.41)
Age	–0.19E–01	(–1.40)	0.38E–01	(0.50)	–0.14E–01	(–1.19)	–0.31E–02	(–0.48)
Schooling	0.35E–02	(0.48)	–0.51E–01	(–1.26)	–0.14E–01	(–2.24**)	0.32E–02	(0.92)
Machinery	–0.13E–01	(–2.27**)	0.89E–03	(0.26E–01)	–0.66E–02	(–1.34)	0.39E–02	(1.42)
Debt	0.16E–01	(2.94*)	0.29E–02	(0.94E–01)	0.81E–02	(1.73**)	0.53E–02	(2.01**)
Area	–0.16	(–3.90*)	–0.52	(–2.41*)	–0.17	(–5.11*)	–0.86E–01	(–4.49*)
Rice price	0.84	(3.23*)	1.57	(1.12)	0.16E–01	(0.72E–01)	0.60	(4.92*)
Fertilizer price	0.19E–01	(0.56)	–0.25	(–0.22)	–0.43E–01	(–1.50)	0.15E–01	(0.95)
Wage	0.19	(2.48*)	–0.18	(–0.44)	–0.36	(–5.74*)	0.64E–01	(1.82**)
Direct seeding	–0.93E–01	(–1.30)	–0.41	(–1.06)	–0.39	(–6.52*)	–0.27E–02	(–0.82E–01)
Technical efficiency	–0.88	(–1.68**)	–0.24	(–0.88E–01)	0.50	(1.17)	4.97	(20.42*)
R^2	0.35		0.17		0.63		0.82	
Adjusted R^2	0.29		0.92E–01		0.60		0.80	
F-statistic	5.54*		2.13**		17.66*		46.79*	
No. of observations	124		124		124		124	

Note: Figures in parentheses refer to the t-statistic.

[a] ln (total flow costs of tractors, threshers, and draft animals).

[b] The total bags of all kinds of fertilizer inputs.

[c] ln (the sum of working days, including hired labor and family labor).

[d] ln (annual gross revenue from rice production per planted area).

* Significant at the 1 per cent level.

** Significant at the 5 per cent level.