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THE HOUSEHOLD RESPONSIBLITY SYSTEM REFORM IN CHINA: A PEASANT'S INSTITUTIONAL CHOICE

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ABSTRACT

Agricultural production in China has changed from the team based system to the household based system. It is argued in this paper that the main reason for this institutional change is the difficulty of monitoring in a team mainly engaging in agricultural production. The incentives to work in a team depend on how accurately labor input is monitored. Because of the nature of agricultural production, the optimum degree of monitoring is very low and thus the incentives to work are also very low in a production team. Under some simplified assumptions, it can be proved that the change from the team system to the household system is a Pareto-improvement. The empirical data on the diffusion of the household production system in each province are found to be consistent with the above theory and with the induced institutional innovation hypothesis.

Ever since 1978, the Chinese government has implemented a series of major reforms, including diversification of the rural economy, production specialization, crop selection in accordance with regional comparative advantage, expansion of free markets, and a marked rise in state procurement prices. These reforms have brought about dramatic changes in China's rural areas. However, the most important change was the emergence and eventual prevalence of the household responsibility system (HRS), which restores the individual household and replaces the production team system as the unit of production and accounting in rural areas.

After the chaos of the Cultural Revolution, China's moderate leaders started to reconsider China's rural policies. Although the government admitted that solving the labor management problems within production teams was the key to improving productivity and recommended measures to relate rewards to performance more closely, the HRS was considered the reverse of the socialist principle of collective farming and was prohibited (Editorial Board of China Agriculture Yearbook 1980, p. 58). The official position at that time maintained that the production team was to remain the basic unit of production, and accounting. Nevertheless, toward the end of 1978 first secretly and later with the blessing of local authorities, a small number of production teams in Anhui Province, which were located at regions where were frequently victimized by flood and drought, began to try out the system of contracting land, other resources, and output quotas to individual households. A year later these teams brought in yields far larger than those of other teams in the same region.[1] Seeing the remarkable effect, the central authorities conceded to the use of the HRS but required that this practice be restricted to the poor agricultural regions, namely, to hilly, mountainous areas and to poor teams in which people had lost confidence in the collective system. However, rich regions welcomed the HRS as enthusiastically as poor regions. It thus spread rapidly to many parts of China. Full official recognition of the HRS as universally acceptable was given in late 1981; at that time, 45.1% of production teams in China had already switched to this system (Jingjixue zhoubao). By the end of 1983, 94.2% of households in China's rural areas had adopted it (State Statistical Bureau 1984, p. 131). It is worth emphasizing that the HRS was worked out among farmers, initially without the knowledge and approval of the central government. It was not imposed by the central authority, unlike many other institutional changes that occurred in the last three decades. In short, the shift in the institution of farming evolved spontaneously. Thus, it should be useful to understand why, after more than two decades of collective farming, China's peasants have chosen the household-based farming system as soon as it has become a viable mode of production.[2]

The Hypothesis

The proposition I would like to advance here is that the voluntary choice of the HRS by the peasants in China's rural areas is a change which can be explained by the induced institutional innovation hypothesis ã la Hayami and Ruttan (chap. 4). The individual household farming system was precluded from the choice set of institutions in the past because of the government's position. The government's recognition of the losses involved with labor management in the production team system softened institutional rigidity and thus reduced the external costs of institutional innovation. The HRS, therefore, became a conceivable mode of production. However, whether it was viable to break down the original production team and adopt the HRS also depended on how easy it was to get consensus within the team. The shift from the team farming arrangement to the HRS caused tensions between the vested-interest team leaders as well as among team members; therefore, transaction costs, such as costs for negotiations, redefinition of each person's rights and obligations, and so forth, were required to get the consensus between various interest groups. For the new institution to be adopted, as Hayami and Ruttan postulated, it was necessary that gains to the innovators be large enough to offset the social costs involved in changing the relationships. The costs to get consensus should be smaller if it is easy to divide the team endowments and to parcel out the team obligations to the households. The costs should also be smaller when the merits of the new system have come to light through the performances of those households that have already adopted the new system. The severity of labor management problem might also be different in different production teams because of diversities in the production practices and other features across teams. Therefore, the gains in shifting to the new system should also be different among teams. It should be reasonable to assume that it is easier to get consensus if the gain is larger. The hypothesis that I would like to test here is the following: The diffusion of the HRS was faster in an area (a) where gains in productivity were larger, or (b) where costs of breaking down the teams were smaller, ceteris paribus. To test this hypothesis, it is, therefore, necessary to know what the sources of the productivity gains and the costs of changes were.

Sources of Productivity Gain

The main source of productivity gains from shifting to the HRS is changes in the incentive structure. Under the production team system, a peasant was awarded work points for each day's work. At the end of each year, the net team income, after deducting for tax, the public welfare fund, and distribution for basic needs, was distributed according to the work points that each peasant accumulated during the year. Work points were supposed to reflect the quantity and quality of effort that each member performed. Theoretically, the work point system is not inherently an inefficient incentive scheme. If the monitoring of each peasant's work is perfect, the incentives to work will be excessive instead of suboptimal. This is due to the fact that the return to a peasant's additional effort has two components. First, he will get a share of the increase in team output. Second, he will get a larger share of the total net team income, as now he contributes a larger share of total effort and thus has a larger share of work points. The former is itself insufficient to make him offer the optimal amount of effort, but the latter overcompensates as long as the average product per unit of effort is greater than the marginal product of effort. Since the relevant region of production, in general, is located at where the average product is greater than the marginal product, a peasant has incentives to overwork. On the other hand, if there is no monitoring of effort, a peasant will not get more work points for his additional contribution of effort. In this case, the return to his increase in effort has only one component, namely, a share of the increase in team output. The incentives to work are thus suboptimal. How much the increase in the work point share is for an additional unit of effort depends on the degree of monitoring. Therefore, the incentives to work in a production team are positively correlated with the degree of monitoring in the production process. The higher the degree of monitoring, the higher the incentives to work, and thus the more effort contributed.

However, monitoring is not costless. The management of the production team thus needs to balance the gain in productivity due to the increase in incentives and the rise in the costs of monitoring. Other things equal, the optimum degree of monitoring is higher (lower), if the effort is easier (harder) to monitor in the production process. Therefore, whether the incentives to work is high or low depends on how difficult it is to monitor effort in the production process. The difficulty of monitoring is affected by many factors. For example, the larger the size of a team, the harder it is to monitor each peasant's effort, ceteris paribus. The nature of production process, such as the spatial and time dimensions, also influences the supervisibility of effort.

The monitoring of agricultural operations is particularly difficult because of agricultural production's sequential nature and spatial dimension. In agricultural production, the process typically spans several months over several acres of land. Farming also requires peasants to shift from one kind of job to another throughout the production season. In general, the quality of work provided by a peasant does not become apparent until harvest time. Furthermore, it is impossible to determine each individual's contribution by simply observing the outputs because of the random impacts of nature on production. It is thus very costly to provide close monitoring of each peasant's effort contribution in agricultural production. Consequently, the optimum degree of monitoring in a team mainly engaging in agricultural production must be very low. The incremental income for an additional unit of effort will be only a small fraction of the marginal product of effort. Therefore, the incentives to work for peasants in a production team must also be low.[3]

In the HRS, the difficulty of monitoring does not exist. By definition, a peasant becomes the residual claimant. He does not need to divert resources to meter his own effort. The marginal return to his effort is the marginal product of effort. Although the economies of scale are sacrificed in the HRS, it has been proved, assuming there is no monitoring in the team system and given some other simplified assumptions, that the incentive structure in the HRS dominates that of the team system unless the coefficient of returns to scale is outrageous large, namely, higher than two; it has also been shown empirically that peasants contribute more effort to production in the HRS (Lin 1987). Under the same simplified assumption, it can also be proved that the change from the production team system to the HRS is a Pareto-improvement if the production function is concave with respect to all its arguments (see appendix). Therefore, the incentives to work are improved by shifting from the production team system to the HRS. Peasants feel happier and contribute more effort to production in the HRS. Agricultural productivity thus jumps. The improvement in the incentive structure represents the major source of gain in this institutional change.

<u>Estimates of the Diffusion of HRS</u>

In this section an attempt is made to test the hypothesis of this paper. The HRS did not emerge as a significant factor until 1980. Only 14.4% of production teams in China adopted the HRS by December 1981

(Jingjixue zhoubao). By the end of 1983, 97.9% of production teams had been converted to the new system of farming. The data I have concerning the diffusions of the HRS are the ratio of teams to total team in each of the 29 provinces in China that had adopted the HRS documented in August 1981 and at the end of 1982 and 1983.

As postulated, the diffusion of the HRS in each area is an endogenous variable that would be faster in an area where the benefits from shifting to the new system were larger or where the costs of breaking down the original team were smaller. The average size of production teams, and the ratio of the gross output value of crop cultivation to the gross value of animal husbandry in each provinces are used as the proxies for the gains of this institutional change. For the costs, the proxies are the average number of machinery, and draft animals per team in each province.

The theory discussed in the last section indicates that the more difficult it is to monitor labor input in the original production team, the larger will be the improvement in incentives and, therefore, the gains from shifting to the HRS. Other things being equal, the larger the size of membership in a team, the harder it is to monitor. Hence, the size of a team is expected to have a positive effect on the diffusion of HRS. The ratio of the gross value of crop cultivation to the gross value of husbandry is also expected to have a positive effect on the diffusion. Due to its returns to scale is limited and monitoring is extremely difficult, most animal husbandry was produced by individual households even before the HRS. For example, a major component of husbandry in China is pigraising. The value of pork alone consisted of 53% of the gross output value of husbandry in 1983 (Editorial Board of China Agriculture Yearbook

1984, pp. 79, 110, 174). Most hogs have always been raised privately. Therefore, for an area, the more important crop cultivation was compared to husbandry, the more severe was the labor management problem in its production. The gains of adopting the HRS were thus larger.

The average number of machinery per team and the average number of draft animals per team are proxies for the degree of difficulty in breaking down a production team. Among all the agricultural inputs, machinery is least divisible. Therefore, if a production team heavily relied on machinery for its production, it would be difficult to break down the production into household-based operations. The effect of the average number of machinery per team on the diffusion of HRS should be negative. On the other hand, the average number of draft animals per team should have a positive effect on the diffusion. In general, draft animals are suitable for household-based operations.

To be precise, the empirical equation that I will estimate is

$$RT = C + \alpha_1 N + \alpha_2 RATCH + \alpha_3 MACH + \alpha_4 DRAFT + (\alpha_5 Y1 + \alpha_6 Y2) + \mu,$$

where RT is the ratio of teams to total teams in each province that adopted the HRS in each year. C is a constant term. N is the average number of agricultural workers per team. RATCH is the ratio of gross output value of crop cultivation and that of husbandry in each province. MACH is the average total horsepower per team of equipment used in farming, forestry, husbandry, fisheries, and household handicraft production. But machinery used in village-run industry, construction, and nonagricultural transportation are excluded. DRAFT is the average number of draft animals per team. Y1 and Y2 are year dummies. μ is the stochastic residual component which consists of elements that are related to the diffusion of HRS in an area but are unobservable to econometrician. One of such unobservable factors is the region-specific potential of returns to scale in its production process. If the potential returns to scale are large, the sacrifice in changing from the team system to the HRS is also large; hence, the diffusion of HRS should be slower in that area.

The size of a team, the numbers of machinery, and of draft animals in a team are themselves choice variables. The decisions about the size of a team and about the usage of machinery or draft animals in a team were responsive to the potential of returns to scale in the production process. These three regressors are thus not uncorrelated with the residual term. Therefore, ordinary least squares regression methods will not yield consistent estimates of the parameters of the diffusion functions. Consistent estimates can be obtained by first estimating N, MACH, and DRAFT with variables that are correlated with these regressors but are uncorrelated with the residual component, then by using the fitted values of N, MACH, and DRAFT, together with RATCH, in estimating the diffusion function. The instrumental variables that are used in the two-stage least squares regressions to estimate the endogenous regressors include cultivated land per worker, the ratio of irrigated land to total cultivated land, multiple cropping index, the ratio of urban population to rural population, and population density.

For comparison purpose, table 1 reports the estimates both by the ordinary least squares regressions (OLS) and by the two-stage least squares regressions (2SLS). In both methods, the diffusion function is first estimated for 1981, 1982, and 1983, respectively. Then the yearly data are pooled together, and the coefficients are estimated again with two year dummies. Both the coefficients and the absolute value of the t-statistics of the coefficients (in parentheses) are presented. The $\overline{R}^2$ has been adjusted for the degrees of freedom.

In both the OLS and 2SLS, the estimates of coefficients and associated t-statistics show, as expected, that DRAFT had a significantly positive effect and that MACH had a significantly negative effect on each province's rates of HRS adoption. These findings confirm the hypothesis that in an area the easier it was to dismantle production teams, the faster the HRS was adopted. The estimated coefficients of RATCH, in both the OLS and 2SLS, all have the right sign, as expected. All the fitted values in the 2SLS are also significantly different from zero. They are also significantly different from zero in the OLS except in the equation of 81. These evidences are thus consistent with the hypothesis that the higher the ratio of cropping to husbandry in an area, the larger the gains of this institutional innovation and, therefore, the faster the rate of diffusion of HRS. Nevertheless, the OLS and 2SLS estimates differ substantially for the coefficient of the average size of a team, N. In the OLS estimates, N did not seem to have any effect on the rate of adoption in an area. All the estimated coefficients are not significantly different from zero, and their values alternate in sign. On the contrary, the coefficients all have the expected positive sign and are significantly different from zero in the equations of 82 and 81-83. 2SLS estimates indicate, as the theory postulates, that the larger the average size of teams was in a province, the faster was the diffusion of HRS in that province. This evidence supports the theory that the larger the size of a team is, the harder is monitoring, and thus the greater are gains from shifting to the HRS. The substantive differences between the OLS and 2SLS estimates also suggests that peasants did response to differences in the returns to scale in the production process in their choice of team size.

Concluding Remarks

Considering the crudeness of the data, the explanatory powers of the regressors are surprisingly satisfactory. Even though, in 1983, 97.9% of production teams in China had already adopted the HRS, the regressors still explain 36% of variation in the rates of adoption among different provinces in the 2SLS. This evidence strongly indicates that the emergence of the HRS and its diffusion process can be understood under the induced institutional innovation framework. The estimated values and their associated t-statistics for N and RATCH in 2SLS are also consistent with the theory that the source of gains from shifting to the HRS is the improvement in the incentive structure with the household-based farming system when monitoring is difficult with the team system.

Due to the difficulty of monitoring in agriculture, a household-based mode of production is more efficient than team production. In the past the household-based system was precluded because of the government's position. However, peasants in China, like peasants in any other country, respond to the opportunities available to them in an efficient way and make themselves better off. They chose to be idle in the past not because they were born lazy but only because it did not pay for them to work harder. Give them efficient incentives and opportunities, and the peasants in a socialist country will also "turn sand into gold" (Schultz, p. 5).

Table 1

Estimates of the Rates of Diffusion of HRS

Independent Variable	Rate of Diffusion							
	OLS				2SLS			
	81	82	83	81-83	81	82	83	81-83
Constant	1.09	.94	1.51	.99	-.51	-.99	.91	-.58
	(1.20)	(1.27)	(3.58)	(2.22)	(.32)	(.71)	(1.19)	(.68)
N*	-.04	.14	-.12	-.03	.41	.71	.07	.43
	(.17)	(.65)	(.93)	(.24)	(.88)	(1.78)[b]	(.29)	(1.72)[b]
RATCH	.03	.07	.01	.03	.06	.10	.02	.06
	(1.06)	(2.88)[c]	(1.37)[a]	(2.62)[c]	(1.57)[a]	(3.23)[c]	(1.71)[b]	(3.35)[c]
MACH*	-.24	-.33	-.07	-.21	-.32	-.47	-.11	-.31
	(3.33)[c]	(5.88)[c]	(2.04)[b]	(5.95)[c]	(2.84)[c]	(5.13)[c]	(2.04)[b]	(5.24)[c]
DRAFT*	.11	.09	.04	.08	.10	.09	.04	.02
	(2.78)[c]	(2.77)[c]	(2.38)[b]	(3.99)[c]	(2.40)[b]	(2.54)[c]	(2.01)[b]	(3.27)[c]
Y1				.31				.32
				(7.14)[c]				(6.93)[c]
Y2				.57				.55
				(12.79)[c]				(11.99)[c]
$\bar{R}^2$	.51	.71	.41	.74	.44	.62	.36	.70

Note: Numbers in parentheses are the absolute value of t-statistics. [a], [b], and [c] indicate that the estimated value is significantly different from zero in one-tailed tests at the 10%, 5% and 1% level of confidence, respectively. * indicates endogenous variable. N, MACH, and DRAFT are logarithms of original values. The data on RT are provided by the Research Center for Rural Development of the State Council of China. All the other data are taken from China Agriculture Yearbook, 1982-1984.

Appendix

In this appendix I attempt to prove that the shift to the HRS is a Pareto-improvement. I shall not attempt to deal with the general problem. Instead, I shall assume that each peasant is identical in preference and is bestowed with the same amount of endowment (say land, t) in addition to their effort, e. The utility index for a peasant is assumed to be

$$U_i = I_i - e_i, \quad i = 1, \ldots, N,$$

where I_i is income for peasant i. The production function is assumed to be of general Cobb-Douglas type. In the HRS, the income for a peasant is

$$I = e^a t^b.$$

Subscriptions will be suppressed when there is no confusion. The income for peasant i in the team system when no supervision exists is

$$I_i = 1/N \,.\, E^a \,.\, (Nt)^b, \quad E = e_1 + \ldots + e_N.$$

<u>Proposition</u>--When there is no monitoring, the change from the team system to the HRS is a Pareto-improvement if the production function is concave with respective to all its arguments.

<u>Proof</u>: The optimum effort supply in the HRS is

$$e = (at^b)^{1/(1-a)}.$$

The optimum effort supply in a team, in Nash equilibrium, is

$$e = N^{(a+b-2)/(1-a)} \,.\, (at^b)^{1/(1-a)}.$$

Substituting the optimum effort supplies into the utility function, denoting the utility index as U_h under the HRS and as U_t under the team system, dividing U_t with U_h, and collecting terms, we get

$$(1) \quad U_t/U_h = [N^{(b-1)/(1-a)} - a]/(1 - a).$$

If the production function is concave with respect to t and e, then b, a < 1. Therefore, (1) < 1. Q. E. D.

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Footnotes

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[1]Chuxian County in Chuxian Prefecture, Anhui Province, reported a 12.5% increase in grain output, whereas production teams in Chuxian County that used the household responsibility system increased grain output by 35.7%. Similarly, the ratio of increase in grain output was 12.4% against 35.7% in Quanjiao County, 0.7% against 37.1% in Laian County, and 0.3% against 31.0% in Jiashan County, all of the same prefecture (Chen 1981a, p. 100).

[2]It was found recently that a village in Guizhou Province had adopted this practice secretly for more than 10 years before the recent reform. The villagers did not admit it until the new policy was announced (Du, p.15).

[3]In a production team, the supply of effort also depends on the peer pressure because of its income-sharing property. For a formal model of the impacts of income-sharing property on the incentives to work and the labor supply, see Lin (1986).