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Tenure, land rights, and farmer investment incentives in China

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Abstract

The goal of this paper is to understand the nature of the property rights associated with China's land tenure systems and to study the impact of these property rights on agricultural production efficiency. The results show that land tenure and associated property rights in rural China affect the production behavior of farmers. The most robust finding is that the right to use land for long periods of time encourages the use of land-saving investments. While the results show that land tenure affects agricultural production decisions, the difference between collective and private plots, however, is small compared to the private plot-communal productivity gap that existed in the pre-reform period. © 1998 Elsevier Science B.V. All rights reserved.

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1. Introduction

Although poor land tenure has been blamed for the relatively slow growth of agriculture since mid-1980s (e.g., Wen, 1989, 1995), policy makers have largely ignored calls for further reform (Johnson, 1995). This policy inaction, however, is not due to the lack of importance attached to the organization of land in the agricultural sector. In recent years a debate has raged over land tenure regulations and the government's commitment to defining a national set of property rights for the rural economy's scarcest resource.

Scholars have taken both sides of the argument. Some say that land tenure is one of the areas most in need of reform in the rural sector (Wen, 1995; Yao, 1995; Zhou, 1994; Johnson, 1995). Insecure land tenure arises from frequent reallocation by local leaders of collective land used by farmers and a plethora of local rules and regulations restricting its use. The uncertainty in land tenure weakens farmer investment incentive in the land, especially in longer-term, land-saving investments (Wen, 1995; Yao, 1995). Poorly defined land rights also may indirectly reduce production since farmers may be unable to access credit without the use of their land for collateral (Besley, 1995). Another link between rights and land investment comes via enhanced possibilities for gains from trade: investment may be encouraged if improved transfer rights make it easier for individuals to rent land.

Another group of scholars, however, suggests that the inefficiencies are not so great and that even farmers are not in favor of tenure reform (Kung, 1995). Low farm gate prices and other factors, not land tenure, have caused sagging productivity. Missing land mar-

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kets, weak credit systems, and other incomplete markets would make privatization of land inefficient and socially dangerous (Dong, 1995).

Given the vitriolic nature of this debate, and the polarization of the views on this matter, it may be surprising that so little empirical research has focused on sorting out the important issues. Much of the available research is based on secondary data that were collected for purposes other than studying land tenure (except for Kung, 1995; Kung and Liu, 1996; Yao, 1995). Data sets are incomplete and cannot test important questions. In some works, much of the institutional richness is lost in favor of theoretical abstraction. No published study has tested for the presence of inefficiency caused by China's land tenure system.

The goal of this paper is to understand the nature of the property rights associated with China's land tenure systems and to study the impact of these property rights on agricultural production efficiency. To meet this general goal, the study will pursue two specific objectives. First, the study will show how farmers use of the land differs according to the tenure regime and the associated property rights. Second, the study will measure the impact of tenure and certain key property rights on the production efficiency of the land.

2. China's land tenure system

Land in most villages can be divided into two types: private plots (ziliudi) and collectively controlled land (jitidi). During the collective period when communes controlled the nation's agricultural production, farmers still managed their own private plots. In most villages, leaders did not intervene into decisions on private plots; farmers had rights to the residual production, could swap plots with other farmers, and enjoyed a fairly high degree of security (i.e., leaders rarely adjusted the holdings of private plots). Although many intervillage differences exist, private plots largely have remained in the possession of the original families since the early 1960s (and have been allocated to new families in the 1970s and early 1980s). Interviews by the authors revealed that many farmers in villages across China treat their land as if it were their own (Li, 1997).

Village officials control the rest of China's cultivated land. After the implementation of the household responsibility system (HRS), local leaders allocated 93.8% of the land to the farmers (the other 6.2% being in private plots – Table 1). Some land went to farmers solely to meet household subsistence requirements (ration land – kouliangtian). Other land went to households on the condition that farmers would deliver low-priced quota grain and cotton to the state (responsibility land – zerentian). Leaders also auctioned the rights of other land for a fee (contract land – chengbaodi). Unlike the picture portrayed by some (e.g., Prosterman et al., 1996), land allocation schemes are not homogenous across China's provinces or regions. Upper level officials mostly have left the details of land allocation to the localities, and the rules of allocation and regulations controlling use of collective land vary widely from village to village (Li, 1997). It is the nature of this allocation process that makes tenure relations in China's villages so complicated.

A detailed field survey of more than 200 randomly selected villages in eight provinces by the authors and an independent enumeration by the State Statistical

Table 1
Structure and incidence of different land tenure types in China

	Private plots	Responsibility land	Ration land	Contract land
Share in total farmland area (%)				
State statistic bureau's (SSB) survey[a] (n=274)	6.2	84.5	8.4	—
Our national village survey[b] (n=184)	6.2	80.8	7.4	4.2
Incidence of different tenure types (%)				
State statistic bureau's (SSB) survey[a] (n=274)	—	—	23.0	—
Our national village survey[b] (n=184)	55.7	90.2	17.5	30.6

[a]Adopted from Cheng and Tsang, 1995, 1996.
[b]Author's field survey (Data from 1995).

Bureau (reported in Cheng and Tsang, 1995, 1996) demonstrated that land tenure forms and the rights associated with each tenure type differ sharply among villages (Table 1). Whereas most villages have responsibility land (more than 90%), only 17.5% have ration land, and only 30.6% have contract land. The distribution across provinces also varies.

Rights governing the most prevalent tenure form, responsibility land, also differ among regions and villages. For example, in 65% of the authors' sample villages, leaders have taken back part of the land and reallocated it among the village's farmers (some villages have done so a number of times). In contrast, leaders in 35% of the villages have not carried out any land 'adjustments' and farmers have enjoyed relatively secure rights on their collectively allocated responsibility land (Li, 1997).

For those interested in measuring the impact of tenure forms and land rights on farm productivity, the complexities of China's land allocation system and intervillage heterogeneity actually provides an opportunity to: (a) identify the effects of moving from collectively allocated land to a system more akin to private holdings; and (b) to measure the impact of specific land rights, in this case the security of holdings. To test the first precept, one can analyze if farmers cultivate private plots differently from responsibility plots. Even though only 6.2% of China's land is farmed as private plots, the way that farmers historically have viewed these plots means that they can be used as a paradigm of how farmers might use their land if all of it were given to them with rights equivalent to those associated with private plots. To test the second idea, an index of tenure security for each plot is needed for measuring whether or not the use of land by farmers depends on land security.

3. Property rights and production efficiency in rural China

To study the impact of the organization of land relations on production behavior, a survey of 130 farmers in five north China villages in Fengning County, Hebei Province was carried out. The survey team enumerated the land holdings of each farm household on a plot by plot basis. The land tenure status and property rights of each plot were identified. Whenever possible, the enumeration team supervisor chose two plots from each household, one a private plot, the other a responsibility plot. Enumerators completely surveyed all inputs and outputs of these plots, including information about the quality of the land. An effort was made to choose plots that were producing the same crop. In all, 80 households in the sample planted both their private plot and at least one of their collective plots in maize and it is this subsample that is used in the paper.

Based on the survey work, private plots appear to have higher yields and receive more inputs than collective plots. Private plots produced 717 kg ha^{-1} more than collective plots, about 13% higher on average (Table 2). Similar results occurred in each of the sample villages (not shown in table). While these findings may point to a difference in productivity based on land tenure form, such differences between

Table 2
Differences in production and input intensity of sample maize farmers on private plots and collective plots

	(1) Private plots[a]	(2) Collective land[b]	(3) Absolute difference (1)−(2)	(4) Percentage difference [(1)−(2)]/(2)
Yields (kg/ha)	6169	5452	717	13
Labor (day/ha)	244.5	207	37.5	18
Organic fertilizer (m^3/ha)	75	57	18	32
Chemical fertilizer (kg/ha)	667.5	578.4	89.1	15
Animal traction (day/ha)	60	52.5	7.5	14
Phosphate (kg/ha)	50.4	42	8.4	20

[a]Private plots refers to land allocated by collective without procurement quota, without agricultural tax, and which is not subject to reallocation.
[b]Collective plots refers to land which is allocated by collective with procurement quota and agricultural tax, subject to frequent reallocation.

private and collective plots is small when compared to the gaps that existed in the pre-reform period (Mead, 1995).

Part of the reason for the difference in output may be that farmers used inputs more intensively on private plots (Table 2). Farmers applied somewhat more labor (18%), nitrogen fertilizer (15%), animal traction (14%), organic manure (32%), and phosphates (20%). Organic manure and phosphates, the two inputs which each have the characteristic of being a more long term investment, are the most under-utilized on collective land.

Several other factors, however, must be considered before concluding if and how land tenure affects production behavior. First, Table 2 contains only a pair-wise comparisons without holding all other things constant. If the land of private plots is of a higher quality than that of the collective plots, some differences between input intensities may be due to land quality and not the property rights associated with the tenure regime. Input intensity may also differ due to the location of the plot. A more convincing analysis would isolate the land tenure effect with regression analysis, an exercise conducted below.

In fact, Table 3 contains evidence that the difference in yield and input intensity could arise from either land use rights or the quality of private and collective plots. On average, farmers have cultivated private plots for 21 years and their collective plots for 9 years. While significantly shorter than the length tenure for private plots and certainly less than the 15 years tenure period that farmers had been promised, the length of tenure of each plot demonstrates that the reallocation of land in the sample village may be less pervasive and infrequent than is sometimes implied by critics of China land tenure system. There is considerable variation, however, among villages (Table 3). For example, farmers in Village 5 have farmed their collective land plots for an average of only 6 years, about half the average time period of farmers in Village 2.

Besides land tenure, land quality also could have caused the observed differences in yields and input intensity between private and collective plots. On average, private plots in the village sample were of slightly higher quality land than collective plots (Table 3). More than 80% of farmers in the sample rated their private plots as 'number 1' quality land (the highest quality in a village). These same farmers only rated 65% of their collective plots 'number 1' quality plots. In some villages, however, the reverse was true (e.g. Village 4). Differential input levels also could be due to differences in the distances between the different plots. On average, collective plots were 33% farther away from the household that private plots (Table 3). It may be that the higher quality of the private plot and greater convenience of farming it have created part of the difference in input intensity and output. Based on these observations, analysis of the impact of land tenure and rights on productivity needs to account for both the land rights differences and land quality variations among plots.

Table 3
Differences in characteristics of private plots and collective plots cultivated by sample maize farmers

	Length of tenture[a] (year)		Land quality[b] (%)		Distance from home (km)	
	Private plots[c]	Collective plots[d]	Private plots	Collective plots	Private plots	Collective plots
Total	21	9	84	65	0.5	0.75
Village 1	19	10	76	48	0.55	0.83
Village 2	20	11	100	67	0.65	1
Village 3	22	7	88	65	0.43	0.55
Village 4	22	8	87	93	0.35	0.4
Village 5	22	6	71	71	0.6	1.21

[a]Length of tenure refers to how the farmer has cultivated the land since he got the plot.
[b]Land quality refers the proportion of plots of first class land in a group of land with same land tenure type.
[c]Private plots refers to land allocated by collective without procurement quota, without agricultural tax, and which is not subject to reallocation.
[d]Collective plots refers to land which is allocated by collective with procurement quota and agricultural tax, subject to frequent reallocation.

4. Testing the impact of property rights on productivity

Following Shaban (1987), the approach used in this study is to measure the impact of land tenure and property rights on observed differences in the input intensity applied by farmers to their private and collective plots, holding constant the influence of household characteristics and land quality. Because a specific land tenure form often consists of a bundle of property rights, the effects of some of the components (or specific rights) of the land tenure can be separately identified. Input intensities for private and collective plots can be described by the equations

$$x_i^{\mathrm{p}} = \alpha_0 + \sum_{j=1}^{J} \gamma_{ji} R_j^{\mathrm{p}} + \sum_{m=1}^{M} \beta_{mi} D_m^{\mathrm{p}} + g_i(Z) + \varepsilon_i \quad (1)$$

$$x_i^{\mathrm{c}} = \alpha_0 + \sum_{j=1}^{J} \gamma_{ji} R_j^{\mathrm{c}} + \sum_{m=1}^{M} \beta_{mi} D_m^{\mathrm{c}} + g_i(Z) + \eta_i \quad (2)$$

where x is input intensity, i represents ith input, superscript p and c stand for private plots and collectively-allocated plots; α_0 is a constant, R_j is an approximation of jth property rights, for example, the security of ones land use rights (or tenure); D_m is mth plot-specific characteristics, such as distance from home, soil quality and a dummy variable to stand for whether the plot is irrigated or not; $g_i(Z)$ represents a set of effects of household characteristics, that have identical effects on the choice of input intensity on private and collectively-allocated plots; ε and η are error terms.

To eliminate the need to account for the numerous, difficult-to-measure household characteristics which could affect input intensity (e.g. a household capital constraint, or farmer's management ability), one can subtract Eq. (1) from Eq. (2) and derive the following equation

$$\Delta x_i = \sum_{j=1}^{J} \gamma_{ji}(R_j^{\mathrm{p}} - R_j^{\mathrm{c}}) + \sum_{m} \beta_{mi}(D_m^{\mathrm{p}} - D_m^{\mathrm{c}}) + \nu_i \quad (3)$$

where the left-hand side of Eq. (3) measures the difference in input intensity between the plots of a single farmer. In the equation, γ_{ji} captures the effects of property rights R_j, on input intensity. However, if the farmer has the same rights on both private and collectively allocated plot, this effect would disappear in the difference step Eq. (3). Only the impact of differences in property rights would be expected to affect differences in input intensity. If data limitations preclude explicitly delineating all property rights that make up each tenure regime's bundle of rights, a constant term could be added to Eq. (3) to measure the contribution to input intensity differences caused by the land tenure net of those explained by the included R's. β_m measures the impact of difference in land quality.

To empirically test the impact of tenure and land rights on production behavior, Eq. (3) is specified with the differences in intensity of five inputs. The equation to be estimated is

$$\Delta x_i = \gamma_i + \gamma_2 \Delta R + \beta(\Delta D_1) + \beta_2(\Delta D_2) + \mu_i \quad (4)$$

where the dependent variable (Δx_i) is a function the differences in plot-specific land rights and quality. Because of data limitations, only one land rights variable is explicitly included – the security of claim to a piece of farm land (ΔR). The difference in security of land use rights between private and collective plots is proxied by a variable measuring the difference in length of time that the two plots have been cultivated by the farmer. The remaining variations in input intensity arising from differences in rights associated with private and responsibility plots are accounted for by γ_1 The variable ΔD_1 measures differences in quality of a farmer's private and collective plot; ΔD_2 accounts for the differences in the distance of the plots from the household; and μ_i is the error term.

5. Data

Using data from the household survey in northeast China (described earlier), the differences in the input intensity between private and collective plots for five inputs – labor, nitrogen fertilizer, animal traction, organic manure, and phosphates – are used in the subsequent analysis. Labor is enumerated in days and includes all labor input on each plot by the household during the 1994 maize season. Chemical fertilizer application is converted into pure nitrogen and phosphate equivalents. Animal traction includes the number of days a farmer uses his/her own or hired bullocks

for plowing, transport, and threshing. The application of organic manure is enumerated in cubic meters.

The 'length of tenure' variable is computed as the difference in the length of the time that the family has cultivated each plot. Land quality is estimated as a subjective measure of the quality of the land (either number 1 – best; number 2 – medium; or number 3 – poor). Within a village, farmers have no trouble specifying land quality in these terms since this is the standard way of referring to land quality. The difference in land quality is measured as the difference between two dummy variables where the variable takes on value of 1 when the land quality is 1, and 0 otherwise (hence the variable can take on three values: −1, 0 or 1). The distance between the house and each plot is measured in kilometers.

6. Results

Because the error term, μ_i, in the difference equation for each of the five inputs in Eq. (4) may be correlated, a seemingly unrelated regressions estimator was used. The goodness of fit measure for the equations averages 0.21 and range from 0.06 to 0.36.

The results of the equation illustrate that property rights of collectively-allocated plots primarily have affected long term – not short term – production efficiency (Table 4). The amount of labor, nitrogen fertilizer, and animal traction applied on private and collective plots by sample farmers were indistinguishable in a statistical sense (see the high standard error on the constant in the first three equations). The differences in the length of time that farmers have cultivated the plots also does not account for the differences in the use of these three inputs (see the low t-ratios on the land-use security variable. This perhaps is understandable since if the farmer receives the full residual output from a plot, regardless of the long-term security of the land, there is no reason why a farmer should not follow profit maximization rules when allocating current inputs that mainly affect the output of the current year's crop.

Tenure security (as represented by the difference in the length of tenure of a plot), however, does affect the amount of organic manure and phosphate fertilizer (Table 4). For every year that tenure has been reduced by China's uncertain system of collective land organization, organic manure use falls by 0.07 m^3 and phosphate use decreases by 0.05 kg. These declines mean that for each year the length of time farmers have controlled a plot of land differs, they are using about 1.5% less organic manure and phosphate fertilizer. Since the mean difference in length of tenure between private plots and collective plots is on average 12 years, this means that, ceteris paribus, had the farmer's rights over long term land use of collective plots been as secure as those enjoyed by private plots, farmers would have been using 18% more organic manure and phosphate fertilizer. Insecurity to the farmer means that in long run he/she may not be able to use his/her land and this is undermining the incentive to invest in these land saving activities.

One potential problem with the results in Table 4 arises from the measure of tenure insecurity. Since the security index measures the length of time that the

Table 4
Seemingly unrelated regression results (without village effects) testing the impact of land tenure and property rights on input intensity in sample villages, 1995

	Dependent variable[a]				
Independent variables	Labor	Nitrogen fertilizer	Animal traction	Organic manure	Phosphate fertilizer
Constant[b]	1.17 (1.08)	2.13 (0.39)	0.39 (1.22)	0.33 (0.82)	0.26 (0.63)
Length of tenure	0.09 (1.38)	0.30 (0.90)	−0.01 (−0.05)	0.07** (2.67)	0.05* (1.98)
Land quality	−0.80 (−0.55)	5.07 (0.69)	−0.52 (−1.23)	−0.30 (−0.55)	−1.50** (−2.71)
Distance from home	−0.01 (−0.01)	−8.35 (−1.26)	−0.16 (−0.42)	0.03 (0.07)	0.97* (1.97)

[a]Dependent and independent variables measured as per μ differences in input of factors between private plots (ziliudi) and collective plots (zerentian).

[b]Constant measures the impact of land tenure on input intensity. Positive sign means more of factor applied to private plot.

t-statistics are in parentheses.

* and ** denote coefficients significant at 5% and 1% level of confidence according to standard t-ratio tests.

farmer has used a piece of land in the past, it may not necessarily be an ideal measure of a farmer's future expectation of land security. It could be that the length of time that has elapsed since the previous reallocation is correlated with greater insecurity. To alleviate this problem, an additional dummy variable is added to the original specification (used in Table 4). The new variable (END95) takes on the value 1 if the farmer knows that the currently cultivated responsibility plot will be taken back at the end of the current crop year; and 0 if not.

By adding this variable, the results reported above are still true if anything reinforced (Table 5). As expected, the coefficient on the new dummy variable is positive in all of the equations (and significant in the organic manure and animal traction equation). If farmers know the contract is expiring in the next calendar year, they would apply less organic manure which would widen the gap between private and responsibility plots. With this effect controlled for, the impact of land insecurity is the same as before. Differences in security still affect the intensity of organic manure and phosphate use. The longer the time that a farmer has cultivated his plot, the more intensely he/she will use land saving inputs.

When including village fixed effects (which allows for the identification of the impact on input intensity of each village's land rights differences), the impact of the land security variable on organic manure and phosphate fertilizer input use also is nearly the same as in the case without village fixed effects (Table 6). More interestingly, land management variations among the villages point to the importance of other land rights. For example, in one village, because leaders reallocate procurement quotas based on yields of responsibility plots, different 'rights to the residual' in the village may be affecting the way farmers manage private and collective plots. The significant signs on the intercept in columns 1 and 2 mean that farmers in village 5 (the omitted village) applied substantially less labor and nitrogen on their collective plots when compared to their private plots, a result observed by Lin (1993) in Hunan Province rice growing regions in the early 1980s. The implied intercept (and hence 'tenure effect') of the other villages which do not have a ratcheting quota policy is close to zero.

7. Conclusions

This paper has provided evidence that land tenure and associated property rights in rural China affect the production behavior of farmers. By far the strongest, most robust finding is that the right to use land for long (or indefinite) periods of time encourages the use of land-saving investments. Long-term use rights, however, do not appear to affect the incentive of farmers to use short-term, current inputs. In individual villages, farmer investment behavior did appear to be affected by other factors, such as the form of the quota (i.e., the rights to the residual).

But while the results clearly show that land tenure affects agricultural production decisions, it remains to

Table 5
Seemingly unrelated regression results (without village effects) testing the impact of land tenure and property rights (includes nD95) on input intensity in sample villages, 1995

Independent variables	Dependent variable[a]				
	Labor	Nitrogen fertilizer	Animal traction	Organic manure	Phosphate fertilizer
Constant[b]	0.18 (0.15)	−1.41 (−0.22)	−0.01 (−0.01)	−0.33 (−0.74)	0.24 (0.50)
Length of tenure	0.08 (1.25)	0.27 (0.80)	−0.01 (−0.24)	0.06** (2.52)	0.05* (1.95)
Contract end in 1995 (END95)	2.27 (1.54)	8.12 (1.08)	0.89* (2.10)	1.53** (2.85)	0.04 (0.08)
Land quality	0.03 (0.02)	8.05 (1.02)	−0.20 (−0.44)	0.26 (0.46)	−1.48* (−2.49)
Distance from home	−0.34 (−0.26)	−9.54 (−1.42)	−0.29 (−0.77)	−0.19 (−0.40)	0.97* (1.95)

[a]Dependent and independent variables measured as per μ differences in input of factors between private plots (ziliudi) and collective plots (zerentian).
[b]Constant measures the impact of land tenure on input intensity. Positive sign means more of factor applied to private plot.
t-statistics are in parentheses.
* and ** denote coefficients significant at 5% and 1% level of confidence according to standard *t*-ratio tests.

Table 6
Seemingly unrelated regression results (with village effects) testing the impact of land tenure and property rights on input intensity in sample villages, 1995

Independent variables	Dependent variable[a]				
	Labor	Nitrogen fertilizer	Animal traction	Organic manure	Phosphate fertilizer
Constant[b]	8.19** (3.03)	67.95** (5.69)	0.72 (0.87)	−1.00 (−0.95)	−0.35 (−0.33)
Length of tenure	0.07 (0.99)	0.02 (0.08)	−0.01 (−0.23)	0.06* (2.28)	0.06* (2.02)
Land quality	0.05 (0.03)	11.00 (1.66)	−0.36 (−0.77)	−0.30 (−0.52)	−1.43* (−2.39)
Distance from home	0.61 (0.46)	−2.43 (−0.41)	−0.22 (−0.54)	−0.30 (−0.58)	0.94 (1.75)
Village 1	−6.90** (−2.55)	−68.44** (−5.72)	−0.28 (−0.33)	1.31 (1.24)	0.62 (0.58)
Village 2	−8.51** (−2.86)	−70.19** (−5.33)	−0.94 (−1.02)	0.70 (0.60)	0.64 (0.54)
Village 3	−8.26** (−2.91)	−67.13** (−5.35)	−0.46 (−0.52)	2.10* (1.96)	0.04 (0.04)
Village 4	−6.09* (−2.11)	−63.03** (−4.94)	0.03 (0.89)	1.49 (1.33)	0.99 (0.86)

[a] Dependent and independent variables measured as per μ differences in input of factors between private plots (ziliudi) and collective plots (zerentian).
[b] Constant measures the impact of land tenure on input intensity. Positive sign means more of factor applied to private plot.
t-statistics are in parentheses.
* and ** denote coefficients significant at 5% and 1% level of confidence according to standard *t*-ratio tests.

be proven how serious the problem is. The difference between private and responsibility plots is small compared to the private plot-communal land productivity gap that existed in the pre-reform period (Mead, 1995). The differences in the use of certain inputs also is small compared to the degree of Marshallian inefficiency measured by Shaban (1987) between crops grown on owner-cultivated plots and sharecropped plots in India. In the case of organic manure, the input most affected by land insecurity, if responsibility land were turned into private plots, the gains in yields from the resulting increase in organic manure use would probably be minimal (given the small output elasticities of current inputs commonly found in most production function analyses in China and elsewhere in Asia (Widawsky, 1996).

If such small differentials are indicative of the case across China, it may be that the cost of China's current land tenure policy is modest in terms of inefficiency. Other writers have suggested that China's current land system provides other benefits to farmers (such as insurance against economic fluctuations and periodic recessions in the off farm job market – Dong, 1998). It may be that the benefits of having 'insurance' provided by the having land under the stewardship of the collective more than outweighs the inefficiency costs. This would be especially true if eliminating these inefficiencies could only come about through privatization. China's current rural economy does not have land courts, a land registration system, or good credit markets for supplying farmers with cash needs in times of income shortfalls. Without such institutions, it may be that land privatization at the current time would have a high cost to society. So, whereas the results of this study clearly show there are gains to reforming China's land system. The relevant question for policy makers is whether or not at this stage of China's development or during this point of time in the economic transition the gains are worth the costs or risks.

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References

Besley, T., 1995. Property rights and investment incentives: theory and evidence from Ghana. J. Pol. Econom. 103(5), 903–937.

Cheng, Y., Tsang, S., 1995. Agricultural land reform in a mixed system: The Chinese experience of 1984–1994, China Info. 10(3/4), 44–74.

Cheng, Y., Tsang, S., 1996. Agricultural land reform in a mixed system: The Chinese experience of 1984–1994, China Info. 10(3/4), 44–74.

Dong, X., 1995. Two-Tier land System and Sustained Economic Growth in Post-1978 Rural China. Working paper, Department of Economics, University of Manitoba.

Dong, Xiao-yuan, 1998. Two-tier land tenure system and sustained economic growth in post-1978 rural China. Paper presented at the 1998 Conference on Land Policy and Efficient Land Use, Peking University's Chinese Center for Economic Research, Beijing, China, May 15–16.

Johnson, D.G., 1995. Property Rights in Rural China, Working paper, Department of Economics, University of Chicago.

Kung, J.K., 1995. Equal entitlement versus tenure security under a regime of collective property rights: Peasants' preference for institutions in post-reform Chinese agriculture. J. Compar. Econom. 21, 82–111.

Kung, J.K., Liu, S., 1996. Land Tenure Systems in Post-reform Rural China: A Tale of Six Counties, Working paper, Division of Social Sciences, University of Hong Kong, Science and Technology.

Li, G., 1997. Land Rights, Tenure, and Leaders in China, Working Paper, Food Research Institute, Stanford University, Stanford, CA.

Lin, J.Y., 1993. Government procurement and rice supply response in China, Paper presented at the second workshop on projections and policy implications of medium and long term rice supply and demand, International Rice Research Institute, Los Banos, Philippines, April.

Mead, R.W., 1995. An Examination of China's Agricultural Reforms: The Importance of Private Plots, Working Paper, Department of Economics, University of Pittsburgh.

Prosterman, R., Hanstad, T., Li, P., 1996. Can China Feed Itself? Scientific American (November), 90–96.

Shaban, R.A., 1987. Testing between competing models of sharecropping. J. Pol. Econom. 95(5), 893–920.

Wen, G.J., 1989. The current land tenure and its impact on long term performance of the farming sector: the case of modern China, Ph.D. dissertation, University of Chicago.

Wen, G.J., 1995. The land tenure system and its saving and investment mechanism: the case of modern China. Asian Econom. J. 9(31), 233–259.

Widawsky, D., 1996. China's battle against pests: an empirical investigation of the impact of insecticide use, host plant resistance, and varietal diversity. Unpublished Ph.D. Dissertation, Food Research Institute, Stanford University, Stanford, CA.

Yao, Y., 1995. Institutional Arrangements, Tenure Insecurity and Agricultural Productivity in Post Reform Rural China, Working Paper, Department of Agricultural Economics, University of Wisconsin, Madison.

Zhou, Q., 1994. Land system in rural China: the case in meitan county of Guizhou Province, In: Wen, G.J. (Ed.), The Land System in Contemporary China, Hunan Science and Technology Press, Changsha, China, pp. 37–104.