Collective versus Individual Property: Tenure Security and Forest Tenure Reforms in China
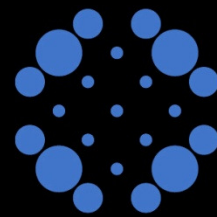
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Collective versus Individual Property: Tenure Security and Forest Tenure Reforms in China

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Abstract

This study assesses the determinants of forest land allocation to households in the forest tenure reforms in China in the period 1980-2005 using data from three provinces in Southern China; Fujian, Jiang Xi and Yunnan. Furthermore, it assesses the current level of tenure security on forest land and how this tenure security is affected by past and more recent policy changes. A key finding is that issuing of written documentation of forest land rights in form of forest land certificates for a specific time period (30-70 years) enhances tenure security beyond what the otherwise perceived rights to land do.

JEL-code: Q15

Key words: Land rights; forest land; China; tenure reform; collective ownership; individual ownership; tenure security; forest land certificates.

Introduction

Tenure security in land is considered crucial to stimulate investment and to create economic growth for three reasons; higher expected returns from investment, better functioning land markets allowing land transfers to more efficient producers, and better access to credit (Demsetz 1967; Besley 1995; Braselle, Gaspart and Platteau 2002). Land allocation has played a special role in China as a key resource that has been shared based on strong equity principles in rural areas where land has been the main resource pillar of the economy (Carter and Yao 1998; Jacoby, Li and Rozelle 2002). Various forms of collective and individual management have been tested with varying success but a breakthrough came with the Household Responsibility System from the late 1970s which stimulated to a strong economic growth in the 1980s. This reform primarily focused on agricultural land which was allocated to individual households and enhanced private production incentives. A similar reform, the "Three Fixes" policy, was started for forest land from 1981 and by 1986 nearly 70% of the collectively-owned forest land had been transferred to individual household management (Xu and Jiang 2009). The experiences with this reform were mixed and less positive in southern China, causing a partial reversal of the reform. However, the subsequent relatively poor performance of the forestry sector leading to small generation of revenues and poor forest management lead to a second forest tenure reform after year 2000, again with a stronger emphasis on forest management by individual households.

This study aims to provide new evidence on the logic of forest land allocation to households in three provinces in southern China; Fujian, Jiang Xi, and Yunnan. While all these three provinces have large forest areas, there were important historical differences between them in how they dealt with the forest tenure reforms in the 1980s and this may also affect how they deal with the new reform based on the past experiences. First, we assess what factors affected the allocation of forest land to individual households in the 1980s as well as in the second reform to see if these factors have changed. This includes assessing the importance of the equity motive in forest land allocation, and the effect of local village elections. Second, we assess households' perceived tenure security for individual forest plots and group-controlled plots that they have been allocated and what factors that influence this level of tenure security. In particular we assess whether the difference in past policies in the three provinces may have created differences in tenure security across provinces. We also assess whether provision of forest land certificates has contributed to enhance tenure security and whether past agricultural land readjustments and the quality of village leaders have impacts on tenure security. Finally, we assess how

the bundle of property rights on household forest plots is related to the perceived tenure security. The main finding of policy relevance is that provision of written proof of time-restricted ownership in form of forest land certificates has increased tenure security and this effect is significant and strong beyond the effect of the bundle of rights that also had a strong impact on household plot level tenure security. No significant impact was found from past agricultural land adjustments on tenure security while there was a negative correlation between past land adjustments and the amount of forest land allocated to households, possibly indicating a negative effect on the demand for forest land. Democratic village elections did not have any positive effect on tenure security but appears to have stimulated the forest land allocation during the new forest tenure reform.

The structure of the paper is as follows. Part 2 puts tenure security into a theoretical and empirical context, part 3 gives a brief review of past experiences with forest and agricultural tenure reforms in China. The New Forest Tenure Reform is explained in part 4, followed by the analysis of forest land allocation in part 5 and the analysis of tenure security on forest land in part 6, before we conclude.

Tenure security in theory and practice
Tenure security is one of the three fundamental neo-classical arguments for land reform (Besley 1995; Braselle, Gaspart and Platteau 2002), the others being transferability (gains from trade) and credit access (using land as collateral), all important to stimulate investment, more efficient land use and economic growth. Additional important benefits from land are equity and poverty reduction effects. The positive mutual relationship between tenure security and investment make both endogenous and a challenge for empirical analyses.

It is obvious that tenure security is essential for the incentives to plant and manage long gestation period crops like trees. Yet, potential economies of scale and the fact that much forests are natural forests that regenerate even if neglected, cause the question about optimal property rights for forest land and trees to be non-trivial and depend on a range of issues. One consequence of this is that policy makers in many countries have experimented with alternative tenure reforms based on ideology and beliefs rather than on careful assessment of benefits and costs of the alternative property regimes.

Broadly we think that land tenure security at farm plot level depends on many factors, including the specific farm plot characteristics, the household owner or operator

characteristics, the land tenure characteristics, local institutional (including market) characteristics, past and present land policies, cultural norms, and historical context.

One can broadly distinguish between three types of approaches to assessing tenure security or insecurity. These are the bundle of rights approach, the hazard analysis of individual plot tenures approach, and the direct inquiry or perceptions approach. Examples of applications of the bundle of rights approach include Brasselle, Gaspart and Platteau (2002) who developed a ranking based on a hierarchy of rights at household level in a study in Burkina Faso. Hazard analyses of earlier land redistributions as an indicator of tenure insecurity is relevant in countries where such policies have been important, such as in China and Ethiopia. Studies using this approach include Carter and Yao (1998); Jacoby, Li and Rozelle (2002); Brandt, Rozelle and Turner (2002); and Rozelle et al. (2002) in China. Brandt, Rozelle and Turner analyze explanations of frequency and intensity of land readjustments. Carter and Yao use household panel data and simulations to show that reducing the number of reallocations by one would increase investment to an extent that would raise output by about 5 percent. Jacoby et al. assess the impact of expropriation hazards on investment in organic fertilizer use. Studies on direct perceptions of tenure security include Holden and Yohannes (2002) in Ethiopia.

In this study the three approaches are combined and specifically used to assess how earlier land readjustments are related to current perceptions of future tenure security at the household forest plot level. Also we assess how a disaggregated bundle of land rights at household forest plot level as well as an aggregated index of these rights are associated with the perceptions of future tenure security. Furthermore, the effects of the new forest tenure reform and the distribution of forest land certificates on the perceptions of future tenure security are assessed.

Tenure security and forest tenure reforms in China: - A review
There have been many dramatic changes in the land tenure systems in China over the last 60 years. For forest lands these changes include collectivization of private forests of farm households in 1956, taking of private trees around homesteads by the communes in 1958, returning the trees around homesteads to households in 1961-62, again taking these private trees from households in the period 1966-1980 (Liu and Edmunds 2003). It is obvious that such frequent policy changes create tenure insecurity among households.

Forest areas in China before 1981 may be classified in state-owned forests and collective forests of which the collective forests account for 61%. From 1981 China started experimenting with new forms of management for its collective forests by establishing three forms of tenure; family plots, responsibility hills (also managed by individual households), and collective management. The collective owns the family plots but the use rights are distributed to households and trees planted on the plots are owned by the households. For responsibility hills the collective owns both the land and the trees and decision-making is shared by the collective and households. For collective management ownership is collective for land and trees and decision-making is by village leadership (Liu and Edmunds 2003). Initially it was illegal to transfer use rights of family plots but such transfers started from the early 1990s and were legalized with the Revised Forest Law of 1998. In the early 1980s 31 million ha of forest land was transferred to 57 million households. This area of family plots remained steady the rest of the century while there was a slight decline in responsibility hill areas from 1984 to 1990. This was partly due to a conversion to family plots and partly due to a conversion back to collective management.

Forest tenure and tax policies were quite different in Northern China vs. Southern China (Yin 2003). In Northern China households were assigned nearby forest areas and bare lands for re-forestation and this created almost a doubling of the contracted forest area. Households were allowed to sell trees at market prices, harvest permits were not required and taxes were low. This stimulated households to plant trees.

In Southern China the experience with the tenure reform in the early 1980s was that it caused a decline in forest stocks and this caused some responsibility hill areas to be taken back to collective management. No clear duration was first given for the family forest plots while responsibility hills were contracted for 5-15 years which was too short for most timber species.

Most of the forest land allocated as family plots was deforested already and was given to the households on the condition that they should plant trees there. This was similar to the responsibility to use the agricultural land that was allocated to individual households. Lack of use or lack of planting of trees therefore resulted in higher tenure insecurity as such lands were recovered by the collectives and either redistributed to other households, leased out or converted back to collective management. According to Liu and Edmunds (2003) this policy did not succeed in enhancing investment but rather had the opposite

effect of discouraging replanting after harvesting of the trees. This may also be a result of the frequent changes in earlier policies and may have initiated myopic harvesting strategies (Albers, Rozelle and Guo 1998; Yin 1998).

Other types of policies that may affect tenure security are logging bans that have been introduced in upper watersheds of Yellow and Yangtze rivers, logging quotas, taxes and fees on harvesting, and marketing restrictions. Whether these affect expected profitability only directly or also indirectly through an effect on tenure insecurity would have to be examined more carefully. In either case they may affect investment and harvesting behavior of households.

The Household Responsibility System contracts for agricultural land were renewed in the late 1990s and this may contribute positively to the feeling of tenure security for forest lands as well. Village land reallocation has been an instrument to ensure an equitable land distribution and has been a substitute for missing land markets in China and several other countries. They have also been used to facilitate collection of taxes and production quotas and may be used in rent-seeking by local cadres (Brandt, Rozelle and Turner 2002). There is, however, large local variation in the extent of tenure insecurity as a consequence of the variation in how local governments have practiced land adjustments (ibid.). It is possible that such adjustments also have affected forest land distribution to households. Villages with a stronger land adjustment philosophy for agricultural land may also have the same for forest land. This would imply that household size is an important determinant of forest land allocation to households. On the other hand, if land adjustments create tenure insecurity this may also reduce the demand for forest land and lead to a negative effect from such readjustments to forest land distributions. However, recent law reforms like the Rural Land Contracting Law of 2003 may have reduced the impact of past land adjustments on current perceptions of tenure security. This may, however, depend on the degree to which the new laws have become locally known and implemented.

The introduction of the Villager Committee Organization Law in 1988 allows villages in China to conduct competitive elections of a village leader and a village committee consisting of four to seven members. Considerable variation has been identified in the speed with which this law has been implemented and also in how it has been implemented (Kennedy, Rozelle and Yaojiang 2004). Kenedy, Rozelle and Yaojiang

found that more open elections were related to perceptions of more fair land reallocations in a study in Shaanxi province.

Wang (2008) found in a nation-wide study that higher quality village elections have improved the quality of rural governance by holding village cadres more accountable to peasants' demands, as demonstrated in the higher level of peasant satisfaction with the performance of village committees in public services provision. The effect of village elections in holding cadres accountable was significantly higher in villages that owned substantial collective resources.

Our data contain variables for trust in village leader[i], the number of village leaders since 1990, and the year the current village leader took position. Our basic hypothesis is that popular leaders have favored distribution of more forest land to individual households. But the reverse causality could also be true. More distribution of village forest land to households could have made village leaders more popular. A higher number of village leaders may be an indicator of democratic elections and so may be the case if the current village leader took office very recently.

The new forest tenure reform in China
This part gives an overview of the recent and earlier forest tenure reform initiatives in China.

Initial steps
In the spring of 2003, the provincial government of Fujian formally approved the reform, but precedents had already been established in 1998[ii] when a rural village, suffering from severe deforestation due to ineffective collective management, decided to reform forest tenure. By 2002, more villages had initiated similar reforms and given user rights to villagers and sold some of the forests to people outside the villages. In the latter case, the individualization of forest management helped eliminate village debt and provided significant rents for the villages. In general farmers who accepted the forest user rights were required to pay a land rental fee to the villages. The forest plots bid away to outsiders earned village revenues in the form of lump sum stumpage payments. Potential gains to the village management such as these provided strong incentives for village leaders to venture into new management schemes. Another survey by Kong, Guo and Li (2006) confirms these findings in Fujian.

The political rationales behind support of the reforms by provincial governments are also indentified by Xu et al. (2008). Historically, especially when forestry was still an important contributor to provincial economies, the provincial governments tended to resist decentralization in order to maintain control over timber revenues. In the case of Fujian, this is demonstrated by the trial of an alternative scheme and by cutting short the scale of the reform in a short period after the first reform. Nonetheless, in the past thirty years the fiscal incentives for the provinces have changed due to the declining share of the forest sector in regional economies (figure 1) when other sectors have grown in importance. As a result of these transformations, the opportunity cost of reforming the forest tenure system has been greatly reduced. In the meantime, governments at all levels face increasing opportunity costs of delaying reforms, such as growing social unrest due to insignificant forestry-derived family income, and increasing difficulty in conservation, etc., making the decision to extend reforms easier. Moreover, national leaders have devoted much greater attention to rural development over the past several years. Farmers' rights over agricultural land have made major progress after the issuance of the Rural Land Contract Law. These progresses in the agricultural sector make the still-stringent policies in the forest sector more susceptible for criticism.

The nature of the collective forest tenure reform since 2000
By the end of 2007, fourteen provinces had announced plans for collective forest tenure reforms. As will be seen later, the magnitude of the current forest land reallocation is not as great as that of the first round of reforms in early 1980s. What makes the second wave reform important can be summarized as follows:
1) Fujian, the largest but once resistant collective forest province adopted mainstream forest tenure reforms aimed at individualization;
2) Provincial decrees have stated that decisions regarding forest land reallocation should be made by village representative committees or by village assemblies requiring a 2/3 vote majority.
3) Redistribution of plots will be accompanied by legal contracts and forest certificates;
4) The maximum allowable contract period is extended to 70 years;
5) Adoption of the Rural Land Contract Law has enabled expanded rights, including those of land transfer, inheritance and mortgaging.

Approach and variation with the three provinces in mind
Fujian started from a situation which emphasized collective management. After failing the test during the period of mid 1980s to early 2000, the provincial government issued a

document calling for tenure reform in form of individualization, setting precedence for the second wave of reforms. Much of the previously collectively managed forest land was distributed to individual farmers for management. But, in Fujian farmer partnership has been a favored management model by many villages, probably a result of a long tradition of collective management. The Fujian provincial government allowed village collectives to collect forest land rental fees to facilitate reform decisions by village leaderships and the local forest authorities.

Jiang Xi individualized the majority of the forest land in the early 1980s. In late 1980s it is believed that much of the forest land was reclaimed by the collectives that set the foundation to pressure for a new reform in early 2000s. Jiangxi basically followed the footsteps of Fujian and issued a reform document in 2004. The basic plan of reform was pretty similar to Fujian's, with the exception of disallowing forest land rental fee collection by village collectives. To compensate the village committees and local governments, the provincial government provided reform funds to these local authorities as incentives for carrying out the reform.

Yunnan is a province with great ethnic diversity. It is generally believed that a large number of rural villages are used to community management in this province. There are also many villages under the influence of the Natural Forest Protection Program which basically banned commercial harvests in affected areas. It is conceivable that in the reform process there might be a tendency of re-collectivization instead of individualization. Our survey data, however, demonstrated that the outcomes are mixed. There have been significant individualization, but re-collectivization also occurred in a number of villages. Yunnan province issued a reform document in 2006 and also started experimenting in nine counties in 2006. Full scale reform started in 2007.

Description of tenure categories
Based on the information collected in the survey areas, we ascertained more than ten different tenure types (or management arrangements). For purposes of analysis, we have grouped them into six broad categories. Relationships between these six categories and existing tenure types are as follows:
   a) Private Plot (Zi-Liu-Shan): similar to private plots in the agricultural land tenure system, households managing this type usually enjoy rights similar to private ownership and comparatively stable tenure rights;

b) Individual Household Management (Dan-Hu-Jing-Ying): forestland managed by individual farm households within the village, this includes responsibility forest land and household-managed forest land negotiated either through a special contract or with a rental agreement. Responsibility forest land is a standard tenure type and is similar to what is referred to as responsibility land in the agricultural sector. The other type is less standard and the terms of the contract or rental agreement are, to a larger extent, subject to village council discretion. In the current round of reforms, a common element in individual contracts is the issuance of forest certificates and the allowance of a long contract periods (30-70 years). These developments have meant that these types are now converging toward the private plot system described above;

c) Partnership (Lian-Hu-Jing-Ying): forest land managed by a group of farmers formed on voluntary basis. These groups usually contain five to ten households;

d) Villager Group (Zi-Ran-Cun, Xiao-Zu): forest land managed by a cluster of families living in the same neighborhood; these clusters are the outgrowth of a form originally used to organize collective production in the planned economy era. In many, but not all, places the villager groups coincide with natural villages. In the current rural system, these are sub-branches of an administrative village and are usually the main form of land holdings with clear boundaries between each other. Forest land managed by villager groups is considered the same as being collectively managed, but at a smaller scale;

e) Outsider Management Contract (Lin-Di-Liu-Zhuan)[iii]: forest land contracted out for utilization and management by individuals and organizations residing outside the villages;

f) Collective Management (Ji-Ti-Jing-Ying): forest land managed directly by an administrative village council. It is generally understood that, since the reforms, the first three categories provide direct benefits to ordinary farmers, while the various levels of village leadership are the direct beneficiaries of the latter three categories. To what degree the reforms have redistributed welfare within villages largely hinges upon these two broad divisions of management;
Ecological reserve forest (Sheng-Tai-Gong-Yi-Lin): newly imposed in collective forest areas by the government in late 1990s and early 2000s. Between 10 and 50 percent of collective owned forest land is classified as ecological forests and is prohibited from commercial use. Although this policy was applied universally, villages with their forests within close proximity to major roads and rivers were most affected. Since this new zoning policy was primarily a government

initiative, the extent of the ecological reserve forest in the villages under survey is used as an exogenous variable demonstrating the level of regulatory intrusion in collective forest areas.

Evolution of forest land allocation

Figure 2 illustrates the time path for the forest land allocation to households in the three provinces Fujian, Jiang Xi and Yunnan in Southern China. This includes land allocated to households for individual management as well as for management in groups (partnership contracts, natural village and collective management). We see that the largest transfer took place in the early 1980s while the new Forest Tenure Reform has at the time of the survey transferred less land to households. There is also a small share of forest land that households have kept since the 1950s. Figure 3 shows the same data with histograms disaggregated by province. Jiang Xi and Yunnan had a more concentrated transfer of land to households in the early 1980s as compared to Fujian where the transfer was more gradual. Figure 4 splits the same data in group and individual management. We see that group management is relatively more common on the recently allocated forest land (after year 2000) while individual management was relatively more common on land allocated in the early 1980s.

Descriptive statistics

Table 1 provides descriptive statistics for the household level variables disaggregated by province from the survey in 2005/2006. It can be seen that the new Forest Tenure Reform started earlier in Fujian and last in Yunnan. It can also be seen that there is more total forest land available in the surveyed villages in Fujian and Yunnan than in Jiang Xi but still the average forest land allocated to households is higher in Jiang Xi than in Yunnan.

Table 2 provides information at household forest plot level. The mean plot size is largest in Fujian and smallest in Yunnan. However, these figures hide that the distribution of plot sizes is skewed thus the median plot size is much smaller than the average plot size in all provinces. More of the forest is on steep slopes in Fujian but the average distance to the nearest road is a bit shorter. The tenure variables show that a very large share of the plots are under individual management, 92% in Fujian, 85% in Jiang Xi and 99% in Yunnan. For plots under group tenure the individual households in Jiang Xi have a relatively larger share of the plots, indicating smaller average group size. A small percentage of the plots has been defined as ecological forest, except in Yunnan where this percentage is above 10% of the plots. Households have received forest land certificates for 13.2% of

the plots in Jiang Xi, 13.8% of the plots in Yunnan and 15.6% of the plots in Fujian. Tenure security at plot level was assessed by asking the households for each plot whether they thought they would still have the plots five years into the future. A score of 2 was given if they were confident that they would still keep it, a score of 1 if they were uncertain, and a score of 0 if they thought they would not keep the plot after five years. The average scores were high in all provinces as seen in the table but significantly higher in Jiang Xi than in the other two provinces. This is the variable used as the dependent variable for the analysis of tenure security.

The table also summarizes some village level variables. The average number of agricultural land adjustments is higher (1.6) in Fujian than in Jiang Xi (1.2) and in Yunnan (0.9). The average score for trust in village leader was higher in Yunnan and the number of village leaders since 1990 was higher in Fujian.

Table 3 presents data on households' perceptions on their land rights disaggregating their bundle of rights into different types of management rights and transfer rights within the village and to outsiders. The management rights are generally perceived to be strong except when it comes to conversion of forest land to agricultural land for crop production (allowed on about 50% of the plots), while intercropping trees and agricultural crops was allowed on more than 90% of the plots. Transfer rights were perceived to be weaker in Yunnan than in the other two provinces. Not much difference was found in the average property rights index, constructed as a weighted average of the vector of rights, for the three provinces. In the following analysis we will see how these disaggregated rights and the property rights index are related to the perception of tenure security at household plot level and whether a written documentation in form of a forest land certificate enhances the perception of tenure security beyond the contribution of the perceived property rights in form of the disaggregated rights or the property rights index.

Allocation of forest land
Based on the context described above the following hypotheses in relation to the process of allocating forest land to households have been tested:
HA1. The equity principle[iv] used for agricultural land is also important for the allocation of forest land. This implies that a main determinant of forest land allocated to households within a village is the household size
HA2. Forest land allocated to households is determined by the skills and ability of the households. Education is used as indicator of ability.

HA3. Local power and influence helps to improve access to forest land. Being a village leader or party member therefore enhances access to forest land[v].

HA4. Democratic village elections have contributed to enhance forest land allocation to households.

HA5. Good (trusted) local leaders have distributed more forest land to households.

HA6. Frequent agricultural land adjustments have reduced the demand for forest land among household and thus reduced allocation of forest land.

HA7. The second stage forest tenure reform uses a different logic for forest land allocation than the first forest tenure reform and puts less emphasis on the equity principle in the land allocation.

Table 4 presents the results of the regression model testing these hypotheses. The two first models (columns 2 and 3) have used the total forest area of households as the dependent variable while the two last models (columns 4 and 5) have used forest land allocated to households after year 2000 as the dependent variable (testing hypothesis HA7). Models with and without the village level potentially endogenous variables were used for lack of good instruments for their prediction. Panel data tobit models with village random effects were used. The extent of left-censoring was more serious in the models with new forest land allocated after year 2000 but some interesting results still came out of it.

Hypothesis HA1 was supported in the models for total forest land allocation but not for forest land allocation after year 2000. Since household size in year 2000 was used as a test variable we may conclude that the equity motive has been important in the past not only in agricultural land allocation but also in forest land allocation. This motive seems not to have been important in the recent forestry tenure reform and therefore hypothesis HA7 cannot be rejected. Household size is likely to be quite stable over time due to the strict family planning policy in China, but we should take the precaution that there can be some reverse causality causing households that received more forest land to also have larger household size. The fact that forest income is a small share of total household income (5-10%, see Figure 1) should imply that the reverse causality effect is very small. Education was not found to have any effect on the recent allocation of forest land so we have to reject hypothesis HA2. Hypothesis HA3 cannot be rejected as a positive and significant relationship was found between membership in the communist party and forest land allocation both for total forest land and for recent forest land allocation (after education has been controlled for). Hypothesis HA4 that democratic village elections have stimulated forest land transfer to households is supported by the analysis as the new

forest area allocated is strongly positively correlated (significant at 0.1% level) with number of village leaders since 1990. The same variable was insignificant for total forest land. Trust in village leader was not significantly correlated with forest land allocation so hypothesis HA5 is rejected. There was a significant negative correlation between the number of land adjustments and forest land allocated to households. This lends support for hypothesis HA6 that land adjustments have caused a reduction in demand for forest land. When comparing the three provinces, significantly more forest land had been allocated to households overall in Jiang Xi province than in the other two provinces, while significantly less had been allocated to households in the same province after 2000. This fits with the overall picture where the forest tenure reform went further in allocating land to households in the early 1980s in Jiang Xi, leaving less forest land available for additional distribution after year 2000. Quite surprisingly we found a positive significant correlation between forest land allocated to households and the dummy for whether the new Forest Tenure Reform has started in the village in the models with total forest area but no such significant effect was found in the recent forest area allocation models. This may be interpreted such that those villages where the reform contributed to more forest land allocation in the past also are more eager to start the new Forest Tenure Reform, implying a reverse causality in the first two models. Finally, we found a significant positive effect of total forest land per capita in the village on forest land allocated as would be expected.

Forest plot level tenure security
Based on property rights theory and earlier studies of tenure (in)security in China and elsewhere a number of hypotheses are launched about the relationship between perceived forest plot tenure security and various variables inter alia forest plot characteristics, tenure characteristics and village and policy characteristics where it is possible to draw on the existing local variation. The benefit of having data on perceived forest plot tenure security and forest land rights at farm plot level allows the use of panel data methods that can control for observed as well as unobserved household heterogeneity by using household random effects and fixed effects models. The hypotheses are as follows:
HB1a. Tenure security is higher on plots that have been allocated to individual households than on plots with shared (group) ownership. Vs.
HB1b.Group ownership gives stronger tenure security especially in Fujian province where collective tenure has been a more important policy.
HB2. Tenure security is larger the higher the share of the plot that the household controls.
HB3. Tenure security is lower for large plots (higher risk of readjustment).

HB4. Tenure security is higher on commercial plots than on ecological forest plots.

HB5. Investments on plots, like irrigation investments, enhance tenure security.

HB6. Tenure security is higher for plots near the home of households than on far-away plots.

HB7. Forest land certificates enhance tenure security.

HB8a. The longer the household has had the plot the more tenure secure it feels vs.

HB8b. The longer the household has had a plot the less secure it feels (the plot is due for redistribution). (Jacoby, Li and Rozelle (2002) discuss this).

HB9. Frequent land readjustments for agricultural land reduce tenure security of forest plots.

HB10. Trust in village leaders (good leaders) is positively correlated with tenure security.

HB11. Tenure security is higher in villages with more democratic elections.

HB12. Stronger property rights in terms of the number of rights that households perceive to have are correlated with higher tenure security.

These hypotheses have been tested using the household forest plot data from the three provinces. The dependent variable was whether households believed they would still keep the plot five years into the future with three possible outcomes. The regression results are presented in Table 5. The key findings are summarized below.

No significant differences were found for individually vs. group managed plots with respect to the perception of tenure security and so was the case for the share of the plot that the household controls, meaning that also group size did not affect significantly the feeling of tenure security. Furthermore plot size did not significantly affect the perception of tenure security, nor did the classification of plots as commercial or ecological plots. The findings therefore lend no support for the hypotheses HB1-HB4. The fixed effects models controlling for unobserved household heterogeneity found that tenure security was significantly higher on plots with irrigation which may imply that such investments enhance tenure security which also is in line with findings in other studies (e.g. Besley 1995; Brasselle, Gaspart and Platteau 2002). Hypothesis HB5 cannot therefore be rejected. The fixed effects models also gave a significant negative (at 10 and 5% levels) effect of distance to home on tenure security, therefore, hypothesis HB6 cannot be rejected. Tenure insecurity is higher for distant plots.

Households were found to be significantly more tenure secure on plots for which they have received forest land certificates. This variable was highly significant (1% level) in

the random effects as well as fixed effects models. The fixed effects models should control for unobserved household heterogeneity that could cause selection into getting certificates but the parameters in the fixed effects models were even higher than that in the random effects models. This represents strong evidence on the importance of written documentation for ownership of forest plots. Forest land certificates have been distributed only recently with a duration of 30 to 70 years, far beyond the 5 year perspective applied in this analysis.

The duration that the households had kept their forest plots appeared to have little influence on the tenure security. The 'Year when plot was contracted'-variable was only significant at 10% level in one of the fixed effects models. This provides weak support for hypothesis HB8b while we may reject hypothesis HB8a. This makes sense in a setting where almost all land, agricultural as well as forest land, is contracted to households only for a limited period of time even though the perceptions that such contracts will be renewed are enhanced based on recent changes in land laws and the following experiences.

The 'Number of land adjustments'-variable that only could be included in the random effects models was insignificant. Hypothesis HB9 may therefore be rejected. Experience with earlier land adjustments for agricultural land appears not to affect the current tenure security on forest land. Likewise, the 'Trust in village leader'-variable did not significantly affect the feeling of tenure security. The 'Number of village leaders since 1990'-variable was only significant (at 10% level only) in one of the models and with a negative sign. If this variable is a reasonable indicator of democratic elections, hypothesis HB11 that democratic elections have enhanced tenure security may be rejected. The 'Start year of current village leader'-variable was highly significant (at 0.1% level) in both the random effects models and with a negative sign. This indicates that recently elected leaders have a significant negative impact on tenure security giving evidence that local leaders still are considered to have substantial power over local land tenure rights as it appears difficult to explain this result as a reverse causality or a spurious correlation.

Finally, the property rights index was found to be highly significant (at 0.1% level) in both the random and fixed effects models and with a positive sign, demonstrating a strong positive correlation between the number and strength of rights and the feeling of tenure security. For the models with disaggregated rights, only the local transfer right was significant in both models and with a positive sign, while the right to intercrop

agricultural crops with trees on the forest plot was significant and positive in the random effect model only. The aggregate combination of rights may be more significant because of multicollinearity between the disaggregated rights. Putting these findings into context, it may be concluded that perceptions of a bundle of rights can be a good indicator of tenure security but it does not provide the whole story. Provision of written documentation of the rights in form of forest land certificates has strengthened the feeling of tenure security as a separate additional effect. This is a lesson of substantial policy relevance and provides support for land certification in settings where there is tenure insecurity that can be enhanced by such written documentation. It should be added that this is not necessarily the case in all settings as local political economy factors could subvert such effects.

Conclusion

This study has revealed that the equity principle was important in the process of forest land allocation to households in the 1980s but the principle appears not to play an important role in the recent forest land allocation to households that took place after year 2000. Democratic elections appear to have stimulated the recent allocation of forest land to households. Forest land certificates strengthened the feeling of tenure security on plots and this may be the most significant finding of policy relevance. Such certificates represent a written documentation that appeared to provide additional security to that of the perceived rights that households had to their land whether these were captured in a disaggregated way or through an aggregate index. Since the surveyed households only had forest land certificates for about 15 percent of all forest plots, expanding such certification can be recommended. It is likely that such certification will further enhance tenure security which again should stimulate investment and lead to better management of forest land and will be the subject of future research. This is in line with recent findings in Ethiopia where land certification has been found to stimulate tree planting and maintenance of soil conservation structures (Holden, Deininger and Ghebru 2009).

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Table 1. Summary Statistics for Household Level Variables

Variable	Fujian		Jiang Xi		Yunnan	
	Mean	St.Error	Mean	St.Error	Mean	St.Error
Household size 2000	4.789	0.066	4.683	0.090	4.628	0.044
Hukou type 2000, 1=Agricultural, 2=Non-agricultural, 3=Not registered	1.015	0.005	1.030	0.011	1.021	0.004
Household does farm work 2000, 1=Yes, 0=No	0.953	0.009	0.983	0.007	0.954	0.006
Average education of household members 2000, years	4.756	0.077	5.130	0.104	4.933	0.066
Age of household head 2000, years	45.023	0.445	46.003	0.621	43.389	0.342
Education of household head 2000, years	4.914	0.130	5.826	0.155	5.565	0.097
Member of communist party or not 2000, 1=Yes, 0=No	0.150	0.015	0.163	0.021	0.115	0.009
Head of household is village head 2000, 1=Yes, 0=No	0.050	0.009	0.037	0.011	0.058	0.007
Household has job in Forestry sector 2000, 1=Yes, 0=No	0.013	0.005	0.000	0.000	0.010	0.003
New Forest Tenure Reform started, 1=Yes, 0=No	0.950	0.009	1.000	0.000	0.867	0.010
Time of start of Forest Tenure Reform	2003.1	0.062	2004.7	0.027	2006.3	0.012
Forest land per capita in village 2000	18.211	0.748	4.310	0.664	17.657	0.747
Agricultural land per capita in village 2000	1.149	0.024	1.050	0.022	1.703	0.032
Forest area allocated to household, mu	46.449	4.174	40.000	7.544	33.733	2.833

Table 2. Descriptive Statistics for Variables Used in the Plot Level Analysis by Province

Variables	Fujian		Jiang Xi		Yunnan	
Forest plot characteristics	**Mean**	**St.Error**	**Mean**	**St.Error**	**Mean**	**St.Error**
Forest plot size in mu	16.164	1.066	12.848	2.313	8.308	0.577
Irrigation dummy	0.122	0.008	0.160	0.012	0.122	0.006
Slope (1=<15%, 2=15-25%, 3=>25%)	2.612	0.015	1.541	0.022	1.475	0.016
Distance to home, km	2.053	0.046	2.097	0.068	2.351	0.060
Distance to road, km	1.270	0.035	1.579	0.060	1.801	0.049
Tenure variables						
Individually controlled plot (dummy)	0.916	0.007	0.853	0.012	0.991	0.002
Share of plot controlled by household, group tenure	0.171	0.013	0.279	0.014	0.136	0.036
Forest type (1=Commercial, 2=Ecological)	1.014	0.003	1.037	0.006	1.107	0.006
Has forest certificate dummy	0.156	0.009	0.132	0.011	0.138	0.007
Year when plot was contracted	1987.6	0.329	1986.0	0.268	1986.1	0.175
Tenure security: Expect to keep plot after 5 years, 2=Yes, 1=Uncertain, 0=No	1.898	0.008	1.934	0.010	1.892	0.008
Village level variables						
Number of land adjustments	1.631	0.025	1.193	0.031	0.857	0.020
Trust in village leader (score 1-10)	6.351	0.030	6.645	0.033	7.535	0.016
Number of village leaders since 1990	4.339	0.027	3.719	0.056	3.740	0.030
Start year of current village leader	2001.3	0.064	2000.6	0.172	2000.2	0.134

Table 3. Disaggregated Land Rights at Household Forest Plot Level by Province

	Fujian		Jiang Xi		Yunnan	
Type of land right	**Mean**	**St.Error**	**Mean**	**St.Error**	**Mean**	**St.Error**
Right to convert forest land to cropland	0.493	0.012	0.528	0.016	0.548	0.010
Right to change forest type	0.811	0.009	0.826	0.012	0.821	0.007
Right to decide tree species	0.845	0.008	0.856	0.011	0.845	0.007
Right to intercrop trees and agric. crops	0.960	0.004	0.914	0.009	0.945	0.004
Right to abandon forest	0.669	0.007	0.826	0.008	0.840	0.005
Right to transfer plot to other villagers	0.751	0.010	0.740	0.014	0.659	0.009
Right to transfer plot to outsiders	0.634	0.011	0.724	0.014	0.590	0.009
Property rights index (sum of rights scores)	5.177	0.041	5.438	0.061	5.255	0.036

Right=1 if yes, Right=0.5 if yes, but requires village approval, Right=0 if no.

Table 4. Determinants of Household Forest Areas: Results from RE Tobit Models

Variables	Total area of forest plots	Total area of forest plots	New forest area after 2000	New forest area after 2000
Household size in 2000	5.554***	5.435***	1.158	1.226
	(1.770)	(1.770)	(2.720)	(2.710)
Jiang Xi province	31.989**	28.338*	-57.579**	-44.641*
	(14.900)	(14.990)	(24.630)	(24.530)
Yunnan province	-2.989	-11.005	-37.929	-12.730
	(20.630)	(21.510)	(32.650)	(34.020)
Hukou 2000=Non-agricultural household	6.930	5.299	47.493	45.539
	(21.860)	(21.860)	(29.920)	(29.780)
Hukou 2000=Unregistered	-4.272	-2.557	-447.896	-426.361
	(107.540)	(107.420)	(15873.030)	(12773.930)
Household does farm work	-9.994	-9.510	-12.757	-13.241
	(16.550)	(16.530)	(25.280)	(25.280)
New Forest Tenure Reform started Dummy	169.622**	180.437**	87.267	102.308
	(74.000)	(72.770)	(98.950)	(95.660)
Time of start of Forest Tenure Reform Year	-4.242	-3.395	-1.769	-5.992
	(4.940)	(5.210)	(7.710)	(8.060)
Forest land per capita in village	1.949****	1.839****	0.628	0.558
	(0.260)	(0.260)	(0.410)	(0.400)
Agricultural land per capita in village	3.072	4.722	9.871	9.988
	(5.250)	(5.240)	(8.290)	(8.230)
Member of communist party or not Dummy	18.756**	18.944**	21.125*	21.309*
	(8.120)	(8.100)	(12.180)	(12.150)
Head of household is village head Dummy	-9.952	-9.318	0.569	1.486
	(12.350)	(12.350)	(18.510)	(18.470)
Household has job in Forestry sector Dummy	-3.786	-3.435	23.784	22.543
	(25.280)	(25.260)	(35.070)	(34.850)
Average education of househ. members Years	0.946	0.876	-0.981	-0.929
	(1.670)	(1.660)	(2.550)	(2.550)
Age of household head	-0.180	-0.186	-0.480	-0.486
	(0.280)	(0.280)	(0.440)	(0.440)
Education of household head	0.188	0.134	-0.933	-1.009
	(1.130)	(1.130)	(1.750)	(1.740)
Number of land adjustments in village		-10.660**		-2.096
		(4.970)		(7.900)
Trust in village leader		4.582		6.218
		(4.930)		(7.750)
Number of village leaders since 1990		3.852		20.375****

		(3.900)		(6.180)
Start year for current village leader		-0.649		-2.949
		(1.200)		(1.920)
Constant	8309.368	7872.375	3391.675	17616.267
	(9888.570)	(10929.050)	(15435.370)	(16966.480)
Prob > chi2	0.000	0.000	0.062	0.007
Number of observations	1795	1795	1795	1795
Rho	0.157	0.144	0.263	0.237
Left-censored observations	217	217	1262	1262

Standard errors in parentheses. * Significant at 10%; ** significant at 5%; *** significant at 1%, ****

significant at 0.1%. Models with village random effects.

Table 5. Factors Correlated with Tenure Security: Household RE and FE Models with Rights Index vs. Disaggregated Rights Variables

Variables	Dependent variable: Household still owns plot after 5 years			
	RE	FE	RE	FE
Forest plot size in mu	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Irrigation dummy	0.049	0.101*	0.051	0.107**
	(0.030)	(0.050)	(0.030)	(0.050)
Slope	-0.025*	-0.025	-0.025*	-0.022
	(0.010)	(0.020)	(0.010)	(0.020)
Distance to home	-0.010	-0.013*	-0.011	-0.014**
	(0.010)	(0.010)	(0.010)	(0.010)
Distance to road	0.006	0.012	0.006	0.012
	(0.010)	(0.010)	(0.010)	(0.010)
Forest type	-0.084	-0.100	-0.067	-0.061
	(0.070)	(0.080)	(0.070)	(0.080)
Has certificate for plot	0.054***	0.062***	0.055***	0.062***
	(0.020)	(0.020)	(0.020)	(0.020)
Year when plot was contracted	0.002	0.003	0.002	0.003*
	(0.000)	(0.000)	(0.000)	(0.000)
Share of plot controlled by hh	0.220	0.410	0.218	0.414
	(0.260)	(0.300)	(0.260)	(0.300)
Individually controlled plot	-0.137	-0.257	-0.130	-0.259
	(0.200)	(0.240)	(0.210)	(0.240)
Rights index (sum of rights score)	0.031****	0.031****		
	(0.010)	(0.010)		
Right to convert forest land to cropland			0.013	-0.007
			(0.020)	(0.030)
Right to change forest type			0.078	0.131
			(0.060)	(0.090)
Right to decide tree species			-0.101	-0.150
			(0.070)	(0.110)
Right to intercrop trees and agric. Crops			0.122**	0.036
			(0.060)	(0.070)
Right to abandon forest			0.002	0.056
			(0.030)	(0.040)
Right to transfer plot to other villagers			0.125**	0.168*
			(0.060)	(0.100)
Right to transfer plot to outsiders			0.014	0.054

		(0.050)	(0.090)	
Number of land readjustments	-0.001		0.001	
	(0.010)		(0.010)	
Trust in village leader	0.007		0.008	
	(0.010)		(0.010)	
Number of village leaders since	-0.010*		-0.009	
1990	(0.010)		(0.010)	
Start year of current village leader	-0.007****		-0.007****	
	(0.000)		(0.000)	
Jiang Xi province	0.018		0.027	
	(0.020)		(0.020)	
Yunnan province	-0.034*		-0.023	
	(0.020)		(0.020)	
Constant	11.787****	-3.564	12.314****	-3.815
	(3.390)	(3.470)	(3.290)	(3.360)
Prob > chi2	0.000	0.001	0.000	0.001
Number of observations	4706	4706	4706	4706

Standard errors in parentheses. * Significant at 10%; ** significant at 5%; *** significant at 1%, ****
significant at 0.1%. RE is random effects models using xtmixed with household random effects, deriving
bootstrapped standard errors with 500 replications, re-sampling households to control for clustering at
household level. FE is fixed effects models using xtreg and applying fixed effects at household level and
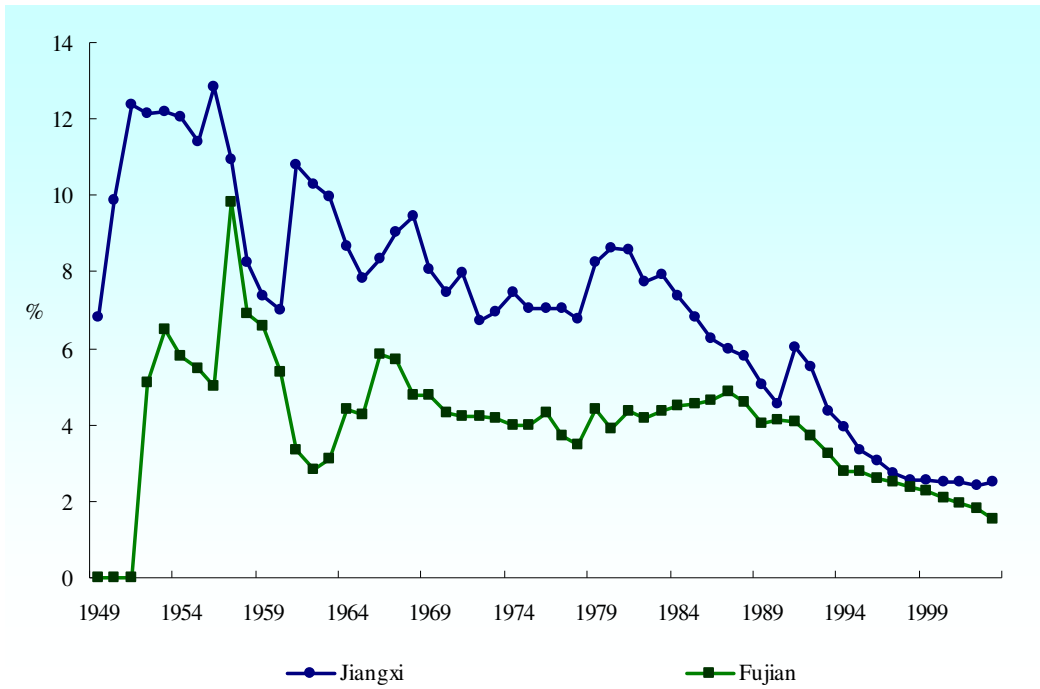correcting standard errors for clustering at household level.

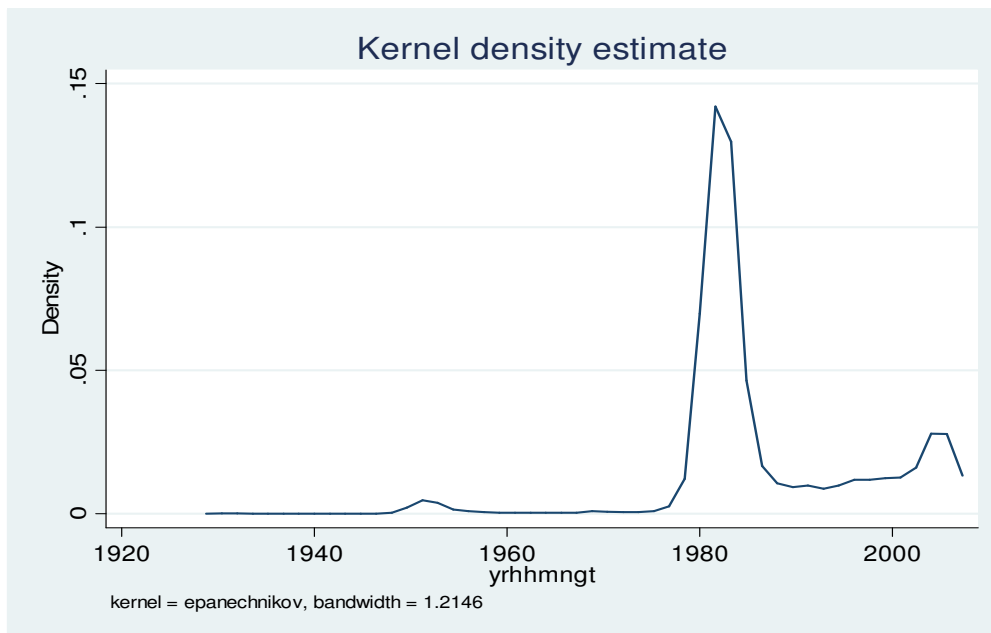Figure 1: Forestry Share in GDP 1950s-1999 (Source: SSB, 2000)

Figure 2. The time of distribution of forest plots to households in Fujian, Jiang Xi and Yunnan provinces in China (based on farm plot level data from 5300 household forest plots).
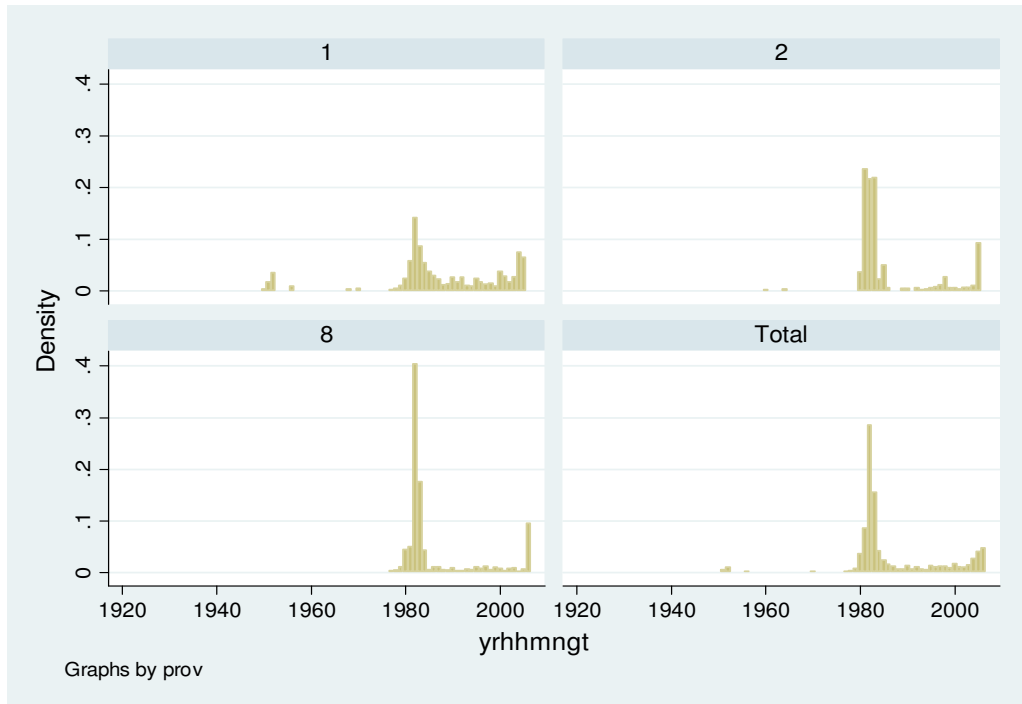
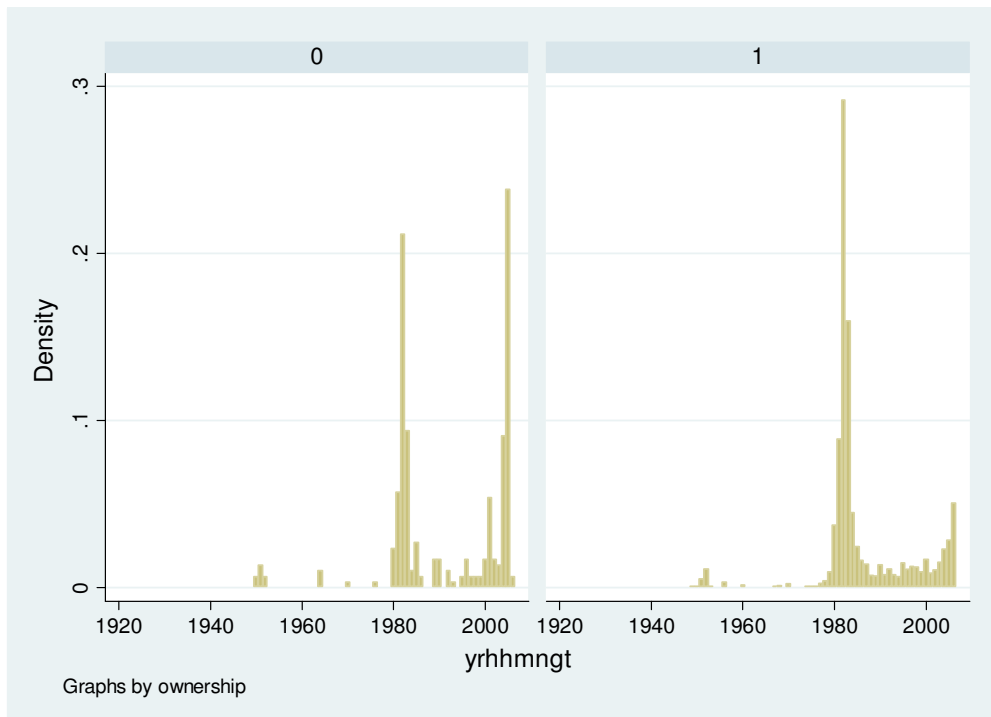Figure 3. Histograms of forest plot allocation to individual households by province (1=Fujian, 2=Jiang Xi, 8=Yunnan

Figure 4. Allocation of forest plots to households by tenure type, 1=individual tenure, 0=group tenure.

[i] This is a score from 1 to 10 with 10 as the best.

[ii] Hongtian Village, Yongan County of Fujian Province individualized forestland tenure in 1998.

[iii] This type is sometimes under the categorization of "market allocated plot".

[iv] This implies that family size was important for how much land a household is allocated within a village. The strict family planning policy in China is likely to imply relatively small changes in family size over time.

[v] Ability of households may also affect party participation but is controlled for with the education variable. Party participation is also a stable characteristic of households (family tradition).