THE EFFECT OF THE NEW ROUND OF COLLECTIVE FOREST RIGHTS REFORM ON FARMERS' AFFORESTATION DECISION - TAKE SONGYANG COUNTY IN SOUTH CHINA AS THE EXAMPLE

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In order to encourage afforestation and promote forestry revenue, a new round of collective forest right reform launched from 2003. The afforestation decision of farmers has important implications for income growth and environmental protection. Therefore, this study attempts to analyze the effects on investment decisions from the types of forest rights, the stability of forest rights and the understanding of farmers on the collective forest right reform. Double Hurdle model estimation results indicate that, comparing with contracted forestland, farmers are more likely to plant in private field; farmers who have the certification of forest property rights tend to invest more money in forest than those who do not have; farmers who perceive the stability of property rights are more willing to conduct afforestation or reforestation and increase monetary investment.

Key words: Collective Forest Rights Reform; Forest Rights; Afforestation decision; South China

1. Introduction

With the successful reform of household responsibility system on farmland, Chinese government shift focus to forestland due to its considerable potential development. While forest industry is featured as long production cycle and long investment return period, which means higher risks than agriculture. Therefore, it is important to figure out the factors influencing the households' investment in forestland, which determine the development of forestry. Based on the success in the reform of land right system, the government has noticed the importance of land right system, especially for the long-term investment in farmland (Wen, 1995). However, the definition of forestry right is still unclear in China, which discourages farmers' investment in afforestation decision (Xu et al. 2008). In 2003, the central government launched a new round of collective forest right reform, which aims to make the forestland rights clear and secure. It is of great policy interest to analyze how this reform influences farmers' afforestation decision or if there is any other factors work.

The new round of Collective Forest Rights Reform has already inspired some empirical studies. For instance, Zhang and Owiredu (2007) find that households' willingness of managing and protecting the forest is affected by the property rights, Zhang et al. (2000) demonstrate that the reform has significant increased farmers' motivation on afforestation and the forestry cover rate also increased after reform, even though there is heterogeneity among different provinces.

Also, some scholars have carried out some studies on the influence of property rights on forest products. Xu et al. (2008) claim the forest right reform has significant effect on timber production. However, Li et al. (2008) indicate that the forest rights definition is still unclear after reform in Sanming city, Fujian province, which slows down the development of forest industry.

Furthermore, some other studies focus on the relationship between property rights reform and afforestation decision. Xu et al. (2008) point out that forest right reform contributed to the increase of afforestation area as well as the increase in farmers' forestry investment. Liao (2007) takes Baoying county of Sichuan province as example to analyze farmers' investment willingness and the results show that the stability of property rights has significant impact on households' afforestation investment and expectation of return on investment. Using Heckman model estimation, Wang (2009) points out that forest rights and forestry service is significantly correlate to afforestation decision.

As described above, some literature exist which discussed the changes after the new round of forest rights reform and also the effects of on afforestation and invest-

ment. Our study particularly focuses on the following questions: (1) which type of forestland is preferred more by farmers after the collective forest right reform? (2) Whether the stability of forestland use right will affect farmers' afforestation decision.

2. Background of Collective Forest Right Reform in China

Until now, the collective forest right reform has experienced three stages: (1) "Three Fixes" policy from 1978 to 1992; (2) Forest right reform pilot period from 1993 to 2003; (3) The new round of collective forest right reform since 2003.

2.1 "Three Fixes" policy from 1978 to 1992

"Three Fixes" policy has significant means to rural households, which launched at national wide from 1981. Until 1986, farm households had contracted at least 70% forestland of collective-owned (Xu 2009). During this reform, forestland rights were divided into three types: private forestland, contracted forestland and collective-owned forestland. Farmers are entitled with forestland use rights and ownership of timber on the private forestland.

The difference between contracted forestland and private forestland is that for the former one, both the land and trees are owned by the collective, but the decision is made by the collective and contracted farmers together. For the collective-owned forestland, the collective owns all the forestland rights, while decision-making is by village leaders. "

Three Fixes" policy relaxed some restrictions on forest rights, and introduced private forestland. However, it also came with some problems, for instance, unclear definition of forestland boundary and owner-

ship and severe deforestation, which push the government to reclaim the private forestland.

2.2 Forest right reform pilot period from 1993 to 2003

In order to solve the problems during "Three Fixes" period, in the following 10 years, the government has tried some resolutions. Firstly, forestland is owned by the collective, while the use right of forestland, ownership of timber are owned by farm households. Secondly, the revenue from forestland has to be distributed between farm households and the collective by certain proportion. This reform solved the definition of forest right to some degree, but there was lack of perfect regulation on forestland transfer which caused some new problems. For instance, contracted forestland was transferred with a price lower than market price, since there is no specific agency for forestland assessment.

2.3 The new round of collective forest right reform in 2003

In 2003, the new round of collective forest right reform was initiated firstly at Fujian province, which spread to ten other provinces in the southern China afterwards. The purpose of the new round of collective forest right reform is to reallocate the use right of collective forestland and target farm households as the operator of forestland. Plus, forest rights certificate is issued by the local government, which can confirm the boundary of forestland, forestland use right, and its duration. The new round of collective forest right reform is expected to encourage farmers' afforestation decision and investment in forestland, since farm households have obtained more rights on their forestland.

3. Data set and variable definition
3.1 Data sources

The data used in this study was collected by household survey in Songyang County, Lishui City, Zhejiang province in February 2015. In our survey, 7 towns were chosen from Songyang County according to the geographic coverage of the program control and the knowledge of the general regional conditions. Then, 14 administrative villages in Songyang County, and 108 households in each villages were randomly selected.

In order to prevent the endogenous problem of property right in the field investigation, we divided use rights of forestland into three types: private forestland, contracted forestland (including two types: contracted forest and who has made) and transfered forestland. Similar method is applied by Ling and Huang (2001), Wang and Zhai (2009).We asked each farmer's two different use forms of forestland, and chose the same use forms of forestland if there are not different use forms of the forestland.

3.2 Afforestation decision

In the questionnaire, we asked farmers whether they have carried out afforestation or not from 2004 to 2014, which is the most important activity in forestry management. There are 104 plots of forestland in the survey existing afforestation decision among 216 plots, 108 farmers, accounting for 48.1% of all plots.

Table 1 show that the average total capital investment in the forestry area is 1818.02 yuan /mu. And the average seed input and chemical fertilizer, pesticide input are 708.14 yuan /mu, 800.85 yuan /mu respectively. During the afforestation process, home labor (the average level is

Table 1. The average input of forestland

Inputs	No. of observation	Medium	S.D.	Min	Max
Total capital input (yuan/mu)	104	1818.02	2934.75	500.08	15384.62
Seed input (yuan/mu)	104	708.14	1142.03	330.57	6461.53
Chemical fertilizer and pesticide input (yuan/ mu)	104	800.85	2122.77	0	15000.00
Household labor input (people /mu)	104	5.30	10.55	0	50.00
Employed labor (people/mu)	104	1.34	3.24	0	25.00

Note: 15 mu = 1 hectare,

5.30people/mu1) is higher than the employed labor (the average level is 1.34people/mu).

Referring to the results of previous studies and the analysis of the above models, we divide main factors that can affect farmers' afforestation decision into the following groups. In the questionnaire, we divided the forestland use rights into three types: private forestland, contracted forestland and the forestland from market transfer. Barren mountain afforestation by farmers occurs rarely in practice. Hence we conclude it into contracted forestland.

Table 2 shows that there are 106 pieces of private forestland land (representing 49.07% of the total sample); 89 pieces of contracted forestland (accounting for the total sample 41.20%) and forestland from the market transfer are 21 pieces, representing 9.73% of the total sample. Forest farmers choose the private forestland to carry out afforestation the most (69 pieces), accounting for 67.35% of total reforestation plots, followed by contracted forestland (22.12%), 23 pieces; and finally, there are 12 pieces of forestland for afforestation in the market circulation. It should be noted that the proportion of private forestland for afforestation is the highest (65.19%), and that of transfered forestland is much higher than the contracted forestland (57.14% v.s 25.84%).

Table 2. The relationship between forestland type and afforestation decision and investment

Forestland types	No. of observation	No. of plots (reforestation)	Reforestation area (mu)	Investment in reforestation (yuan/mu)			Labor input (days/mu)		
				Seed	Fertilizer and pesticide	Total	Home labor	Employed labor	Total
Private forestland	106	69	7	442.84	793.84	1236.68	1.38	6.79	8.18
Contracted forestland	89	23	2.97	509.08	715.53	1214.61	0.79	3.04	3.83
Rented land	21	12	46.83	123.47	429.66	553.13	2.11	1.05	3.16

Note: 15 mu = 1 hectare.

According to types of forestland use rights, the input in different forestland use rights differs each other. In the selected samples, the average afforestation area in private forestland is 7 acres, average seeding input and chemical fertilizer and pesticide input are 442.84 yuan/mu and 793.84 yuan/mu respectively, average home labor and employed labor is 1.38/mu and 6.79 /mu respectively.

Usually, the stability of forestland use rights is measured by forestland adjustment, the possession of forestland rights certificate and the contract of transferred forestland. Since that in the sampled county there did not occur any large forestland adjustment after the collective forest right reform, we use "farmers' own-recognized probability of whether the forestland is still owned by themselves or not in 10 years" to measure the stability of forestland use rights. In other words, this variable is measured by the households' perception of forestry right security.

Table 3 displays the relationship between whether issuing the forestland rights certificate and households' afforestation decision. In the afforestation plots, 87.5% of them have forestland rights certificate. Comparing the afforestation capital investment of these two kinds of property right status, the average seed input of the one

that has certificate is 6.96 times more than the other one (793.02 yuan/mu v.s. 113.96 yuan/mu). And the average chemical fertilizer and pesticide input of the one who has certificate is 2.16 times more that of the other one (858.60 yuan/mu v.s 396.61 yuan/mu). However, the input of labor does not differ too much.

Figure 2 shows the relationship between afforestation investment and the degree of recognition on stability of forest rights. We find that the more secure farmers think, the more money invest in afforestation. If the degree of recognition on stability of forest rights is lower than 40%, then there is no afforestation investment.
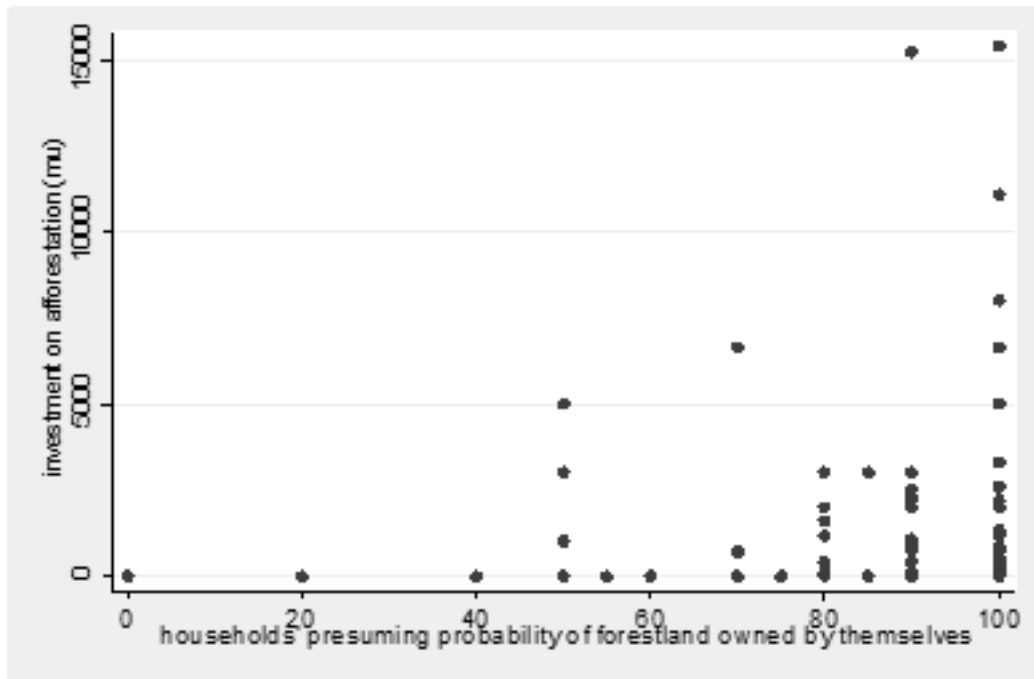
4. Empirical Model Specification

Some scholars analyzed the relationship between farmland right and investment in farmland and find that farmland rights significantly increase investment from three different sides (Ji. et al, 2014). Therefore, we hypothesize that forest right may also stimulate investment in forestland. This paper tries to explore which kind of forestland farmers are more willing to invest in after reform. In other words, is there any difference in the investment in different types of forestland. Also, this paper tries to identify whether the security of forest rights will improve households' afforestation.

Table 3. Forestland property right certificate and afforestation

		sample	Afforestation input(yuan/mu)			Labor input in afforestation (people/mu)		
			Seed input	Chemical fertilizer and pesticide input	total	Home labor	Employed labor	total
Whether to have certificate	yes	91	793.02	858.60	1651.61	5.37	1.25	6.62
	no	13	113.97	396.61	510.58	4.81	1.95	6.76

Figure 1. The amount of afforestation investments and the degree of recognition on stability of forest rights

The empirical regression specification is:

$$Y_i = \alpha + \beta_1 P_i + \beta_2 C_i + \beta_3 Cert_i + \beta_4 Prob_i + \beta_5 Age_i + \beta_6 Edu_i + \beta_7 Non_i + \beta_8 For + \beta_9 Income_i \\ + \beta_{10} Area_i + \beta_{11} Quality_i + \beta_{12} Vil1_i + \beta_{13} Vil2_i + \beta_{13} Vil3_i + \beta_{14} Vil4_i + \beta_{15} Vil5_i \\ + \beta_{16} Vil6_i + \varepsilon_i$$

where i indicates the individual household, Y are variables relate to afforestation, one is a dummy for afforestation decision and the other is the amount of investment in afforestation. In this study, we focus on the three different forestland types, private forestland, contracted forestland and transferred forestland. To avoid multicollinearity, we set transferred forestland as base, and put private forestland dummy (P) and transfered forestland (C) into the model. Besides, we choose two variables to measure forestland use rights stability: $Cert$ equal to 1 if the household has the forestland certification, otherwise 0; and $Prob$ means the degree of recognition on stability of forest rights which is measured by the probability of obtaining forest rights in the next 10 years from the point of view of individual household. Other explanatory factors include household head's age (Age), education (Edu), the labor put in nonfarm (Non) and forest management (For), household total annual income ($Income$), forestland area ($Area$) and quality ($Quality$). Considering the regional differences, village dummy ($Vil1, Vil2, Vil3, Vil4, Vil5, Vil6$) were created, while and Zhuyuan village is used as base group. ε_i is an error term that accounts for individual unobserved heterogeneity between households.

Table 4. Descriptive statistics of variables in the empirical model

variables	Explanation and unit	Mean	S.D
Dependent variable			
Y1	Whether make afforestation decision, yes=1, no=0	0.48	0.50
Y2	Investment in afforestation (yuan/mu)	875.05	2226.13
Independent variable			
P	If private forestland equal to 1 others 0	0.49	0.50
C	If transferred forestland equal to 1, others 0	0.10	0.30
$Cert$	yes=1, no=0	0.88	0.33
$Prob$	The probability of obtaining forest rights in the next 10 years from the point of view of individual household, %	85.63	65.96
Age	Years old	52.69	8.71
Edu	years	7.06	2.37
Non	The amount of non-farm labor/household total labor, %	54.99	32.81
For	The amount of labor in forestry management/total labor, %	67.81	28.04
$Income$	yuan	26484.61	18715.87
$Area$	mu	11.77	19.50
$Quality$	1=high, 2=medium, 3=low	1.64	0.73
Vil1	Household in Chishou =1, others=0	0.15	0.36
Vil2	Household in Dadongba =1, others=0	0.18	0.38
Vil3	Household in Sandu=1, others=0	0.20	0.40
Vil4	Household in Wangsong=1, others=0	0.07	0.26
Vil5	Household in Xiping =1, others=0	0.13	0.34
Vil6	Household in Zhangxi =1, others=0	0.20	0.40

5. Results and Discussion

Considering this is a closely connected two-stage decision, we firstly use the Probit model to find out the factors that affect farmers' decisions on afforestation, and then make another regression with censored data by Double Hurdle model to find the factors affecting farmers' investment in afforestation.

The regression results are presented in Table 5. Firstly, compared with contracted forestland, farmers are more likely to carry out afforestation in private forestland. In the case that other factors remain unchanged, the possibility of afforestation in private forestland is 0.65 higher than that of contracted forestland, which is significant at the 1% statistical significance level. It may because that the duration of private forestland is longer than that of contracted forestland, hence farmers are more willing to carry out afforestation activities in private forestland. The results of transfered forestland are not significant, but the results are positive, which are consistent with the expected direction. The results indicate that compared to contracted forestland, the farmers are more willing to carry out afforestation on transfered forestland. It may because the farmers can

choose management on they own. Regarding forestry right stability, the issuing of forestry right certificates is not significant on farmers' afforestation decision at the 1% significance level. However, farmers' perception of forestland rights stability is significant, meaning that the more stable farmers themselves think forestland property right is, the more possible they will carry out afforestation. Regarding family characteristics, forestland area has a slight effect on the farmers' decision-making, but forestland quality is statistically significant at a 1% significance level. The possibility that the farmers carry out afforestation on the forestland with high quality of is 0.47 higher than that with low quality. Farmers' non-farm employment rate on their afforestation decision-making is significant, the higher of farmers' non-agricultural employment rate is, the more likely they will not carry out afforestation. For individual characteristics of the decision maker, the effect of age on afforestation is statistically significant at a significant level of 1%, which means that the possibility of afforestation will be reduced by 0.05 every one year older. In terms of geography, except the Sandu Town where the dummy variable is significant at the 10% level of significance, other areas are not all significant, which indicates that unobserved factors in cultural, institutional, economic context have no significant impact on decisions of whether to carry out afforestation.

At a 10% significance level, the impact of property right certificate on afforestation investment is significant. This means compared to farmers who don't have forestland rights certificate, those who having certificate will invest another 665.4

yuan in afforestation. This result demonstrates that the forestland rights certificate can bring about a kind of safeguard function to afforestation. Also, Farmers' own cognition on the stability of the forestland rights also affects the afforestation investment per mu, which is statistically significant at the 1% significance level. With 1% increase in the personal-recognized probability of owning the forestland, the capital invested will increase 6.49 yuan.

The effect of forestland area on afforestation investment is significant at 1% significance level. Every 1 mu increase in area, the investment per mu will decrease 25.7 yuan. It may because that the larger the area is, the more likely for households to obtain scale economy. Also, household forestry participation rate is statistically significant for afforestation input per mu at 1% significance level. Investing 1% more household labor in afforestation will increase 10.66 yuan in afforestation input. And family annual income per capital is statistically significant at 5% significance level. 1 yuan increase in per capital income will increase 0.01 yuan in afforestation input.

According to the estimated results, the age of decision maker has significant impact on afforestation decision, which is statistically significant at 5% significance level. It indicates that one year older, the afforestation input per mu will decrease 65.43 yuan. It may because the older the decision maker is, the more conservative he/she is. Also, the education degree of decision maker is statistically significant at 5% significance level. It means that one year educated more will decrease 139.8 yuan in afforestation input. The reasonable explanation is that the higher the edu-

cation degree is, the better his/her skill is. So the investment range is larger and therefore decrease the afforestation input. Another explanation is that the higher the education degree is, the more likely for the decision maker to use pesticide and chemical fertilizer scientifically and therefore decrease the rational cost.

The third line in table 2 shows the factors influencing farmers' capital input per mu after the collective forest right reform. The model results show that those farmers who have forestland rights certificate, and have higher self-perceptions of forestland stability, tend to invest more in afforestation per mu.

Table 5. Regression results of afforestation driver

	1st stage Probit whether carry out afforestation after 2003	2nd stage truncreg Afforestation input per mu
Private forestland	0.65***	-123.40
	(0.23)	(266.80)
Transfered forestland	0.21	613.70
	(0.80)	(505.70)
Forestland rights certificate	0.31	665.40*
	(0.66)	(386.90)
Probability of owning the forestland in 10years	0.03***	6.49***
	(0.01)	(1.13)
Forestland acreage	-0.01	-25.71***
	(0.01)	(8.20)
Forestland quality	-0.47***	-75.18
	(0.16)	(137.20)
Household non-farm employment	-0.01*	-7.45
	(0.004)	(6.73)
Household forestry management participation rate (10-3))	5.50	10.66***
	(3.41)	(4.05)
Household annual income per capital (10-3)	0.004	13.8**
	(0.01)	(6.10)
Age	-0.05***	-65.43**
	(0.02)	(26.85)
Education	-0.06	-139.80**
	(0.05)	(66.99)
Chishou village	0.23	-1.48
	(0.56)	(1.27)
Dadongba	0.32	-1.37
	(0.51)	(1.22)
Sandu	0.95*	-1.49
	(0.52)	(1.14)
Wangsong	0.80	-1.16
	(0.60)	(1.19)
Xiping village	0.79	-1.78
	(0.52)	(1.11)
Zhangxi village	0.022	-1.77
	(0.52)	(1.18)
Constant	-0.29	2.00***
	(1.46)	(341.4)
obesevation	216	216
Pseudo maximum likelihood logarithm	-101.50	-1948.52
Pseudo R2	0.32	—
White statistics	58.36	89.02

Note: there is heteroscedasticity in the data, so the results in parenthesis is robust standard error; ***、 **、 * denote statistical significance at 1%、5%、10% level respectively

7. Conclusions

According to the analysis above, we can have the following conclusions: compared to the contracted forestland, households are more willing to carry out afforestation decision on private forestland. The significant difference between the two kinds of forestland is that the duration of private forestland is longer, which means that the longer the property right duration is, the households are more willing to conduct afforestation decision.

Households with forest rights certificate invest more capital than those do not have one, which means the issuing of certificate do encourage households' investment in afforestation. Also, households' awareness of the forestry right stability has significant impact on afforestation investment. Households who see forest right more stable tend to invest more in afforestation. Apart from the factors mentioned above, forestland area, forestland quality, household non-farm employment rate, household forestry engagement rate and the age and education degree of the household's decision maker etc. also have impact on households' afforestation decision. Since we only choose one sample county in the survey, the difference in this county is not too much and the relevant collective forest right reform has not been implemented totally. Therefore, we do not consider about the impact of tax system and forestry service on afforestation decision, which may require a further research.

The county government should ensure the implication of the collective forest right reform. Since the new round of collective forest right reform in 2003, one important measure is the issuing of rights certificate of households' current-owned forestland.

However, the reality is that because of the contracted absence of county forestry department, the issuing procedure is quite slow, even false. It indicates that the forestry benefit of households can not been protected, which will hold back the participation and investment of afforestation. Therefore, the county forestry department should take the collective forest right reform seriously and guarantee households' legitimate right practically.

Improve policy publicity on households. During the survey process, we found that households know little about the new round of collective forest right reform. They know little about the forestland adjustment in the village and the function of the forestry property right certificate, which will affect their perception of forestland right stability and influence the afforestation decision afterwards. There is an information asymmetry between households and government. Therefore the county/town government and village committee should improve public's awareness of the collective forest right reform and therefore helping the public to make the optimal afforestation decision.

References:

Armen A A (1965) Some Economics of Property Rights Politico 30(4):816-829

Beekman G, Bulte E H (2012) Social norms, tenure security and soil conservation: Evidence from Burundi. Agricultural Systems 108:50-63.

Brasselle A S, Gaspart F, Platteau J P (2002) Land tenure security and investment incentives: Puzzling evidence from Burkina Faso. Journal of Development Economics 67 (2):373-418

Besley,T (1995) Property rights and investment incentives: Theory and evidence from Ghana. Journal of Political Economy 103(5): 903-937.

Bo FM (2004) Analysis of factors influencing household afforestation.Journal of China Agricultural University (in Chinese)

Furubotn, E. G., Pejovich, S (1972). Property Rights and Economic Theory: A Survey of Recent Literature. Journal of Economic Literature, 10(4), 11371162

Harold Demsetz (1996) The core disagreement between Pigou, the profession, and Coase in the analyses of the externality question. European Journal of Political Economy 12(4): 565-579

He LY, Huang JK (2001) Land use rights stability and fertilizer use:based on empirical study in Guangdong province. China Rural Survey (5):42-48 (in Chinese)

Jiang H, Zhang DW (2001) Incentive mechanism of forestry investment and property rights institutional arrangement. Journal of Agrotechnical (1):8-14 (in Chinese)

Ji DY, Ma XL, Shi XP (2014) Impact of land tenure security on land investment: a literature study[J]. Journal of Nanjing Agricultural University 14 (3):52-61 (in Chinese)

Ji DY, Ma XL, Shi XP (2015) The Impact of Forest Property Rights on Forestland Investments: From the Perspective of Property Rights Integrity and Security: a Case from Suichuan and Fengcheng of Jiangxi Province. Issues in Agricultural Economy (3):54-61 (in Chinese)

Li YC (2004) The definition and performance analysis of Chinese forestry property rights: based on the tenure reform in Sanming city, Fujian Province. Chinese Rural Economics (11):60-65 (in Chinese)

Liao ZJ (2007) Forestry private rights degree and economic efficiency: based on the case study in Baoying county, Sichuan Province. Issues in agricultural economy (7):38-42 (in Chinese)

Xu JT, Sun Y, Jiang XM, Li J (2008) Collective forest tenure reform in China: Analysis of pattern and performance. Forestry Economics 09:27-38 (in Chinese)

Xu JT, Jiang XM (2009) Collective Forest Tenure Reform in China: Outcomes and Implications. Presentation at the World Bank conference on land governance March 9-10

Wang HY, Qu YL (2009) Household forestry production behavior study under property right reform. Agricultural economy (3):71-73 (in Chinese)

Wen, G J (1995) The Land Tenure System and Its Saving and Investment Mechanism: the Case of Modern China. Asian Economy 9(31):233-259

Zhang DW, Owiredu E (2007) Land Tenure, Market and the Establishment of Forest Plantations in Ghana. Forest Policy and Economics (9):602-610

Zhang YQ, Jussi U, Jari K (2000) Impacts of economy reforms on rural forest in China.

Forest Policy and Economies 1(l):27-40

Zhong FN, Ji YQ (2009) Land rights, non-agricultural employment opportunities and farmers' agricultural investment. Economic Research Journal (12):43-51 (in Chinese)