Analysis of Factors Influencing Forest Farmers' Enthusiasm for Forest Culture and Management after the Completion of Reform of Collective Forest Right System

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Abstract Taking Jiangshan City in Zhejiang Province for example, this article uses the binary logit choice model based on the field survey data, to study the factors influencing forest farmers' enthusiasm for forest culture and management after the completion of reform of collective forest right. Finally the following recommendations are put forth: further improving and implementing the forest ecological benefit compensation fund system; reforming the felling management mode and gradually establishing the sustainable forest management system based on forest management plan; improving the technology, market and information services to strengthen the forestry science and technology support; developing the specialty industries such as the bamboo industry and oil-tea camellia industry; developing the under-forest economy and cultivating the under-forest industries with characteristics based on the local circumstances.

Key words Collective forest, Reform, Forest farmers, Enthusiasm

1 Introduction

To speed up the development of forestry and eliminate institutional obstacles to forestry development, the CPC Central Committee and the State Council issued *Views on Comprehensively Promoting the Reform of Collective Forest Right System* in June 2008, which further defined the major principles and tasks of the reform of collective forest right system.

The reform of collective forest right system is another major reform in rural areas following the household contract responsibility system, and also the core of entire forestry reform (Jia Zhibang, 2006). The focus of forest tenure reform is to make the property rights clear and strengthen the dominant position of forestry operators.

The main body of the reform of collective forest right system is forest farmer, and how to motivate farmers to actively participate in the reform of forest right system and improve the forest farmers' willingness to operate is related to the forest tenure reform achievements and sustainable forestry development. According to the statistics of State Forestry Administration, Chine determined the ownership of 2.6 billion mu of collective forest land as of the end of 2011, accounting for 95% of the total area of collective forest land.

In recent years, many experts and scholars have studied and analyzed the theory, performance, and effects of collective forest right reform, and the forest farmers' policy willingness. Sun Yan *et al.* used the field survey and research data to analyze the effects of forest right reform in five counties and cities of Jiangxi Province on the woodland operation model (Sun Yan *et al.*, 2006). Qiu Ju *et al.* studied the household contract management of forest land and market-oriented forestry economy (Qiu Ju *et al.*, 2007). Xu Jintao *et al.* used the field survey and research data of Fujian and other provinces from 2006 to 2007, to analyze the factors influencing the provincial forest tenure arrangement, and evaluate the initial results of forest right reform (Xu Jintao *et al.*, 2008).

At present, most regions of China have completed the reform of collective forest right, but there are few studies of the factors influencing forest farmers' enthusiasm for forestry operation after the completion of reform of collective forest right system. Zhejiang Province is the first province to carry out the reform of collective forest right system. The province has made great strides in the reform of collective forest right system. As of February 2012, it certified the ownership of 86.545 million mu of forest land and a total of 4.259 million certificates of forest rights were issued and replaced. It has become one of the provinces basically completing the task of forest tenure reform in advance.

Currently, the province's forest coverage has reached 60.58%. In 2011, the total forestry output value exceeded 315.5 billion yuan, and forestry contributed more than 18% to forestry farmers' income. Therefore, we select Zhejiang Province as the first to complete the reform of collective forest right system for field survey.

2 Overview of the survey area

Jiangshan is a county-level city located in Quzhou prefecture, Zhejiang Province, China. Located about 250 kilometers southwest of Hangzhou, the provincial capital, it is the only county-level city in the prefecture. As of 1999, Jiangshan's population stood at 563196. The city is named aptly: Jiang means river and Shan means mountain; a river runs through the city and scenic Mt.

Received: January 18, 2014 Accepted: March 3, 2014
Supported by the Fundamental Research Funds for the Central Universities (CAFYBB2011006-04).
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Jianglang sits on its border.

The topography of Jiangshan City is high in the south and low in the north, and the central part of the city is semi-enclosed basin. Jiangshan City features a subtropical humid monsoon climate, and affected by terrain, it has the characteristics of basin climate and mountain climate.

In 2004, Jiangshan City took the lead in the province to carry out the subject reform with making the property rights clear as the main content. Since the reform of more than five years, it has initially established a modern forestry property rights system adapting to the market economy. It has been classified as the demonstration city of the reform of forest right system and the demonstration city of provincial forestry reform by Zhejiang Provincial Department of Forestry.

At the end of 2010, the city's forest coverage reached 68.4%, and the total stock volume of forest was 6.005 million cubic meters. The subject reform of forest right system in Jiangshan City was basically completed, and 99.30% of forest land ownership of 21 towns and 1 state-owned forest farm was determined and certified (2008 data). The collective forest reform prompts a change in the management mechanism, and improves the forest resource use efficiency.

The city has established 22 trading markets for forest right transfer, comprising 1 municipal trading center, 1 regional trading center, and 20 town trading centers. During the "Eleventh Five-Year" period, the area of collective forest land ownership transferred reached 37652 mu, and the transaction sum was 55.0958 million yuan; its forest right mortgage loan balance reached 174 million yuan, in the forefront of the province; the forest insurance area was 0.7043 million mu, with 140 million yuan of premium. Now the forest area is in a good order, the forestry property disputes are significantly reduced, and forest farmers' enthusiasm for forest culture and management is greatly improved.

3 Data sources

In May 2011, the research group, assisted by Jiangshan Municipal Bureau of Forestry and Jiangshan Municipal Forestry Science and Technology Extension Station, carried out the survey and research of the current situation of reform of collective forest right system in Jiangshan City.

3.1 Survey design The questionnaire is divided into the village questionnaire of dynamic information of the reform of collective forest right system and farmer questionnaire. The village questionnaire mainly includes population, income, employment, forestry resources, and forest land operating types in the village.

The farmer questionnaire is divided into the basic situation of farmers and questionnaire. The basic situation of farmers includes age, education level, total household population, number of labor force, forest land area and operating items.

The questionnaire mainly includes the following questions:

(i) Is there any change in the operating area of forest land after the forest tenure reform? Increase or decrease?

(ii) Are you willing to collectively employ the forest rangers to take care of the forest land after the forest tenure reform?

(iii) Are you willing to insure the forest land?

(iv) Are you willing to increase investment in forestry?

(v) Is the village meeting convened to discuss the implementation of allocating forest land ownership to all households?

(vi) Does the forest tenure reform bring benefits to the family?

(vii) Is the tax burden obviously reduced after the forest tenure reform?

(viii) Do you obtain the afforestation grants, tending funds and ecological compensation?

(ix) Have you considered expanding the scale of forest operation?

(x) Are you satisfied with the supporting policies for forest tenure reform?

3.2 The object of survey During the survey period, the research group mainly surveyed and visited 10 towns, 30 villages in Jiangshan City, to know the farmers' forestry input and farmers' forestry income before and after the forest tenure reform. And we distributed 30 copies of Village Questionnaire of Dynamic Information of the Reform of Collective Forest Right System and 100 copies of Farmer Questionnaire of Dynamic Information of the Reform of Collective Forest Right System in the 30 villages.

The research group also obtained a lot of data from Jiangshan Municipal Bureau of Forestry, Jiangshan Municipal Bureau of Statistics, and Jiangshan Municipal Forestry Science and Technology Extension Station. Meanwhile, the research group conducted in-depth understanding of the forestry cooperative in Chang'an Village of Changtai Town.

Currently, a total of 30 copies of village questionnaires and 86 copies of farmer questionnaires are called back. The preliminary analysis of these data show that the collective forest right reform in Jiangshan City has completed the stage of making the property rights clear, the forest farmers' income is increased to some extent and the forest right reform in Jiangshan City has entered a deepening stage.

Table 1 The scale of forest right mortgage loan Unit: 10^4 yuan

Year	Forest right mortgage loan amount
2010	17 800
2009	12 400
2008, 2007, 2006	4 475

Table 2 Forest right disputes

Years	Number of disputes
2010	3
2009	5
2008	12
2007	9
2006	12

This article mainly selects the factors having a significant impact on forest farmers' enthusiasm for forest culture and manage-

ment from many factors related to collective forest right reform, to predict and analyze the effectiveness of collective forest right reform, and put forth policy recommendations for the deepening of reform.

4 Model establishment and analysis

4.1 Hypothesis According to previous studies, the lessons learned during the survey and the process of selecting independent variables, we propose the following hypotheses:

H_1 The stability of property rights will help improve the farmers' enthusiasm for forestry production, that is, it will improve forest farmers' enthusiasm for forest culture and management.

H_2 Insuring the forest land input will increase sense of security for forestry property, thereby increasing forest farmers' enthusiasm for forest culture and management.

H_3 Whether benefiting from the forest tenure reform will affect forest farmers' enthusiasm for forest culture and management. The tax relief, seed subsidies, subsidies for afforestation, and tending fund will increase the enthusiasm for forest culture and management.

H_4 The forest tenure reform policy will affect forest farmers' enthusiasm for forest culture and management, and available loans will increase the enthusiasm for forest culture and management.

4.2 Model selection First general linear probability model is introduced and its form of regression is as follows:

$$Y_i = \partial_1 X_{1i} + \partial_2 X_{2i} + \partial_K X_{Ki} + \eta_i \quad i = 1, 2, \cdots, N \tag{1}$$

where N is the sample size; K is the number of explanatory variables; X_{Ki} is the value of individual i of variable K; Y_i is the discrete random variable taking value of 0 and 1.

Let $p_i = p(Y_i = 1)$, then $1 - p_i = p(Y_i = 0)$, the expected value is derived as follows:

$$E(Y_i) = 1 \times p(Y_i = 1) + 0 \times p(Y_i = 0) = p_i \tag{2}$$

So, $E(Y_i) = \partial X_i$, $\partial = (\partial_1, \partial_2, \cdots, \partial_{ki})$, $X = (X_1, X_2, \cdots, X_{ki})$ it is transformed into the following expression:

$$E(Y_i) = p(Y_i = 1) = p_i = \partial X_i \tag{3}$$

When $0 < \partial X_i < 1$, the equation was established, and the linear model can be expressed as follows:

$$p_i = \begin{cases} \partial X_i, & 0 < \partial X_i < 1 \\ 1, & \partial X_i \geqslant 1 \\ 0, & \partial X_i \leqslant 0 \end{cases} \tag{4}$$

Now the linear model is converted into probability model. Assuming there is an unobserved variable:

$$Y_i = \partial k_i + \eta_i^*$$

where η_i^* is the random disturbance term.

The relationship between Y_i^* and Y_i^* is as follows:

$$p_i = \begin{cases} 1, & Y_i^* > 0 \\ 0, & Y_i^* \leqslant 0 \end{cases} \tag{5}$$

When Y_i^* is greater than the threshold value 0, $Y_i = 1$; when Y_i^* is smaller than the threshold value 0, $Y_i = 0$.

So, $p(Y_i = 1 | X_i, \partial) = p(Y_i^* > 0) = p(\eta^i > -\partial X_i) = 1 - F(-\partial X_i)$ (6)

Accordingly, $p(Y_i = 0 | X_i, \partial) = F(-\partial X_i)$ (7)

where F is the distribution function of η_i^*.

So the original regression model can be transformed into the following formula:

$$Y_i = 1 - F(-\partial X_i) + \eta_i \tag{8}$$

In this article, we use binary logit choice model for estimation. The dependent variable is set as the forest farmers' enthusiasm for forest culture and management after the forest tenure reform, which is 0 – 1 binary variable.

If the forest farmers' enthusiasm for forest culture and management is improved after the forest tenure reform, the value is 1; if there is a decrease or no change in the forest farmers' enthusiasm for forest culture and management, the value is 0.

The independent variables in the model and their definitions can be shown in Table 1.

The form of the model is as follows:

$$Y = C + \beta_1 AGE + \beta_2 EDU + \beta_3 ASSET + \cdots + \beta_{19} SATISFACTION + \eta_i \quad (4.9)$$

We retain 77 groups of valid data and at the same time adjust some selected variables accordingly.

4.3 Results and analysis Eviews software is used to carry out regression analysis of the model, and this model can explain 73.68% of the survey data. Chi – square value reaches 51.22 ($p = 0.00$), and HL statistical value is 17.43 ($P = 0.56 > 0.05$), so it accepts the null hypothesis that there is no significant difference between the observation data and predicted data, indicating that the model can well fit the overall sample data and the independent variables can well explain the dependent variables.

Table 1 Independent variables in the model and their definitions

Variables	Definitions	Value assignment
AGE	Age	Natural values
EDU	Education level	6 = below junior high school, 9 = junior high school, 12 = senior high school/vocational school, 15 = junior college
ASSET	Family property	Natural values
POP	The proportion of labor to total household population	Natural values
WORKER	Number of migrant workers	Natural values
AREA	Arable land area	Natural values
FOREST	Changes in the area of forest land operated before and after forest tenure reform	1 = increase, 0 = decrease or remain unchanged
TIMBER	Willingness to fell timber	1 = free felling, 0 = felling after being approved or felling is prohibited

(Table 1)

Variables	Definitions	Value assignment
MANAGE	Whether they are willing to collectively employ the forest rangers to take care of the forest land	1 = yes, 0 = no
ASSURANCE	Whether forest farmers are willing to insure the forest land	1 = yes, 0 = no
INVEST	Whether they are willing to increase investment in forestry	1 = yes, 0 = no
MEETING	Whether to convene the village meeting to discuss the implementation of forest distribution policy	1 = yes, 0 = no
BENEFIT	Whether the forest tenure reform brings benefits to the family	1 = yes, 0 = no
TAX	Whether the tax burden is significantly reduced	1 = yes, 0 = no
SUBSIDY1	Whether to get afforestation grants	1 = yes, 0 = no
SUBSIDY2	Whether to get forest tending fund	1 = yes, 0 = no
SUBSIDY3	Whether to get forest ecological benefit compensation	1 = yes, 0 = no
SCALE	Whether to expand the scale of forest operation	1 = yes, 0 = no
SATISFACTION	Whether they are satisfied with the supporting policies for forest tenure reform	1 = satisfied, 0 = unsatisfied

Table 2 Model fitting degree

% Correct	Chi - square	H - L
73.68%	51.22(0.00)	17.43(0.56)

Note: % Correct mainly displays the proportion of observed values that are grouped appropriately, and if the grouping is more appropriate, it often indicates that the predicted probability value is closer to the actual value (1 or 0), and the model is fitted well; Chi - square value is an measuring indicator of wald test, its null hypothesis is that the estimated coefficient is zero, and the smaller the concomitant probability, the greater the possibility that the null hypothesis is rejected; the null hypothesis of HL statistic is that there is no significant difference between the observed data and the predicted data, and the smaller the concomitant probability, the greater the possibility that the null hypothesis is rejected.

Table 3 Model parameter estimation

Variables	Estimated coefficients	Standard deviation	Z statistic	Concomitant probability
AGE	-0.121 8**	0.055 9	-2.178 7	0.029 4
EDU	-0.155 7	0.216 8	-0.718 3	0.472 6
ASSET	0.020 1	0.042 0	0.479 6	0.631 5
POP	-0.322 5	1.805 2	-0.178 6	0.858 2
WORKER	-0.776 9	0.638 6	-1.216 4	0.223 8
AREA	0.165 6	0.259 8	0.637 5	0.523 8
FOREST	0.548 5	1.223 7	0.448 2	0.654 0
TIMBER	0.767 3	1.210 4	0.633 9	0.526 1
MANAGE	-0.074 3	1.343 7	-0.055 3	0.955 9
ASSURANCE	-3.454 3*	1.971 9	-1.7517	0.079 8
INVEST	1.785 0	1.323 3	1.348 9	0.177 4
MEETING	4.995 5**	1.995 5	2.5033	0.012 3
BENEFIT	3.870 9*	2.073 0	1.867 2	0.061 9
TAX	1.983 7*	1.080 2	1.836 3	0.066 3
SUBSIDY1	1.320 1	1.651 4	0.799 3	0.424 1
SUBSIDY2	0.707 1	1.410 6	0.501 2	0.616 2
SUBSIDY3	-1.697 6	1.521 9	-1.115 4	0.264 7
SCALE	1.923 6*	1.144 4	1.680 7	0.092 8
SATISFACTION	-1.730 5	1.784 3	-0.969 8	0.332 1

Note: *, **, *** represent the significance level of 10%, 5% and 1%, respectively, when the coefficients of the regression factors are not zero.

According to Z statistic in Table 3, it can be seen that EDU (education level), ASSET (family property), POP (the proportion of labor to total household population), FOREST (changes in the area of forest land operated before and after forest tenure reform), and MANAGE (whether they are willing to collectively employ the forest rangers to take care of the forest land), have no significant effect on forest farmers' enthusiasm for forest culture and management after the forest tenure reform.

At the 10% significance level, the factors influencing forest farmers' enthusiasm for forest culture and management after the forest tenure reform include ASSURANCE (whether forest farmers are willing to insure the forest land), BENEFIT (whether the forest tenure reform brings benefits to the family), TAX (whether the tax burden is significantly reduced), and SCALE (whether to expand the scale of forest operation).

At the 5% significance level, the factors influencing forest farmers' enthusiasm for forest culture and management after the forest tenure reform include AGE (forest farmers' age), and MEETING (whether to convene the village meeting to discuss the implementation of forest distribution policy).

(i) The factor having the greatest impact on forest farmers' enthusiasm for forest culture and management is MEETING (whether to convene the village meeting to discuss the implementation of forest distribution policy), that is, the democratic level of the forest tenure reform policies has a significant positive effect on forest farmers' enthusiasm for forest culture and management, and it is significant at the 5% level, indicating that what the forest farmers are most concerned about is whether the forest tenure reform policies are open and transparent, and whether the woodland property rights are clear.

(ii) AGE (forest farmers' age) is significant at the 5% level, but the coefficient is negative, indicating that farmers' enthusiasm for forestry operation is reduced with age. When getting older, they are more reluctant to engage in the forestry production activities with a long cycle of the return on investment, which is the same as the research result of Sun Yan and Xu Jintao on Jiangxi and Fujian (Sun Yan, Xu Jintao, 2011).

(iii) ASSURANCE (whether forest farmers are willing to insure the forest land) is significant at the 10% level, but the estimated coefficient is negative, indicating that after the forest land is insured, forest farmers believe that if there is an accident, the in-

surance company will be responsible for the losses, thereby reducing the input to pest control and natural disaster prevention, and reducing the forest farmers' enthusiasm for forest culture and management.

(iv) The monetary and fiscal policies on the forest tenure reform have an impact on forest farmers' enthusiasm for forest culture and management. Whether the forest tenure reform brings benefits to the family, and whether the tax burden is significantly reduced, are significant at the 10% level, and the coefficient is positive. It is consistent with the hypothesis.

The tax relief, seed subsidies and tending fund for forest farmers can bring them more economic benefits, and they have more funds for forestry production activities, thereby enhancing the enthusiasm for forest culture and management.

(v) Whether to expand the scale of forest operation is significant at the 10% level, indicating that the forest farmers have high enthusiasm for forest culture and management after expanding the scale of forest operation, which is consistent with our common sense.

5 Conclusions

Survey results and empirical analysis show that the reform of collective forest right subject in Jiangshan City has been completed, it has entered a deepening stage of reform of supporting policies and measures, and forest farmers' enthusiasm for forest culture and management has been greatly improved.

Regression model shows that whether there is a stable and clear property right of forest land is the primary factor influencing farmers' enthusiasm for forest culture and management. When the property rights are stable, the supporting monetary policy becomes an important factor restricting farmers' enthusiasm for forest culture and management.

According to the research results, in order to further improve forest farmers' enthusiasm for forestry production and increase forest farmers' income after the reform of collective forest right system, we put forth the following recommendations:

(i) Further improving and implementing the forest ecological benefit compensation fund system. It is necessary to conduct the classification and compensation work of ecological welfare forest; establish a sound organizational security system for the key ecological welfare forest, to ensure the improvement of construction effectiveness of welfare forest; strengthen forest ecosystem security measures, and improve forest ecosystem benefit monitoring and forest disaster monitoring and forecasting system.

(ii) Reforming the felling management mode and gradually establishing the sustainable forest management system based on forest management plan. It is necessary to innovate upon the felling management mode, improve the felling quota management system, and realize the sustainable forest operation and multi-objective management. By felling management, forest managers are guided to implement the felling and achieve sustainable forest management based on the forest operation plan.

(iii) Improving the technology, market and information services to strengthen the forestry science and technology support. It is necessary to establish forest rights information management system, to promote the modernization of forest rights management; enhance the forestry science and technology promotion system, and fully rely on the technology and talent advantages of forestry universities and forestry institutions, to carry out introduce the latest technology, knowledge and ideas.

(iv) Developing the specialty industries such as the bamboo industry and oil-tea camellia industry. It is necessary to use location advantages to expand the scale of specialty industries, in order to explore new ways for forest farmers to increase income.

(v) Developing the under-forest economy and cultivating the under-forest industries with characteristics based on the local circumstances. In short, establishing a forestry property rights system, with clear property ownership, clear division of responsibilities and rights and smooth circulation, is the most fundamental goal. There is an urgent need to establish the supporting policy systems (ecological compensation system, felling system, forest rights transfer system, and forestry financing system) for the forest farmers after the forest tenure reform.

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