Analysis of Factors Influencing Farmers' Participation in Forest Farmers Cooperatives Based on Empirical Research of Zhejiang Province

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Abstract Based on field research data of farmers in Zhejiang Province, the authors analyzed factors influencing farmers' participation in forest farmers cooperatives (hereafter referred to as FFCs) by the binary logistic regression model. Results show that understanding of farmers about cooperatives has a great influence on their behavior of participation in FFCs. Besides, educational level of householders and existing member scale of cooperatives also have significant influence on farmers' behavior of participation in cooperatives. Therefore, it is required to strengthen propaganda of cooperatives, deepen their understanding of cooperatives; cultivate new high quality farmers to provide talents for development of cooperatives; establish incentive mechanism to encourage farmers to participate in cooperatives.

Key words Forest farmers, Forest farmers cooperatives, Participation behavior, Influence factors

In recent years, FFCs get considerable development in China, but farmers' participation enthusiasm is still very low[1-5]. This, to a great extent, impedes long-term standardized development of cooperatives, and limits cooperatives to give full play their function in promoting economic development of mountainous areas and increasing farmers' income. Therefore, analysis on influence factors of farmers' participation behavior from microscopic perspective is necessary[6], and it is preferred to reveal internal mechanism of development of cooperatives[7], to provide theoretical basis and policy recommendations for better development of cooperatives. Domestic scholars have made effective researches on farmers' participation behavior[4-11], but there are few researches about influence factors of farmers' participation in FFCs. This study is based on field research of 258 farmer households in Zhejiang Province in 2009 and 2010. Through establishing the binary logistic regression model, we analyzed factors influencing farmers' participation in FFCs. This will play an important role in promoting development of FFCs and making relevant policies.

1 Research area and data source

1.1 Research area Zhejiang Province, situated in southeast coast of China, has a total area of 101 800 km^2, of which 70.4% is mountainous area. Collective-owned forest area accounts for more than 95% of the forest area. In the 90 counties (cities and districts) of the whole province, 51 are forest counties, so Zhejiang Province is a province which takes the leading position in reform of collective-owned forest and development of forest farmers cooperatives. By 2009, in Zhejiang Province, there were 1 512 FFCs, cooperative members up to 134 500, connecting 924 000 farmer households, driving 270 000 hm^2 area base, involving production, processing and circulation of leading forest products, such as flowers, bamboos, dry and fresh fruits, and economic forest.

1.2 Data source Using the stratified random sampling method, according to distribution characteristics of FFCs in the research area, we carried out field survey in four cooperatives in Longquan City and two cooperatives in Fenghua City and Lin'an City separately in December of 2009 and July of 2010. We surveyed members and non-members, received 270 copies of the questionnaire, of which 258 (139 from cooperative members and 119 from non-members) are valid, as listed in Table 1.

2 Factors influencing farmers participation in cooperatives

Existence and development of forest farmers cooperative are closely related with farmer households. Whether farmer households participate in cooperatives mainly depends on the comparison between expected income and participation cost[12]. Expected income will be influenced by many factors, such as situations of farmer households, development of cooperatives and local macro-market economy. Therefore, according to existing research achievements, we divided major factors influencing farmers' participation in cooperatives into 6 groups:

(1) Householder characteristics of farmer households: Sex, age, educational level of householders, and their knowledge of cooperatives. Theoretically, the higher the educational level of householders and the higher cognition level of cooperatives, the higher possibility of participating in cooperatives.

(2) Family characteristics of farmer households: Family labor and economic strength[11]. And the family economic strength

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is evaluated by family net income per capita.

(3) Production characteristics of farmer households: Operation scale of forest products[7] and importance degree of forestry production. The former is measured by operation area of forest products, and the latter is evaluated by the proportion of forest income into total family income.

Table 1 Sampling conditions

Sampling areas	Sample cooperatives	Cooperative members	Non-members	Total
Longquan City	Xiaozhuang Bamboo Cooperative	13	23	36
	Nengfu Afforestation Professional Cooperative	26	0	26
	Longzhu Bamboo Shoot Cooperative	23	21	44
	Shengyuan Teaseed Oil Professional Cooperative	15	18	33
Fenghua City	Jinpingshan Honey Peach Professional Cooperative	15	15	30
	Universal Flower and Tree Professional Cooperative	14	11	25
Lin'an City	Daoshi Lake Hickory Nut Professional Cooperative	19	15	34
	Huri Hickory Nut Professional Cooperative	14	16	30
Total		139	119	258

Note: all forest farmers in the area of Nengfu Afforestation Professional Cooperative joined this cooperative, so the non-member column is zero.

The above data was sourced from our field research.

(4) Development characteristics of cooperatives: Existing member scale of cooperatives and if technical training is provided for cooperative members. Cooperative members are foundation of survival and development of cooperatives. Thus, the development scale and operation situation of cooperatives are mainly manifested in size of members. Training provided by cooperatives can be deemed as a kind of welfare received by farmer households from cooperatives. In theory, if a cooperative is larger, farmer households will be more willing to participate in.

(5) Development characteristics of local market: Perfection degree and smoothness degree of forest product circulation system. If market system of forest products is perfect, circulation of various cooperatives is well organized, and forest farmers have no difficulty in selling products, their enthusiasm for joining in the cooperative will be not high. Therefore, if forest farmers sell more forest products through other channels, the possibility of their joining in the cooperative will be lower[7].

(6) Development characteristics of local economy: Measured by the degree of economic development. In 2009, the per capita GDP higher than average level of Zhejiang Province is developed area, and the rest is less developed area. In economically developed areas, market system is relatively perfect and forest farmers depend little on forest income, so forest farmers' enthusiasm for joining in cooperatives is lower than that in less developed areas[7].

3 Establishment and analysis of empirical model

3.1 Selection and description of variables According to the above analysis, the selected variable is whether farmer households participate in FFCs, explanatory variables are sex of householder (X_1), age of householder (X_2), length of education of householder (X_3), knowledge of householder about cooperatives (X_4), number of family labor forces (X_5), family net income per capita (X_6), operation area of forest products (X_7), importance degree of forest production (X_8), quantity of members in cooperatives (X_9), whether cooperatives provide technical training (X_{10}), development degree of local market (X_{11}) and degree of economic development (X_{12}), as listed in Table 2.

Table 2 Description, characteristic value and expected symbol of variables

Variable	Variable name	Variable description	Average value	Standard deviation	Expected symbol
Y	Whether farmer households participate in forest farmers' cooperatives	Dummy variable; Yes = 1, No = 0	0.538 8	0.499 5	
X_1	Sex of householder	Dummy variable; Male = 1, Female = 0	0.879 8	0.325 8	+
X_2	Age of householder[a]	Continuous variable; expressed in years old	48.236 2	9.898 4	?
X_3	Length of education of householder	Continuous variable; expressed in years	7.486 4	3.115 0	+
X_4	Knowledge of householder about cooperatives	Dummy variable; Yes = 1, No = 0	0.674 4	0.469 5	+
X_5	Number of family labor forces	Continuous variable; expressed in people	2.620 2	1.294 6	−
X_6	Family net income per capita	Continuous variable; expressed in yuan	16 324	20 744	+
X_7	Operation area of forest products	Continuous variable; expressed in hm^2	3.721 4	108.72	+
X_8	Importance degree of forest production	Continuous variable; expressed in %	59.557	33.220	+
X_9	Quantity of members in cooperatives	Continuous variable; expressed in people	296.11	350.07	+
X_{10}	Whether cooperatives provide technical training	Dummy variable; Yes = 1, No = 0	0.368 2	0.483 3	+
X_{11}	Development degree of local market	Continuous variable; expressed in %	81.880	35.001	−
X_{12}	Degree of economic development[b]	Dummy variable: Developed = 1, Less developed = 0	0.248 1	0.4327	−

Note: a: Theoretically, the influence of age on farmers' behavior of participating in cooperatives is not definite[7]. b: Degree of economic development is divided by economic development level of the county (city) where surveyed farmer households live. We considered that the per capita GDP higher than average level of Zhejiang Province in 2009 is developed area, and the rest is less developed area[7]. The above data was sourced from our field research.

3.2 Establishment of empirical model Since there are only two types of possibility of farmers' behavior, joining in the cooperative or not joining in, it is preferred to adopt binary Logistic regression model. We controlled the selected variables within the range of (0,1), and established following empirical model[14]:

$$\ln\left(\frac{p_i}{1-p_i}\right)=\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5+\beta_6X_6+\beta_7X_7+\beta_8X_8+\beta_9X_9+\beta_{10}X_{10}+\beta_{11}X_{11}+\beta_{12}X_{12}+\mu_i$$

where $p_i=P(Y=1)$, $Y=\begin{cases}1, & \text{participating}\\ 0, & \text{not participating}\end{cases}$

In the model, Y stands for two types of results, $X_i(i=1,2,\cdots\cdots10)$ signifies explanatory variables (Table 2), μ_i is the random perturbation item, namely, the non-observed perturbation factors that exert influence on farmers' participation behavior.

3.3 Regression results and discussion of Logistic model In the course of model regression, firstly we carried out Wald probability statistic and backward linear regression. We obtained 10 regression results, and estimation results are relatively stable. Through comparison and analysis, we listed the 3 regression results that have the highest degree of fitting (Table 3). Major factors influencing farmers' behavior of participating in FFCs can be summarized as follows:

(1) Knowledge of householder about cooperatives has significant influence on farmers' behavior of participating in cooperatives. This variable coefficient passed 10% significance test in model 1, passed 1% significance test in model 2 and model 3, and the standardization coefficient is high. This variable, the same as direction of expected influence, will also exert positive influence on farmers' behavior of participating in cooperatives, showing that full knowledge of cooperatives will increase possibility of farmers' participation in FFCs. Farmers will mainly consider the expected income when participating in cooperatives[7], so the deeper knowledge of advantages of forest farmers' cooperatives, the higher expected income from participating in cooperatives, and the higher possibility of their participation.

(2) Educational level of householders will exert significant influence on farmers' behavior of participation in cooperatives. This variable coefficient passed 10% and 5% significance tests in model 2 and model 3 separately. This shows that without changes in other variables, if householders have higher educational level, they will have higher possibility of participating in cooperatives. This result is consistent with the previous assumption and also accords with development reality of FFCs. Farmers having higher educational level will be more willing to accept new things, and accordingly they can realize their benefits better through forest farmers' cooperatives.

(3) Existing member quantity of FFCs will have significant positive influence on their behavior of joining in cooperatives. This variable coefficient in model 1 is significant at 5% level, and significant at 1% level in model 2 and model 3. At current state, the development of Chinese FFCs is not standardized and farmers' behavior is not rational to some degree. As a result, most farmers just follow the trend. This is very obvious in our field. Therefore, if existing cooperative members are more, the expected income of farmers' participation in cooperatives will be higher, and farmers will be more willing to join in cooperatives.

Table 3 Logistic regression results of factors influencing farmers' participation in cooperatives

Explanatory variables	Model 1		Model 2		Model 3	
	Non-standardized coefficient	Standardized coefficient	Non-standardized coefficient	Standardized coefficient	Non-standardized coefficient	Standardized coefficient
X_1	2.268(0.102)	9.663	0.382(0.524)	1.465	0.575(0.239)	1.777
X_2	0.002(0.936)	1.002	−0.001(0.940)	−0.999	−0.005(0.763)	−0.995
X_3	0.137(0.102)	1.147	0.108*(0.086)	1.114	0.114**(0.042)	1.121
X_4	0.891*(0.060)	2.437	1.390***(0.000)	4.015	2.230***(0.000)	9.304
X_5	−0.284(0.215)	−0.753	−0.049(0.732)	−0.952	−0.080(0.430)	−0.923
X_6	0.000(0.779)	1.000	0.000(0.473)	1.000	0.000(0.909)	1.000
X_7	0.011*(0.092)	1.011	0.001(0.771)	1.001	0.004(0.163)	1.004
X_8	0.008(0.341)	1.009	0.010(0.146)	1.010	0.006(0.343)	1.006
X_9	0.003**(0.019)	1.003	0.004***(0.000)	1.004	0.002***(0.009)	1.002
X_{10}	22.014(0.995)	3.636E9	/	/	/	/
X_{11}	−0.816(0.991)	0.442	−2.490(0.984)	0.083	/	/
X_{12}	0.476(0.415)	1.609	0.335(0.477)	1.398	0.523(0.215)	1.687
Constant term	75.637(0.992)	7.062E32	245.088(0.984)	2.75E106	−3.458***(0.004)	−0.031
Chi-square test	229.866***		158.743***		91.972***	
−2 Log-Likelihood value	126.246		191.369		264.140	
R^2 of Nagelkerke	0.788		0.614		0.401	
Prediction accuracy//%	90.3		80.6		71.3	

Note: the value within parenthesis is Wald statistical value; *, ** and *** separately signify significance at 10%, 5% and 1% level.

4 Conclusions and recommendations

We analyzed factors influencing forest farmers' participation in cooperatives using SPSS statistical software through establishing binary Logistic regression model. Our research indicates that factor influencing forest farmers' participation in cooperatives mainly include knowledge of householder about cooperatives, existing member quantity of forest farmer cooperatives and educational level of householders. Based on the above analysis, it is recommended to:

(1) Strengthen propaganda of FFCs, to let more farmers know these cooperatives. On the one hand, it should take full advantage of mass media to make some advertisements of FFCs; on the other hand, it is preferred to organize professional personnel to explain and publicize knowledge of forest farmers' cooperatives, so as to strengthen farmers' cooperation awareness.

(2) Reinforce cultivation of new farmers. Relevant departments should increase investment in farmer education, to provide favorable re-education conditions for farmers, stimulate them to promote their ideas, and cultivate vigorous, knowledgeable and innovative talents to inject lasting vigor for development of forest farmers' cooperatives.

(3) Establish incentive mechanism for farmers' participation in cooperatives. Government should encourage and support development of FFCs. Firstly, it should create excellent macro-environment for cooperative development. Secondly, it should encourage establishing incentive mechanism in accordance with provisions of *Law of the People's Republic of China on Specialized Farmers' Cooperatives*, to increase potential income of farmers' participation in cooperatives.

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