

Comparison of the Determinants Affecting Forest Investment by the Type of Private Forest Land Owners¹

Yeong-Wan Seo^{2*} and Jong-Cheon Choi²

山主 類型別 山林投資 要因 比較分析¹

徐榮完^{2*} · 崔鍾天²

ABSTRACT

The case study of the Cooperatives' members and Sincere Forest Managers/Forest Successors was carried out to find the determinants affecting the forest investment of private forest owners and analyze their effects on it. For this the landowners' forest investment probability function was estimated using the logistical regression model. The results showed that the forest investment of the Cooperatives' members was the function of forest area, stand age, forest income, and technical assistance. Three of the variables (forest income, forest area, and technical assistance) exhibited a positive effect on the forest investment as expected, while stand age showed a negative effect unlike the expectation of the study.

In case of Sincere Forest Managers and Forest Successors forest area, distance(1)(distance from forest to road accessible by vehicle), knowledge of financing program, and forest income were significant indicators for the forest investment. All these variables showed the expected signs; forest area, knowledge of financing, and forest income had a positive effect on the forest investment, and distance(1) showed a negative effect.

Key words : Sincere Forest Managers and Forest Successors, forest investment probability function, the logistical regression model

要 約

본 연구는 로지트(logit) 모델을 이용하여 협업체 회원과 독립가·임업후계자의 산림투자에 영향을 미치는 요인을 규명하고 그 효과를 비교·분석하였다. 분석결과 협업체 회원의 경우 산림면적, 임령, 산림소득, 기술지원이 산림투자에 영향을 미치는 요인으로 나타났다. 이중 임령은 예상과는 달리 산림투자에 負(-)의 영향을 미치는 것으로 나타났으나 나머지는 모두 예상대로 正(+)의 영향을 미치는 것으로 나타났다.

반면에 독립가 및 임업후계자의 경우 산림면적, 거리(1)(산림에서 자동차통행이 가능한 도로까지의 거리), 용자제도에 대한 인지, 그리고 산림소득이 산림투자에 미치는 요인으로 나타났다. 이들은 모두 예상한 바와 같은 부호를 나타냈다. 즉, 산림면적, 용자제도 그리고 산림소득은 산림투자에 正의 영향을, 거리(1)은 負의 영향을 미치는 것으로 나타났다.

¹ Received on September 17, 2001.

Accepted on October 17, 2001.

² College of Forest Sciences, Kangwon National University, Chunchon 200-701, Korea 강원대학교 산림과학대학.

* Corresponding author : ywseo@mirae.kangwon.ac.kr

INTRODUCTION

Korea's forest land area consists of 65% of the total land area, 9,931 million ha, while its condition is poor compared to other countries with rich forest resources.; in the year of 1999 the forest stock below 30 year-old occupies 73.4% of the total stock, the average stock and the forest road density are 60.3m³/ha and 2.2m/ha respectively. This makes Korea import more than 90% of the domestic demand for timber every year, which amounts to about one billion dollars. Therefore, the build up of forest stock through a drastic forest investment is still needed for the stable supply of timber in Korea. Especially the private forest land which is about 70% of the total forest land is expected to play an important role in solving this problem.

Personal and ownership characteristics are commonly used to classify private forest land owners into groups that are thought to have different degrees of interest in forest investment(Kurtz and Lewis, 1981; Greene and Blatner, 1986; Romm et al., 1987b). These characteristics are used to predict owner propensities to invest in forestry or to respond to public policies and programs (McComb, 1975; Kurtz and Lewis, 1981).

Meanwhile, most of private forest land owners avoid investing in their forest land because of the poor condition of forest investment; a low rate of return, the consumption of long term, and even a small size of ownership(An, 1983; Yoo and Song, 1991; Seok, 1992). The government has taken various programs to induce the forest investment of private forest land owners; for example, subsidy, financing with a low rate of interest, and technical assistance. Many studies have been carried out to find the effect of these programs on the forest investment of private forest land owners, but they showed mutually contradictory results; Boyd(1984) and de Steiguer(1984) found little evidence of any reforestation effort due to subsidy program, while Kim(1992), Royer(1987) and Romm et al.(1987a, b) found the strong evidence.

The purpose of the study is to examine and compare the forest investment behavior of two types of private forest land owners - the Cooperatives' members and Sincere Forest Managers & Forestry Successors-, focusing on the effects of owner and ownership characteristics and public policies.

METHOD

The subjects of the study are two groups; one is Sincere Forest Managers and Forestry Successors, and the other the members of Cooperatives of Forest Management. From April to July of 2000 questionnaires were mailed to most of Sincere Forest Managers and Forestry Successors in 'A Look of Sincere Forest Managers and Forestry Successors (1998)' published by Korea Forest Service, while Cooperatives are limited to four regions of Kang-won-do(Hongcheon, Pyeongchang, Injae, and Hoeng-song) which are known to be comparatively well-organized.

As shown in Table 1, 16.5% of the Cooperatives members and 24.6% of Sincere Forest Managers and Forestry Successors responded fully to the questionnaires. The results of the survey were used to find the factors which have effects on owners forest investment behaviors and to compare them by owner types.

Table 1. The Collection of Questionnaires.

Classification	Cooperatives	Sincere Forest Managers & Forestry Successors	Total
Sended (%)	720 (100.0)	747 (100.0)	1467
Collected (%)	124 (17.2)	195 (26.1)	319 (21.7)
Used (%)	118 (16.5)	184 (24.6)	302 (20.6)

Forest investment was defined as any expenditure of money in tree planting, thinning, or stand improvement(for example, fertilizing, pruning or

weeding). The study identified owners who had and had not made forest investment during the five years preceding the survey. Four characteristics of owners - age, income, education, and forest income - and four characteristics of their ownerships - forest size, stand's age, distance(1), and distance

(2) - were considered. Also two cost sharings - subsidy and financing - and technical assistance were included as government characteristics. The definitions and statistics of these characteristics are showed in Table 2 and Table 3 respectively.

Table 2. Definition of exogenous variables.

Variable	Measurement
Owner's age	Year
Income	Average monthly income(10 thousand won)
Education	Years of formal education
Forest income	Dummy, experience to raise income from forest land
Forest size	Hectare(ha)
Stand's age	Year
Distance(1)	Distance from forest land to road accessible by vehicle (m)
Distance(2)	Distance from forest land to owner's house (km)
Subsidy	Dummy, awareness of subsidy program
Financing	Dummy, awareness of financing program
Technical assistance	Dummy, professional forester prepare any forest management plan.

Table 3. Statistics of exogenous variables by owner's type.

Variable	Mean		Standard deviation		Expected sign
	Cooperatives	SFM & FS*	Cooperatives	SFM & FS*	
Owner's age	61.29	55.80	9.85	13.52	-
Income	112.58	168.40	80.60	80.08	+
Education	10.20	12.89	3.26	3.25	+
Forest income	0.33	0.53	0.47	0.50	?
Forest size	33.54	119.14	79.98	161.30	+
Stand's age	26.53	24.78	15.72	8.56	+
Distance(1)	529.57	478.33	463.14	426.09	-
Distance(2)	26.74	19.40	37.17	16.88	-
Subsidy	0.43	0.74	0.50	0.44	+
Financing	0.41	0.84	0.49	0.37	+
Technical assistance	0.34	0.83	0.48	0.38	+

* SFM & FS : Sincere Forest Managers and Forestry Successors

A logit regression model was used to relate these characteristics to the incidence of forest investment. Logit models estimate the probability that an individual with a given set of characteristics will take a given action(Pindyck and Rabinfeld 1981). The dependent variable in the regression is the natural logarithm of the odds of taking the action. The

independent variables are the different categories of characteristics. Each individual with a same combination of characteristics represents an observation.

Thus, the regression produces an equation that gives the natural logarithm of the odds that individuals with each possible combination of charac-

teristics will take the action. Logit model was used by Binkly(1981), Romm et al.(1987a, b), and Royer(1987) to find the determinants of forest investment in private forest lands.

In this study, the model has the form of

$$P_i = \frac{1}{1 + e^{-(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_j X_j)}}$$

or

$$\ln\left(\frac{P_i}{1 - P_i}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_j X_j$$

where P_i is the probability of forest investment and X's are the characteristics defined in Table 2. The regression was performed with SHAZAM (Econometrics Computer Program, 1993).

RESULTS

Table 4 shows two logistical regressions for the forest investment of the Cooperatives' members. Each equation shows the estimated coefficients and asymptotic t-ratios for the parameters of a full and reduced model. In the full model, all of the posited exogenous variables are entered. Four of the variables are significant within the 20% level; Forest income which is the strongest indicator of forest investment and stand's age which is the weakest indicator meet the 1% test, while forest size and technical assistance are significant only at the 20% level. Of the four variables, three variables exhibit the expected signs, but the exception is stand's age.

In the reduced model, the variables not meeting the 20% test are eliminated, with little effect on the significant levels of the other regressors. Forest income and stand's age remain highly significant determinants of forest investment, with forest size and technical assistance also contributing.

Partial derivatives and elasticities of the probabilities of forest investment from the reduced model are also presented in Table 4 and shows the magnitude of the sensitivities of the landowners

Table 4. Estimated logit regression equation for the likelihood of forest investment of the Cooperatives' members.

Variable	Full model	Reduced Model		
	Beta (t-ratio)	Beta (t-ratio)	Derivative prob @ mean ^a	Elasticity @ mean ^b
Intercept	0.6759 (0.3512)	0.1176 (0.2823)		
age	-0.0009 (-0.0378)			
Income	-0.0026 (-0.9401)			
Education	-0.0517 (-0.7215)			
Forest income	1.7094*** (3.5013)	1.7417*** (3.6623)	(0.1384)	c
Forest size	0.0041* (1.3924)	0.0046* (1.4985)	0.0010	0.0711
Stand's age	-0.0421*** (-2.6524)	-0.0456*** (-3.0255)	-0.0113	-0.4232
Distance(1)	-0.0002 (-0.3900)			
Distance(2)	0.0001 (0.0253)			
Subsidy	0.4508 (0.8504)			
Financing	0.5270 (1.0342)			
Technical assistance	0.6524* (1.5214)	0.8913** (1.9467)	(0.0744)	c
P(Y=1)	0.483	0.488		
-2Log L	132.048	163.448		

$$^a \beta_i P(1 - P) \quad ^b \beta_i (1 - P) X_i$$

^c Not applicable for a dummy variable.

* denotes significance at the 20% level

** denotes significance at the 10% level

*** denotes significance at the 1% level

to each parameter. For example, a 1% increase in forest size results in approximately a 0.07% increase in the likelihood of forest investment. The Cooperatives's members who have made earnings from their forest are about 13% more likely to invest than those who had not. Also those who have been advised from professional foresters through a forest management plan are approximately 7% more likely to invest.

Table 5. Estimated logit regression equation for the likelihood of forest investment of Sincere Forest Managers and Forestry Successors.

Variable	Full model		Reduced Model	
	Beta (t-ratio)	Beta (t-ratio)	Derivative prob @ mean	Elasticity @ mean
Intercept	1.2765 (0.7066)	-0.3651 (-0.7949)		
age	-0.0004 (-0.0188)			
Income	-0.0008 (-0.2794)			
Education	-0.0845 (-0.9860)			
Forest income	1.7459 (3.6492)***	1.5834*** (3.5262)	(0.1329)	c
Forest size	0.0055** (1.9226)	0.0045** (1.8826)	0.0005	0.0737
Stand's age	-0.0177 (-0.7098)			
Distance(1)	-0.0007** (-1.8219)		-0.0001	-0.0415
Distance(2)	0.0041 (0.28875)	-0.0007** (-1.8015)		
Subsidy	-0.3835 (-0.5825)			
Financing	1.8537*** (2.5590)	1.3428*** (2.7804)	(0.1916)	c
Technical assistance	-0.3609 (-0.5963)			
P(Y=1)	0.804	0.809		
-2Log L	145.824	181.908		

** denotes significance at the 10% level
 *** denotes significance at the 1% level

Table 5 shows two logistical regressions for Sincere Forest Managers and Forestry Successors. Somewhat unlike the results of the Cooperatives' members, forest size, distance(1), financing, and forest income result in the determinants that have an effect on the investment and all these variables show the expected signs. Of these variables forest income and financing meet the 1% test and distance(1) and forest size are significant at the 10% level.

DISCUSSION AND POLICY IMPLICATION

The results of the estimated logistical regression models may be insufficient to explain the forest investment behavior of private forest land owners with only four variables significant. Nevertheless the above findings have implications for the forest investment behavior and the policy debate that surrounds the inducement of forest investment by private forest land owners in Korea. The main implications based on the above results are as follows.

The first outstanding point is that knowledge of subsidy is not the significant indicator for the investment of both types of forest owners. This doesn't make sense in the light of the fact that most of the forest management activities of the Cooperatives' members are made by Forestry Association Union with subsidy from government. But it was found in the phone interview with the members selected randomly that, although they knew the Union carried out forest management activities for them, they did not know whether the activities were made by the subsidy program. This tells why awareness of subsidy results in an insignificant indicator in the study, and thus positive informing of public policies to the owners is needed to make them join in the forest investment on their own initiatives.

Sincere Forest Managers and Forestry Successors who carry out forest management activities according to the management plan by themselves have the different reason from the Cooperatives. In the interview with those selected randomly, they said that they knew the subsidy program but it was not easy to receive the subsidy. They thought the program had the name without the reality. The distrust on the subsidy program is considered to explain the reason that the program dose not influence the forest investment of Forest Managers and Forestry Successors. Therefore, the subsidy program is needed to be extended and revised so that as many owners who want to invest in their forest as possible can use the subsidy.

The second point worth noting concerns the negative effect of stand's age on the forest investment. This can be explained by the fact that such forest management activities as planting, thinning, and improvement of stands are generally made in young forests. In the interview with some of the owners, planting was carried out in the forest which had been damaged by forest fires or forest pest insect (especially pine gall midge). Also most of such forest improvement activities as weeding and fertilizing had been done in the young stands, while scarcely thinning done in the forest surveyed in this study. Therefore, we infer that stand's age may positively be related to the investment associated with timber harvesting.

The third point is that only four of the independent variables are significant indicators for the two types of private forest land owners. Income, education, age of owner, knowledge of subsidy, and distance(2) had no effect on the investment of both types of the owners. This is considered because of the deteriorated climate on the forest investment in Korea, as many preceding studies (An, 1983; Kim, 1988; Seok, 1992) have pointed out. Therefore, the creation and supply of other new beneficial projects except timber are required to make earnings of short term from the forests (Yoo and Song, 1991; Chung et al., 1996).

The fourth point is that knowledge of financing program is the strongest indicator for the forest investment of Sincere Forest Managers and Forestry Successors, while it is not significant for the Cooperatives' members. This tells that the financing program works well for the inducement of the forest investment from Sincere Forest Managers and Forestry Successors as expected, although some forest economists may raise a question in this result because of the lower rate of return from the investment than the interest rate of the loan.

LITERATURE CITED

1. An, H. C. 1983. A Study on the Private Forest Owner's Attitudes toward Forest Practices in Agricultural and Mountain Villages. *Journal of Jinju National University* 21 : 141-153.
2. Binkley, C. S. 1981. Timber Supply from Private Nonindustrial Forests : A Microeconomic Analysis of Landowner Behavior. *Yale Univ. School of Forestry and Environmental Studies Bulletin* 92. 97pp.
3. Boyd, R. G. 1984. Government Support of Nonindustrial Production : The Case of Private Forests. *Southern Journal of Economics* 51 : 89-107.
4. Chung, J. S., E. S. Park and K. H. Kim. 1996. An Analysis on the National Project to Promote Management of Private Forest Management Cooperatives : Actual State of Its Management and Cognition of Its Members. *Journal of Korean Forestry Society* 85(3) : 487-495.
5. de Steiger, J. E. 1984. Impact of Cost-share Programs on Private Reforestation Investment. *Forest Science* 30(3) : 697-704.
6. Forestry Administration. 1998. A Look of Sincere Forest Managers and Forestry Successors. 247pp.
7. Greene, J. L. and K. A. Blatner. 1986. Identifying Woodland Owner Characteristics Associated with Timber Management. *Forest Science* 32(1) : 135-146.
8. Kim, J. K. 1988. Logic of the Cooperative Management for the Private Forest. *Journal of Korean Forestry Society* 77(2) : 242-241
9. Kim, N. G. 1992. A Study on Landowner's Perception of Forest Investment and Incentive Policies for Private Forest Investment. Ph. D. Thesis, Seoul National University. 137pp.
10. Kurtz, W. B. and B. J. Lewis. 1981. Decision-making Framework for Nonindustrial Private Forest Owners : An Application in the Missouri Ozarks. *Journal of Forestry* 79(5) : 285-287.
11. McComb, W. H. 1975. Mismanagement by the Small Landowner. *Journal of Forestry* 73(4) : 224-225.
12. Romm, J., C. Washburn. R. Tuazon and J.

- Bendix. 1987a. Public Subsidy and Private Forestry Investment : Analyzing the Selectivity and Leverage of a Common Policy Form. *Land Economics* 63(2) : 153-167
13. Romm, J. R. Tuazon. and C. Washburn. 1987b. Relating Forestry Investment to the Characteristics of Nonindustrial Private Forestland Owners in Northern California. *Forest Science* 33(1) : 197-209.
14. Royer, J. P. 1987. Determinants of Reforestation Behavior Among Southern Landowners. *Forest Science* 33(3) : 654-667
15. Seok, H. D. 1992. An Economic Analysis of Korean Forestry. Korea Rural Economic Institute. 250pp.
16. White, K. J. 1993. SHAZAM Econometrics Computer Program. McGraw-Hill, New York. 482pp.
17. Yoo, B. I. and Y. G. Song. 1991. A Study on Basic Policy for Private Forestry in Korea. The Research Reports of the Forestry Research Institute 43 : 95-109.