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Farm Pluriactivity and Contribution to Farmland Preservation: A Perspective on Evaluating Multifunctionality from Mountainous Hiroshima, Japan

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The significance of pluriactivity is increasingly recognized in industrialized countries. The growing significance of rural policy in these countries requires clarification of the new roles of pluriactive farms in connection with the multifunctionality of agriculture and rural areas. This has drawn attention recently. However, until recently little was known about what contribution pluriactive farms have made to land preservation, which has been pointed out as one factor of multifunctionality. Moreover, an analytical framework for exploring this externality of pluriactivity has not yet been established. This paper therefore defines the contribution to land preservation by pluriactive farms as an internalization process of externality in hamlets and tries to detect this internalization process as signaling. Then this paper clarifies what process was involved in this contribution and what characteristics of pluriactive farms contribute to this process. The results show how pluriactive farms offering farm-based accommodations attain both private management and local farmland preservation under favorable farming conditions while householders hold off-farm jobs in western Japan. These farms do this by shifting their farming to labor-efficient rice production and by increasing their farm areas by taking on farmland from older farms. This behavior is supported by group farming within the hamlet area, which we can define as an off-farm farming activity. This paper reveals this complementary effect of pluriactivity in the hamlets, which prevents farmland from being abandoned. This is modern incentive-compatible behavior of farmers in the rural community, which attains both household and community rationality, and was measured as signaling. This signaling can provide a logical basis for public support of these farms. Thus it can be an effective tool for policy evaluation of farm activities having external effects such as multifunctionality.

Key words: pluriactivity, rural diversification, farm-based accommodation, externality, signaling, multifunctionality.

1. Introduction

The growing significance of rural policy in industrialized countries requires clarifying the new roles of pluriactive farms in connection with multifunctionality of agriculture and rural areas, such as in preserving the rural landscape and countryside, a topic that has drawn attention recently.[1] In spite of the sentiment that pluriactivity plays an increasingly important role in the rural policy arena, this area has been poorly studied from this perspective.[2]

Declining farm activity, especially in the less-favored areas, is causing deterioration of this local function of preserving the countryside, which is one factor that comprises multifunctionality in agriculture and rural communities. This declining positive externality of the traditional land preservation function requires an evaluation of this function and clarification as to how this function may be continued. Specifically, it is necessary to clarify how to evaluate this function from a policy perspective, what mechanism is working for connecting this function with farm

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activity, and how to measure the function. Therefore the purpose of this paper is to evaluate the land preservation function provided by pluriactive farm households and then determine prospects for future policy measures for multifunctionality and rural diversification. This is because for the proper evaluation and exploration of multifunctionality, we need a broad perspective of the activities of farm households.

With respect to evaluating externality in the countryside, an apparent contrast has been observed because there is little evaluation from the supply side compared with intensive evaluation from the demand side, such as the CVM. Thus this study tries to shed light on the supply side. However, until now there has been no proper framework to evaluate activities of farm households in generating externality in the local community, such as in hamlets. This externality is internalized in the pluriactivity of the local community, which brings about information asymmetry between local communities and the rest of society.

This study focuses on the internalization process of externality rather than externality itself, which heretofore has been studied from the demand side.

On the other hand, intensive economic analyses of pluriactivity have been carried out, focusing on the off-farm job-holding behavior of farm households. These studies clarify the characteristics of farm households where off-farm jobs are held, especially by husbands and wives. However, how farm pluriactivity is involved in this internalization process has received only slight empirical attention.

Therefore, this paper first explores how to observe the internalization process of externality that pluriactive farm households are involved in within the local community by incorporating the concept of signaling as a benchmark of the contribution to land preservation, and it then clarifies the level of the contribution empirically. In other words, this paper attempts to evaluate the significance of pluriactivity by incorporating the concept of internalization of externality and signaling from the viewpoint of land preservation. The concept of signaling often has been used for the evaluation of economic activity for marketable goods, especially with regard to the labor market (Spence [18]). However, there are cases of asymmetric information when signaling is sent even if the market does not exist, which can often happen in agriculture, especially in connection with the rural community. One example is activities with external effects by pluriactive farms. In this case, signaling has not been applied fully.

Thus this paper considers that signaling works as a mediator between authorities trying to monitor this function to offer support measures and those farm operators wanting to be recognized as generators of the internalization process of externality.

Second, this paper investigates what kind of farm activity contributes to the preservation of local farmland at the hamlet level by focusing on the features of farm households offering accommodations, which presents an opportunity for new business in the less-favored areas, and on prospects for the future direction of farm pluriactivity. Third, it examines what mechanisms are working in this process by exploring farm characteristics. In conclusion, the implications of integrated farming and rural policy measures for preserving multifunctionality and promoting rural diversification are discussed.

2. Background of the Analysis and the Present Situation of the Study Area

In the hilly and mountainous areas of Japan, farmland is often abandoned because farmers have become too old to carry on farming and have no one to succeed them. This problem is especially serious in the Chugoku region, the western part of the main island of Japan, and there is concern about how to preserve farmland that has been traditionally passed from generation to generation, since this has important consequences for the conservation of the countryside (Nagata [12]). The abandonment of farmland not only causes the destruction of the traditional rural landscape, which has been preserved over centuries, but also invites crop damage due to the invasion of wild animals, which often leads to a chain reaction of further abandonment

Around the time of the GATT Uruguay Round, there was much concern that farming communities in less-favored areas might disappear because there were no immediate prospects that these farms would become more competitive with larger farms, a result of

geographical constraints. To ease these concerns, the national government began to promote *green tourism*, or the Japanese version of farm tourism, before settlement of the Uruguay Round.

The area studied in this paper is an area of western Japan that has the highest ratio of off-farm employed farmers in the country. Compared with other industrialized countries, Japan has one of the highest rates of off-farm employment. As mentioned later, some aspects of Japanese agriculture differ from those of other developed countries; however, the essential problems that rural areas face are identical. With progressive rural depopulation, the aging of the rural population, and decreases in the prices of farm products, the number of farm households holding off-farm jobs has increased greatly, and concerns for new income sources and endogenous rural development such as *green tourism* are attracting growing attention.

In dealing with Japanese agriculture, we must consider three factors that make it different from agriculture in other developed countries. First, part-time farming is already very common in Japan because of the small size of farms in general, the national average being 1.2 ha. The portion of part-time farmers is the highest of the industrial countries (OECD [13], Kada [11]). This is a natural consequence of small farms. Second, rice farming is the main pillar of agricultural production; thus the farmland studied here is mainly paddy fields, which are cultivated by labor-saving machinery (Hayami and Yamada [8]). Third, we cannot ignore the existence of group farming in hamlets because the hamlet has been the basic territorial and social unit of the farming community and now functions in a more contract-oriented form rather than being based on traditional interdependent relationships (Fukutake [3], Jussaume [10]).

In the Sanyo area facing the inland sea of the Chugoku region, which includes Hiroshima Prefecture, the number of people taking off-farm jobs increased because of the growth in job opportunities offered by offices and factories during the period of rapid economic growth after World War II. Generally, Type II part-time farming, a farm household with more than half its income coming from nonfarming jobs, is already very common among farmers, especially in this region because of the traditionally small sizes of farms. The focus of this study is thus on the development of on-farm pluriactivity rather than the development of off-farm nonfarming opportunities. This is because the development of on-farm activities is more important for preserving farming and the rural community.

The area studied in this paper is Geihoku town. Here the incidence of farmland abandonment is remarkably low, even though it is in the hilly and mountainous area of Chugoku, which has an abandonment rate far higher than the national average. Geihoku is in the middle of the mountainous Chugoku region bordering on Shimane Prefecture. This plateau area can produce vegetables, besides the main crop, which is rice. The cooler highland climate enables farmers to produce cabbages, spinach, and tomatoes during the summer for shipment primarily to the market in Hiroshima. Services for rice production are provided mainly through group farming organizations formed in the hamlets. Type II part-time farming is also common.

Furthermore, Geihoku is well known as the southernmost ski area of the main island of Japan, Honshu. The largest ski area in Hiroshima Prefecture, it attracted 53% of all skiers coming to the prefecture in 1992. Taking advantage of this local resource, farm-based accommodations targeting skiers have been promoted since the late 1960s, aiming to prevent further depopulation and to provide an outlet for family labor in the winter months. The results of a questionnaire administered by the author in 1993 reveal that the total investment in farm accommodations in this area amounted to 6.66 million yen. The average accommodation capacity was 15.3 persons, and the average number of rooms was 4.1 per farm. The average number of guests per year was 200.[3)]

Overall, Geihoku is one of the most suitable areas for the evaluation of the connection between the land preservation function and pluriactivity of farms in Japan.

3. A Framework for the Analysis of Land Preservation and Signaling

1) Conceptual framework

This section presents a conceptual framework for the following analysis clarifying what farm

activities assist land preservation and the mechanisms involved. Since the hamlet is the basic unit of the farming community, as mentioned, the author begins with hamlet level analysis. Assumptions and preconditions of the framework based on the actual situations are as follows:

1) Land preservation function is brought about by farm pluriactivity in hamlets. This paper will examine farm activity from the pluriactive point of view, taking into account not only farming aspects, but also other activities conducted by farm households.

2) This externality has been internalized in hamlets through the efforts of farm pluriactivity. In other words, the function of hamlets based on farm pluriactivity internalizes externality. However, because situations related to this function differ from one local community to another, it is not well recognized in society because of information asymmetry between the local community and the rest of society.

3) As long as this externality is well internalized, there is no problem in resource allocation even when society does not recognize it. The problem arises when this internalization process has trouble in maintaining this function because of progressive depopulation and aging of the population in the local community. This is actually happening in the mountainous areas.

4) However, society still expects this function to continue without considering the social cost of producing this function. This underpaid situation means that optimal resource allocation in this society is not attained. Another problem is that this underpaid situation accelerates further through a decline in function of the local community with deteriorating farming conditions. Therefore we need to detect how this function operates before its deterioration. If we can observe this function by catching signaling from the local communities, we can obtain a basis for policies to implement support measures based on the level of activity. Thus the application of the concept of signaling is significant in monitoring this function.

5) The demand side is assumed to be a given because we focus on the supply side.

In summary, the basic idea is to support a local mechanism to maintain the function of

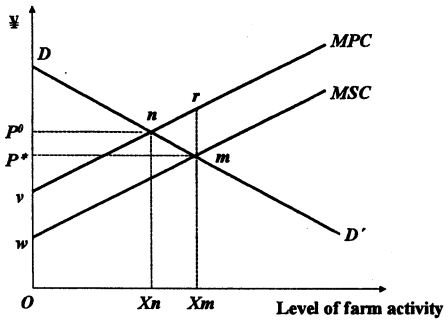

Figure 1. Level of farm activity and externality

internalization of externality instead of supporting externality directly. The advantage of this way of thinking is that the policy authorities can offer support, depending on the level of the activity and prompting farm pluriactivity simultaneously.

Now, keeping in mind these preconditions, we will explore the framework depicted in Fig. 1. Figure 1 represents farm activity and the externality of the land preservation function in hamlets of less-favored areas. The level of farm activity is measured horizontally and the price of composite farm products vertically.

When a local community functions well, externality is internalized. In this case, equilibrium is attained at point *m* where the marginal social cost, *MSC*, crosses the demand curve. The level of farm activity is at *Xm* in this case, and the maximum social surplus is achieved because farmland is well preserved, meaning that externality is successfully internalized in the hamlets. In this sense, this function of hamlets is defined as an incentive-compatible behavior of pluriactive farm households, both with individualistic and collective rationality.

In the case of noninternalization or a nonexternality, the price of the composite farm products is higher than in cases of internalization, since externality makes farm activity easier in the latter case in terms of continuation of farm activity. With respect to marginal social costs, *MSC*, recognition is limited to the local community. Policy authorities do not recognize it because of information asymmetry.

As mentioned earlier, as long as the land preservation function is maintained, there is no problem in resource allocation. However, in the less-favored areas this function has been

declining, and some of the hamlets cannot afford to maintain it. In this case, efforts for internalization must be undertaken not by hamlets as a whole, but only by specific farm households in the hamlets as a private activity to try to maintain the activity level at *Xm* in Fig. 1 on the *MPC*, marginal private cost, at point *r*, not any point on the *MSC* because the generated externality is not internalized. Furthermore, since policy authorities fail to grasp *MSC*, support measures cannot help to attain internalization.

Thus the activity at this point creates a dead weight loss *mnr*, which means that the activity at point *r* is neither socially nor privately an optimal point. This results in lowering the activity level at *Xn*, which is the private optimal point. Thus the activity at point *r* is not an equilibrium point in the long run, but only an unstable temporary point on the way to point *n*. In other words, pluriactivity in the hamlets is active and high at point *m*, but it is neither at point *f* nor *r*. We can find these points by examining pluriactivity in the hamlets.

Thus when the activity level goes down because of the deterioration of conditions for farm activity, the internalization process eventually ceases to function well. The mechanism of the land abandonment currently happening in this country can be explained by the failures of internalization and of recognition of the internalization process.

The point here is that the internalization process is a social joint product in the hamlets, whereas externality itself is a technical joint product. When the function of the local community declines, the internalization process does also. To maintain this function in the long run, we need to recognize this effect not only at the local level, but also at the social level, which is a precondition for support measures.

The difference of this function comes from differences in farm pluriactivity. If we can monitor this difference as signaling, we can recognize more easily this multifunctionality; this is more practical than measuring *MSC*, which is actually hard to estimate. Another advantage of this method is that the provision of support measures can be based on the level of farm activity

The next question to be clarified from empirical and policy perspectives is the building of an actual analytical framework to measure this externality.

Table 1. Four domains of farm activity

	On-farm	Off-farm
Farming	*A (rice, vegetables, flowers)*	*C (operator of group farming)*
Nonfarming	*B (farmhouse accommodation)*	*D (employee of local private or public sector)*

Parentheses are examples in the study area.

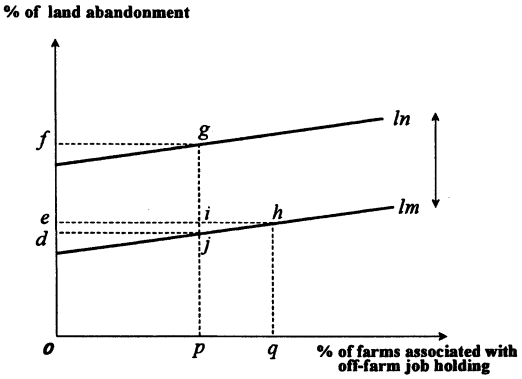

Figure 2. Signaling of land preservation caused by pluriactive farms

2) Analytical framework

Here the composition of pluriactivity is examined. Table 1 shows the domains of farm pluriactivity in terms of "on-farm" or "off-farm" and "farming" or "nonfarming." This definition is used for its simplicity and applicability, in general. If a farm household conducts only on-farm farming activity, this does not constitute pluriactivity, but monoactivity. This means that full-time on-farm farming is conducted, such as production of rice, vegetables, and flowers. With regard to on-farm nonfarming activity, farm-based accommodations providing service goods is a typical example. With off-farm farming activity, group farming is the case, providing contracted farming service to other farmers in the hamlets. Off-farm nonfarming activity indicates off-farm job-holding, such as employment in the public or private sector, which is typical of part-time farming. Thus the incidence of land abandonment in the hamlet is determined by the pluriactivity that is based on combinations of the four domains of farm activity.

Figure 2 illustrates the framework, based on

the framework of Fig. 1, that measures the rate of land abandonment vertically and the rate of farms having off-farm nonfarming employment horizontally (all other conditions being equal). Their positive correlation is illustrated by the lines *lm* for the hamlet where pluriactivity resulting in land preservation in the hamlets is conducted actively by farm households, and *ln* for the hamlet where this type of pluriactivity is not conducted actively. Therefore the land abandonment rates *f* on *ln* and *d* on *lm* in Fig. 2 correspond to the farm activity levels *Xn* and *Xm* in Fig. 1, respectively.

This is based on the assumption from the reality mentioned in the former section that farming and on-farm pluriactivity have a negative effect on abandonment, and a higher portion of farms having off-farm nonfarming employment leads to more abandonment.

To simplify the discussion here, the slopes are assumed to be equal according to the assumption mentioned above. If the rate of farms associated with off-farm job-holding is at point *p* for the hamlet, the level of pluriactivity for land preservation is low, and if it is at point *q* for the hamlet, the level of pluriactivity is high; where $p<q$, then the rate of abandonment is determined at *f* for the low-pluriactivity hamlet and at *e* for the high-pluriactivity hamlet, such that $e<f$. The vertical separation explains the difference in the incidence of abandonment. The difference is understood as a downward shift in land abandonment from *ln* to *lm*, displayed as $gj=gi+ij$, where *ij* is the difference in the rate of land abandonment corresponding to the increase in off-farm employment, and *gi* or *fe* is the real effect of the downward shift or the internalization process. If the difference in off-farm employment between the two types of farms is not extreme, we could consider *gi* nearly equal to *gj*, generally because off-farm employment is so common in this region that the slope is not steep, indicating that the difference between the two is virtually negligible.

Then if we can measure the shift in *gi*, which is considered to be signaling of the internalization process of pluriactive farms in the local community, it can be used as a benchmark of screening from the point of view of policy administration. In short, the function of the internalization generated by farm pluriactivity in the hamlets is recognized as differences in land abandonment, *gj*, by policy authorities in this manner.

Rising questions now are how this shift takes place and what farm activities contribute to it. These empirical questions are examined below.

4. Estimations of Farmland Abandonment

1) Model

A structural model of the occurrence of farmland abandonment in the hamlet is formulated in Equation 1. In this model, the incidence of land abandonment in the hamlet is determined by levels of farm pluriactivity corresponding to the four domains of farm activity mentioned above.

$$H=h(\boldsymbol{a}, \boldsymbol{b}, \boldsymbol{c}, \boldsymbol{d}) \quad (1)$$

where,

H=rate of land abandonment
h=function of land abandonment
$\boldsymbol{a}$=factor vector of on-farm farming activity
$\boldsymbol{b}$=factor vector of on-farm nonfarming activity
$\boldsymbol{c}$=factor vector of off-farm farming activity
$\boldsymbol{d}$=factor vector of off-farm nonfarming activity

2) Data and estimation method

Farm-based accommodation businesses are under the jurisdiction of local health centers, which oversee all lodging businesses. However, since there is no designated category for farm-based accommodation in the registration list of lodging businesses, the author examined the list of farms from the 1990 Agricultural Census and compared it with the list of lodging businesses to identify which were farm-based accommodations. This study included 38 hamlets, with the average hamlet consisting of 20 farms. The actual variables for estimation are as below and selected, first, as corresponding to the realms shown on Table 1 and second, to avoid the possible multicolliniarity among variables that often disrupts obtaining stable estimates.

a. On-farm farming activities: This refers to the production of rice and vegetables, which are the two major crops of the area. However, it is inappropriate to use vegetable area per farm and paddy field area per farm in this estimation because of multicollinear effects with other variables such as group farming. It is

therefore more appropriate to use the rate of consolidated paddy fields per hamlet instead of paddy-field area per farm. The implementation of land consolidation requires a consensus of hamlet members regarding a commitment to rice production. Thus this variable reflects not only a long-term commitment to rice production by farmers in the hamlet, but also the traditional farming policy of land consolidation, making better physical conditions for rice production as a result of the introduction of more efficient machinery after consolidation. In other words, this variable shows the mixed effects of on-farm farming activity and traditional farming policy.

b. On-farm nonfarming activity here refers to farm-based accommodation activity. I used a dummy variable; a farm operating a farm-based accommodation in the hamlet=1, whereas a farmhouse without accommodation=0.

c. Off-farm farming activity refers to the portion of farms that received operation services for rice production. Ideally, we must use a variable for the supply side, provided services, rather than the demand side, received services. However, since the supply-side variable such as the portion of farms providing services has a multicollinear relation with other variables, the demand-side variable was used here. Group farming organizations mainly coordinate demand and supply for this type of work in hamlets; therefore we can regard this variable also as a group farming activity in hamlets.

d. Off-farm nonfarming activity refers to the portion of farm households that are associated with steady off-farm jobs.

The data were taken from the Agricultural Census Hamlets' Cards of 1990 except for one variable, the number of farm-based accommodations, which was obtained by matching the census data with the list administered by the local health center, as mentioned above. The dependent variable is the sum of the area of abandoned land and uncultivated land. This is because the occurrence of abandonment would be underestimated if we included only the abandoned land given in the Agricultural census (Odagiri [14]). To avoid heteroskedasticity of the variables, the variables are converted into ratios. This helps prevent any unequal dispersion that may be caused by differences in the sizes of hamlets and farms. As for the estimation, theoretically there is a small possibility that no land abandonment has occurred in the hamlet, and in such case the Tobit model must be used to deal with truncated data. In reality, however, land abandonment occurs in every hamlet, and the results of estimation by the Tobit model and the ordinary least square (OLS) estimation were almost identical. Thus the OLS method was used for the estimation.

$$H_k=\beta_0+\beta_1 a_{1k}+\beta_2 a_{2k}+\beta_3 b_k+\beta_4 c_k+\beta_5 d_k+\mu_k \quad (2)$$

where,

H_k=rate of land abandonment for hamlet k ($k=1, 2, \cdots, n$)

a_{1k}=proportion of completed rice paddy consolidation for hamlet k

a_{2k}=vegetable-planted area per farm for hamlet k

b_k=dummy variable of farms offering accommodations in hamlet k (yes=1, no=0)

c_k=proportion of farms receiving operation services for rice production in hamlet k

d_k=proportion of farm households associated with steady off-farm jobs in hamlet k

β_i=parameters to be estimated (β_0=constant), ($i=1, 2, \cdots, m$)

μ_k=stochastic error for hamlet k

3) Results of the estimation

Table 2 shows the results of the estimation. Neither heteroskedasticity with the White test nor multicollinearity with Variance Inflation Factors (VIFs) showing a value greater than two was found.[4] The adjusted goodness-of-fit value (adjusted R^2) of 0.46 was not high, so we may be able to raise the level of fitness by using different variables such as the portion of elderly farmers. However, since this paper focuses on farm activities, having stable parameters that reveal which activities actually contribute to land preservation is more important than forecasting land abandonment. Because there are no other comparable precedent studies, the author thinks these results are acceptable. For reference, the levels of significance were shown to be up to 20%.

First, with regard to on-farm farming activity, the portion of paddy fields for which consolidation was completed proved to be the most significant factor in the prevention of abandonment of land among the estimated

Table 2. Estimated results of land abandonment model (hamlet level)

Activities	Variables	Estimation Estimates(β_j)	Standardised estimates
	Constant	0.1160***	-
a_1	Proportion of completed rice paddy consolidation	-0.0659**	-0.3046
a_2	Vegetable planted area per farm	0.0025*	0.2489
b	Dummy variable of farms offering accommodation (yes=1, no=0)	-0.0235**	-0.2671
c	Proportion of farms receiving operation service for paddy fields	-0.0962***	-0.4359
d	Proportion of farms involved with steady off-farm jobs	0.0485+	0.2240
	Adjusted R^2	0.4635	

Notes: 1) Activity corresponding to the variable means; *a*: on-farm farming activity, *b*: on-farm nonfarming activity, *c*: off-farm farming activity, *d*: off-farm nonfarming activity. 2) Dependent variable is obtained for each hamlet by the formula below. (abandoned area+uncultivated area)/(cultivated area +abandoned area). 3) Significance levels are shown by the results of *t* test, such that ***=1%, **=5%, *=10%, +=20%, n.s.=not significant.

Sources: Agricultural Census Hamlets' Cards (Geihoku 1990), $n=38$ (except for data on accommodation, which was obtained from the list of lodging operators complied by the Prefectural Local Health Center.)

parameters. In Geihoku, land consolidation was carried out under the initiative of the local government from 1974 to 1990, aiming to preserve farmland by easing conditions for mobility of land. This effect appears clearly in the estimated result. In other words, this result has verified the importance of land consolidation projects in preventing the abandonment of farmland. In this sense it might be said that this effect is a prerequisite for farm activity rather than a result of the farm activity.

As for vegetable crops, the estimate shows a positive value, although the statistical significance is not high (10%). This suggests that abandonment of farmland may be promoted by increasing the production of labor-intensive vegetable crops.

Second, as for the variable of farm-based accommodations, because this is a parameter that has statistical significance (5%) the existence of farms providing farm-based accommodations is shown to contribute to the preservation of farmland in the hamlet.

Third, concerning group farming, the portion of farms that received operation services shows a significant negative value (1%), indicating the importance of this activity in land preservation.

And fourth, concerning off-farm nonfarming activity, the portion of farm households associated with steady off-farm jobs shows a positive value, meaning that it promotes land abandonment; however, the 20% level of significance is not high. This is because there is little difference between hamlets concerning the ratios of farms associated with off-farm nonfarming jobs.

To summarize, estimates that have a statistical significance of 1% or 5% are variables related to land consolidation, group farming, and farm-based accommodations, that is, on-farm farming and on-farm nonfarming activities. These activities are capable of bringing about farmland preservation, whereas off-farm nonfarming activity, as indicated by the portion of farms involved with the holding of off-farm jobs, has an opposite effect, though not to a highly significant extent.

Thus the signaling *gi* indicates the composite effect of land consolidation, group farming activity, and activity undertaken by farms running accommodations as estimated above. The author considers this composite shift-effect as an internalization process of the land preserving externality brought about by farm activities in the hamlets.

The next point to be examined is how these effects actually work to contribute to land

preservation. From these parameters I also obtained the following estimates of the actual contribution of each activity toward the prevention of land abandonment.[5]

Three-tenths of the total shift is from the effect of a land-consolidation policy that aims at improving labor productivity. The other seven-tenths is from the effect of pluriactivity of the farms. Four-tenths of these is from the effect of group farming activity conducted at the hamlet level; the remaining three-tenths is from the effect of farm-based accommodations conducted on an individual basis. Thus this shift effect is comprised of policy effects and pluriactivity at the community and individual levels.

Overall, 70% of the shift effect detected as signaling of land preservation comes from the activities of pluriactive farms, such as providing accommodations and group farming, and 30% from the mixed effect of farming activity and traditional policy.

The above result shows that signaling is applicable to evaluate the contribution of pluriactive farms when the effect of traditional farming policy is taken into account.

The remainder of this paper examines what mechanism works toward the formation of these effects of pluriactive farms and examines how these effects work mutually. To this end, I examine the characteristics of pluriactive farms and their behavior below.

5. Farm Activities and Farm Characteristics

To explore farm characteristics, I will examine the relationship between farm activity and the characteristics of farms from the viewpoint of whether a farm offers accommodations, since the effect of farm-based accommodations was detected as an outcome of farm pluriactivity. This classification enables us to perform farm-level analysis while maintaining the basic framework mentioned above.

1) Data and method

This study uses data from the Agricultural Census Data on Farms, which allows us to see changes from data collected for five-year periods, beginning in 1980, 1985, and 1990. Since the data identify each farm, we can treat these as panel data in this period. Here, farms are divided into two groups, depending on whether they offer accommodations. Differences in conditions in the two groups are then compared. When we use data from the censuses consecutively, due attention is necessary because the definition of the minimum requirement of a farm household was changed in the 1990 census. (The minimum requirement for sales of farm products was raised to ¥500,000, from ¥100,000, and the minimum size of a holding was increased from 5*a* to 10*a*.) This paper follows the definition used in the 1990 census. Our classification of farm accommodations is also based on the 1990 registration, which means ex post evaluation from the situation in 1990 for the situations in 1980 and 1985, which enables a coherent comparison. To allow us to focus on the comparison of *a-farms,* farms that offer accommodations, and *n-farms,* farms that do not offer accommodations, with all other conditions being equal as mentioned in the framework, hamlets that had no *a-farms* were omitted from this analysis. The land consolidation effect, which is a prerequisite of land preservation rather than an activity itself, is not considered because there was no available data dealing with land consolidation in the census farm data. The number of farms available for consecutive analysis of the 22 hamlets was 451, 85 *a-farms* and 366 *n-farms*. A comparative analysis was carried out by using the chi-square test for the qualitative variables (except when the sample size was too small and the Fisher's exact test was used) and the *t*-test for quantitative variables.

2) Household composition

Table 3 reveals several interesting differences in farm household composition between the two groups. First, the percentage of male householders is slightly higher and the portion of married male householders among *a-farms* is higher than on *n-farms*. In other words, *a-farms* have fewer single householders.

Concerning heirs, *a-farms* have a relatively higher rate of successors than *n-farms*, more than a third in comparison to less than 30% for the latter. Concerning the age of family members, though the average age of the householder surpassed 50 in 1990, *a-farm* householders are slightly younger. This tendency toward a younger age on *a-farms* can also be seen for the wife and successor, though the difference between the two farm groups is not significant.

A significant difference was recognized with respect to family size. The size of families had

Table 3. Household composition (chi-square test, *t*-test)

Year	1980	I		1985	II		1990	III	
Accommodation	Yes	No	Result	Yes	No	Result	Yes	No	Result
Male householder/not	100.0	96.7	+	100.0	96.5	*	98.8	94.5	+
Married householder/not	98.8	90.7	**	96.5	88.0	**	91.8	84.4	*
Successor/not	36.5	26.0	*	34.1	24.0	*	34.1	27.6	n.s.
Age of husband	48.5	50.3	E+	49.8	51.8	E+	52.7	54.5	E+
Age of wife	44.8	46.3	E n.s.	46.6	48.1	E n.s.	49.8	50.8	E n.s.
Age of successor	25.5	25.2	E n.s.	24.9	26.8	E+	25.9	28.0	E n.s.
Family size	4.8	4.1	E ***	4.6	4.0	E ***	4.5	3.9	E ***
Females ≥16 years	1.9	1.6	E ***	1.9	1.6	E ***	1.9	1.6	N ***
Males ≥16 years	1.7	1.6	E n.s.	1.7	1.5	N **	1.7	1.6	N+
Children < 16 years	1.2	0.9	E **	1.1	1.0	E n.s.	1.0	0.9	E n.s.

Notes: 1) Results of the test of equality of variances are shown as E=equal variances, N=unequal variances. 2) Significance levels by *t*-test are the same as for Table 2. 3) Broken line divides the methods of statistical test; chi-square test and *t*-test.

Source: Agricultural Census Farm Data (Geihoku 1980, 1985, 1990), $n=451$.

Table 4. Type of employment (chi-square test)

(% of farm households)

Year	1980	I		1985	II		1990	III	
Accommodation	Yes	No	Result	Yes	No	Result	Yes	No	Result
% of Type II farm households	80.0	65.6	**	81.2	69.7	**	84.7	74.3	**
% of householders working on own farm over 100 days	21.2	37.2	***	12.9	30.6	***	17.7	27.9	*
% of householders working on off-farm non-farming jobs over 100 days	80.0	63.7	***	75.3	63.4	**	68.2	59.6	+
As regularly employed off-farm	61.2	36.3	***	55.3	46.2	+	64.7	57.7	n.s.
% of householder's wife working on own farm over 60 days	52.4	57.8	n.s.	46.3	49.7	n.s.	44.9	43.4	n.s.
As day worker/temporary worker	25.0	28.3	n.s.	32.9	29.8	n.s.	11.5	22.3	**
As self-employed on-farm	13.1	2.4	***	46.3	5.9	***	33.3	6.5	***

See notes for Table 3.

been gradually decreasing every 5 years, dropping to 3.9 persons per *n-farm*, compared with 4.5 persons per *a-farm* in 1990. Regarding age composition, the number of female family members 16 years old or older on *a-farms* was significantly higher than on *n-farms*, supporting the concept that accommodation activity is generally shouldered by women. Furthermore, the number of family members below the age of 16 declined to 0.9 person per *n-farm*, compared with 1.0 person per *a-farm*. This shows that the size of *n-farm* families is gradually decreasing, with a loss of momentum in regard to reproduction.

In short, the multiple-generation farm household observed traditionally in rural Japan is disappearing from *n-farms*, but is often maintained on *a-farms*. Thus *a-farms* tend to maintain better conditions for household reproduction.

3) Employment situation: On-farm farming and off-farm nonfarming activities

Differences between *a-farms* and *n-farms* are evident with regard to the employment situation of household members (Table 4). First, a look at householders reveals that the rate of Type II farming, that is, with householders

Table 5. Farming factors (*t*-test, chi-square test)

Year	1980	I		1985	II		1990	III	
Accommodation	Yes	No	Result	Yes	No	Result	Yes	No	Result
Rice paddy area (a)	108.58	93.33	E **	108.14	94.60	N *	129.93	100.72	E ***
Total holding area (a)	124.25	105.49	E **	130.52	112.04	E n.s.	135.31	110.81	N **
% change of total holding area	—	—	—	8.90	4.40	N n.s.	17.40	3.60	N **
Change of area of rented land (a)	—	—	—	-1.74	6.41	E *	10.79	2.46	N *
% of land abandonment	13.9	12.1	E n.s.	1.6	7.2	N ***	2.1	3.4	N *
Owned forest area (a)	1098.95	941.74	E +	1149.73	945.37	N *	1064.05	943.85	E n.s.
% of harvested rice area	62.9	63.4	E n.s.	72.9	64.9	N ***	63.5	56.5	N ***
% of income from greenhouse vegetables	43.0	37.1	E n.s.	37.4	38.3	E n.s.	33.7	48.3	E ***
Greenhouse area (a)	5.65	4.11	E *	5.19	5.39	N n.s.	6.16	6.81	N n.s.
Greenhouse flower planted area (a)	—	—	—	1.19	3.50	E n.s.	0.53	6.29	N *
% of owned machinery									
Tiller	62.4	80.1	***	67.1	75.1	+	50.6	64.5	**
Sprayer	48.2	60.1	**	81.2	88.3	*	76.5	76.5	n.s.
Rice transplanter	41.2	42.1	n.s.	45.9	52.2	n.s.	40.0	48.6	+
Combine auto thresher	24.7	19.7	n.s.	30.6	23.8	+	36.5	27.9	+
% of farm households with farming sales over ¥1,000,000	48.2	38.8	+	57.7	44.8	**	50.6	35.3	***

See notes for Table 3.

involved in nonfarming employment, is significantly higher among *a-farms*. It is not surprising that the number of working days *a-farm* householders spent on their own farming is also lower and therefore that the number of off-farm working days is significantly greater than for *n-farms*. As for job-holding status, the portion of householders holding regular off-farm jobs was higher throughout the period for *a-farms* than for *n-farms*, though the difference narrowed because of a consistent rise in the rates for *n-farms*. This fact roughly confirms that *gi* nearly equals *gj*.

Briefly, *a-farms* are farms in which the householder conducts steady part-time farming while holding a regular off-farm nonfarming job. In the case of householders' wives, the rate of working as a daily worker or a temporary worker dropped significantly on *a-farms* in 1990. This change in job holding behavior is probably due to many farms starting to offer accommodation services around this time. For the same reason, we also see a rise in the proportion of self-employment on *a-farms*.

In summary, first, accommodation activity does not appear to influence the job-holding status of the householder, who is usually the husband, but it does influence the status of female family members, such as like the wife or the mother-in-law. Second, the householders of *a-farms* tend to have regular off-farm jobs, which is the typical job-holding pattern of Type II farms in this region. We can thus confirm the $p<q$ relationship of Fig. 2, whereas the difference is narrowing.

4) Agricultural production: On-farm farming activity

Table 5 provides details on agricultural production and preservation of farmland for *a-farms* and *n-farms*.

First, the total size of *a-farms* tends to be larger than of *n-farms* in terms of area of cultivated land, area of paddy fields, and area of forests. Moreover, there is a significant difference in the rate of increase in cultivated land from 1985 to 1990 between the two groups: 17.4% for *a-farms* and 3.6% for *n-farms*. This difference is explained by *a-farms* having accumulated land rented from elderly farmers in recent years. In other words, *a-farms* are expected to play a role of preserving farmland in the hamlet by increasing the area of their

Table 6. Factors related to group farming (chi-square test)

(% of farm households)

Year	1980	I		1985	II		1990	III	
Accommodation	Yes	No	Result	Yes	No	Result	Yes	No	Result
% of participation in group farming	47.1	40.4	n.s.	67.1	58.2	+	72.9	74.9	n.s.
% of farms receiving services for operation of rice paddies									
Plowing/soil preparation	34.1	23.2	**	68.2	54.4	**	62.4	56.6	n.s.
Transplanting	3.5	2.5	n.s.	8.2	5.5	n.s.	5.9	10.7	+
Harvesting/threshing	30.6	19.7	**	55.3	44.3	*	60.0	51.6	+
% of farm providing services for operation of rice paddies									
Plowing/soil preparation	3.5	1.9	n.s.	20.0	18.0	n.s.	16.5	14.2	n.s.
Transplanting	1.2	1.6	n.s.	4.7	1.1	**	1.2	1.6	n.s.
Harvesting/threshing	3.5	2.7	n.s.	18.8	12.8	+	16.5	14.8	n.s.

See notes for Table 3.

farmland as a part of their farm management behavior. The lower incidence of farmland abandonment of *a-farms* comes from this function.

Farmland abandonment, which was more than 10% in 1980, has decreased greatly since then. With regard to the composition of uncultivated land and abandoned land, the share of uncultivated land was high in 1980, but it had decreased by 1990. This is because the area of uncultivated land decreased as group farming progressed and land consolidation projects were completed. In short, the fall in the abandonment rate of cultivated land is due to a decrease in uncultivated land. Thus it is safe to say that we could confirm $e<f$ of Fig. 2.

In terms of actual agricultural production, *a-farms* produce more rice, but fewer crops such as vegetables and flowers. This means *a-farms* have placed more emphasis on rice production in recent years, whereas intensive farming such as flower and vegetable production using greenhouses is more prevalent on *n-farms*.

Concerning agricultural machinery, there is no significant difference in the rate of ownership of tractors. *A-farms* own fewer tillers, sprayers, and rice-transplanters, but they own more expensive combines, which are used in rice harvesting. These facts explain the performance of *a-farms* in terms of the necessity of labor-saving operations and accumulation of capital, which are related to their greater involvement in off-farm employment.

Concerning the value of sales of farm products, the gap between the two types of farms widened every five years for the period examined. More than half the *a-farms* were in the over-one-million-yen strata in 1990, which means total sales of agricultural products was higher for *a-farms* than for *n-farms*.

In summary, *a-farms* are more active than *n-farms* with regard to on-farm farming activity. *A-farms* tended to be larger, to sell more farm produce, and to be more willing to take on extra farmland while putting emphasis on labor-saving strategies, such as shifting toward more rice production and labor-saving machinery. This therefore allows them to realize a lower level of farmland abandonment than *n-farms* do, which explains how the farm-based accommodation effect measured in the former section is generated.

5) Group farming: Off-farm farming activity

Table 6 shows details concerning participation in group farming for rice production. This is often carried out through voluntary organizations that allow for mutual help by, for example, sharing machinery and providing operation services in the hamlet. The rate of participation has risen every five years and has increased from about 40% in 1980 to almost 75% of all farms in 1990. This increase in participation is due to efforts to set up group farming organizations in each hamlet by the local government and the extension service, both of which have provided initiatives for farmers. Although the participation rate of *a-farms*

tended to be higher than that of *n-farms* from 1980 to 1985, the difference was narrower in 1990.

An important finding is that *a-farms* and *n-farms* tend to play different roles in group farming. Even though more than 50% of farms receive services through group farming, the rate of farms offering services was less than 20% in 1990. This means that farms are divided into two classes: a large percentage that receives services and a small percentage that provides services. Concerning the actual farming of rice, the proportion of *a-farms* that receive services for plowing, soil preparation, harvesting, and threshing tended to be higher than of *n-farms*. This tendency is also seen for services offered; however, the difference between *a-farms* and *n-farms* is not so significant. Thus *a-farms* tended to benefit more from group farming because of their more severe time constraints caused by their main employment being off-farm work. These findings explain how the group farming effect works.

To summarize, *a-farms* tend to maintain multiple-generation families and thus have better farming conditions in terms of family labor. As a consequence, these farms tend to be comparatively larger, renting more land for farming and concentrating more on rice production. In regard to group farming, they tend to receive rather than provide services. In summary, *a-farms* are run by part-time farmers with steady off-farm employment, but they play an important role in the preservation of farmland within the hamlet. Thus we could confirm the shift effects on the preservation of farmland brought on by *a-farms* and group farming.

6. Discussion

The purpose here is to examine the results of the above analysis and to clarify what mechanisms work to cause a shift toward farmland preservation. We will then determine the implications this has for future policy measures concerning rural diversification, such as the development of *green tourism*, in coordination with traditional farm policy measures.

From the analysis so far, we see that *a-farms* have adapted their farming into that of stable Type II part-time farming because most farmers hold an off-farm job as their main job. To cope with the severe labor constraints because of the workforce being involved in off-farm jobs, it is rational for these farmers to shift their farming to increased rice production for which labor-saving mechanization are well developed. In this sense, they are taking full advantage of the labor-saving technologies of rice production, and the time saved thus can be used for managing more farmland. Consequently they are able to attain optimum labor allocation personally on one hand and also to contribute to the preservation of local farmland on the other. In other words, this is modern incentive-compatible behavior of farmers in the rural community, which attains both household and community rationality. In this sense, this farm-level behavior is an aspect of hamlet function.

Thus the analysis here clarifies how a complementary relationship between the two-internalization aspects works: that at the farm level and that at the group farming level. This farm-level aspect cannot entirely cover the whole internalization process, and neither can group farming. In this sense these aspects are complementary to each other and attain the shift effect together. According to the framework of Fig. 1, the social cost of preserving farmland is internalized by *a-farms* and group farming. To achieve internalization, group farming requires the role of *a-farms* and vice versa.

In this context, a prerequisite for the efficient activity of *a-farms* is the existence of group farming in the hamlet. With the help of these systems, farmers can meet the requirements of peak labor times, such as rice planting and harvesting, even when farming additional land. This is one of the main reasons why *a-farms* generally receive services rather than provide them in group farming. Put another way, the farmland-preservation role of *a-farms* would be undervalued if we considered only the role *a-farms* play as a provider of group-farming services.

Since central and local authorities are now promoting farm tourism in these areas, we must understand that the importance of this complementary relationship in the internalization process will increase as farm tourism develops. This positive complementary relationship is caused by the vitality of pluriactivity of the farms. Thus this complementary function of pluriactivity is reflected in the signaling of

farmland preservation, and this function can be used also as a logical basis for public support.

To maintain and further develop this complementary function, the enhancement of labor productivity is crucial through measures such as land consolidation and the establishment of direct-seeding methods, which can replace the present seedling-transplant method generally used for rice. These issues are a part of traditional farming policy. However, this current analysis reveals that these farming policies can complementarily support rural diversification measures, such as the development of farm tourism.

7. Conclusions

To comply with the growing significance of pluriactivity in rural policy, this paper evaluated the role of pluriactive farms in preserving farmland in the local communities. This land preservation function is declining in the less-favored mountainous areas although it has externality that comprises one factor of multifunctionality. Thus this function needs policy support for its continuation. However, there is no effective framework to deal with this issue.

This paper has presented a framework showing that externality is internalized through farm pluriactivity in the hamlets and how to detect this function by incorporating the concept of signaling. Then by empirical analysis focusing on farm-based accommodations, the behavior and characteristics of pluriactive farms were clarified.

The results reveal that farms offering accommodations maintain favorable farming conditions in terms of family and farm size and confirm that they are shifting their farming to labor-efficient rice production while increasing the size of their farmland by taking on farmland from elderly farmers in the hamlet. This behavior is supported by group farming, an off-farm farming activity in the hamlet, which helps to alleviate the labor constraints of these farms. These efforts complement each other and have the effect of realizing a relatively low incidence of farmland abandonment in the area. This is a modern incentive-compatible behavior of farmers in the rural community, which achieves both household rationality and community rationality. In this way the internalization process is carried out and then measured as signaling. Thus signaling can be an effective tool for the efficient identification of necessary policy targets of farm activities having externality internalized locally, but not socially recognized under the recent stringent government budget.

Another point for policy implications is that it is important to enhance these complementary functions not only as an important factor of multifunctionality to preserve the local community, but also as promotion for a diversified rural economy. Until now we have tended to separately consider each subject, in this case land consolidation, group farming, and farm tourism. Therefore the recognition of this complementary internalized process will be the first step for the future integration of farming and rural policy.

1) Policy evaluation of countryside stewardship programs, see van Huylenbroeck and Whitby [19]. Multifunctionality has not yet been strictly defined. However, the Japanese White Paper of Food, Agriculture, and Rural Areas [19] points out that it consists of effects such as countryside preservation, the nurturing of water resources, preservation of the natural environment, preservation of traditional culture, and preservation of the landscape. OECD gives a working definition of multifunctionality in connection with the joint production of agriculture and externalities. See Pezzini [15].

2) For recent developments on pluriactivity, see Brun and Fuller [1], Fuller [4], Gasson [5], Hallberg, Findeis, and Lass [7].

3) Because of the scope of this paper, details on accommodation, activity are not given. For farm diversification, including farm tourism, see Haines and Davies [6] and Slee [16], and for studies of farm tourism in European countries, for instance, see Bryden et al. [2].

4) Studenmund [17] says that the multicollinearity is severe when VIF >5 as a common rule of thumb.

5) The contribution to land preservation is obtained by $m/(i+j+k)$, $(m=i, j, k)$, where i=the estimate of the farm-based accommodation effect, j=the estimate of the group farming effect, and k =the estimate of completed land consolidation, which are estimates showing significant negative values. The actual contribution is rounded at two decimal places to illustrate the main points of this paper.

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