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The role of formal and informal institutions in farmland consolidation: the case of Shiga prefecture, Japan

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ABSTRACT

This study proposes an appropriate institutional system for coordinating farmland use in Japan, which is not effectively utilized from the economic and environmental viewpoints for various reasons. In this regard, we conduct an examination of the role played by rural communities. We propose a conceptual model to identify the conditions for successful use coordination and classify the various forms of farmland consolidation into four simplified models. We compare these models in terms of (1) change in profits from individual use to collective farmland use, (2) transaction costs for farmland consolidation, (3) need for collective action, and (4) the ability to coordinate community interests. The econometric analysis indicates that possibilities for farmland consolidation exist through coordination among individual cultivators. We also show that promoting the collective actions of communities with a high level of social capital is more likely to coordinate farmland use, concentrate farmland into the hands of large-scale cultivators, and prevent farmland abandonment. Overall, our findings point to the importance of social capital accumulation in rural communities, and we discuss how this social capital can be converted into informal institutions that can promote farmland consolidation.

Keywords: farmland consolidation, rural communities, social capital, land use rights, collective farming, Japan

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1. INTRODUCTION

This study proposes an appropriate system for coordinating land use through an examination of the role played by rural communities in coordinating farmland use in Japan.

Agriculture in Asia faces declining comparative advantage due to increasing wage rates in the process of economic development. Otsuka (2013) argues that Asian countries must expand farm sizes to reduce labor costs and maintain competitiveness in food production. Agriculture in Asia, particularly rice farming in paddy fields, is not just important as an economic activity, but also contributes to maintaining the multi-functionality of agriculture. Thus, it serves as a positive externality for the environment, and ensures food security as well as the well-being of the rural sector. On the other hand, farmland in Japan is not effectively utilized from the economic and environmental viewpoints because the average farm size is too small and the plots remain highly fragmented. The concentration of farmland into large-scale farms has gradually come about in recent years owing to the retirement of aged cultivators. According to the Agricultural Census, the share of farmland cultivated by farms of more than 5 ha is 57.9% in 2015, while the share was 43.3% in 2005 and 51.4% in 2010. On the other hand, the fragmentation of plots continues to be an issue because the newly available plots are often separated from other plots already under the management of the cultivator. According to a survey by the government in 2013, core farmers (the average farm size is 18.4 ha) cultivate on average 31.5 plots with average plot size 0.59 ha.

The sector is also economically inefficient as economies of scale are not being realized because of small-sized operations and fragmented fields. This inefficiency in farmland use reduces farmland profitability and adds to the incidence of abandoned farmland. Conversely, many previous studies have pointed to the existence of economies of scale in Japanese rice farming. Hayami and Kawagoe (1989) show that economies of scale in rice farming emerged in the mid-1960s owing to the medium-sized farm mechanization. Takahashi and Honma (2015) show the economies of scale have been gradually increasing since the 1980s, by which time medium-sized farm mechanization was complete. Furthermore, the fragmentation of farmland leads to economic inefficiency because of the increased time needed to move between fields and manage irrigation water. Estimating a stochastic frontier cost function, Kawasaki (2010) reveals that fragmentation increases production costs and offsets economies of scale.

The lack of farmland consolidation also leads to inefficiency with regard to externality.

Farmland is private property and is considered by the field of economics as a private good with excludability and rivalry. However, collective use of farmland supplies public goods such as environmental protection and landscape management, which are essential components of a rural society. Farmland consolidation can lead to efficiency gains in multi-functionality through the adoption of appropriate farming methods. For example, if the farm management comprises a single farmer, who can make decisions regarding consolidated farmland consolidation, the landscape in the entire community would become more integrated owing to improved coordination with regard to the scheduling and crops. In addition, farm management of consolidated land is better able to prevent the flooding of rice paddies, as the water levels in the fields can be reduced prior to heavy rain. Shobayashi et al. (2010) state that consolidation of farmland helps reduce the amount of water required for irrigation because the single farmer could utilize the drained water from the upstream parcels.

Then why has progress in farmland consolidation been too slow despite these long-recognized inefficiencies? The recent literature on farmland consolidation in Japan focuses on the transaction costs related to farmland. Such transaction costs arise through the processes of negotiation, measurement, and enforcement. For example, expectations for farmland conversion for non-agricultural use also give rise to transaction costs. In Japan, the farmland price for non-agricultural use is much higher than that for agricultural use. Farmers on small-sized farms are unwilling to lease out farmland because they are afraid that the expected capital gain from conversion may fall. Arimoto and Nakajima (2010) focus on the institutional barriers to farmland consolidation, including legal barriers, compensation for tenants' investments, transaction costs, and the high potential for farmland conversion. Conducting an econometric analysis with prefectural data, Takahashi and Honma (2015) demonstrate that farmland consolidation remains inhibited by various transaction costs related to the farmland.

The provision of public goods arising from agricultural production poses another problem. This problem is severe because of the growing diversity of the stakeholders involved in farmland use. In the past, the composition of rural society was simple as the only actors constituted family farms and non-farmers holding farmland. The composition has become more complex over time; currently, the various types of farm management include non-farmers and former farmers. These rearrangements in the rural society complicate the relationship between the beneficiaries and providers of economic and environmental features related to farmland.

Given the high transaction costs related to farmland and the issues associated with providing public goods, it is difficult to achieve the consolidation of farmland solely through market transactions. Thus, some institutional mechanism is necessary.

Recent developments in institutional economics show that, as informal institutions, communities contribute to market imperfections in addition to the government's provision of the public good through formal legislation (Aoki and Hayami 2001). The comparative advantage offered by a community is the supply of local public goods embodied in humans, also called social capital. Hayami (2009, p.98) proposes the following as a definition of social capital: "Social capital is defined as the structure of informal social relationships conducive to developing cooperation among economic actors aimed at increasing social product, which is expected to accrue to the group of people embedded in those social relationships." According to Hayami (2009), the local public good commonly supplied by the community includes the 1) provision of social safety nets, 2) conservation of the commons, and 3) reduction of transaction costs through the enforcement of contracts by means of corporation ostracism.

The role of the community in management of common property resources has come to be widely acknowledged through the pioneering work of Ostrom (1990). Ostrom (1990) studies community mechanisms regarding spontaneous rule making for the management of common property resources, and demonstrates that the customs and social norms of the community are essential preconditions for rational rules. Pretty (2003) argues that when social capital is high in formalized groups, people have the confidence to invest in collective activities, knowing that others will do so too. Past studies illustrate the conservation of common property resources by communities in Japan, such as common forests (Kijima et al. 2000; Shimada 2014), grazing land (Shimada 2015), irrigation systems (Sarker et al. 2015), and fishery resources (Platteau and Seki 2001). It is possible that the management rules exercised for common property resources by communities, such as promoting coordination and reducing transaction costs, would also apply to farmland use.

Based on the above arguments, this study examines the following research issues with regard to coordination of farmland use by rural communities in Japan. First, we clarify the conditions for the coordination of farmland use and determine the role of rural communities in this coordination based on a conceptual model. Second, we model the existing forms of farmland use coordination in Japan, and clarify the advantages and limits of community management. Third, we clarify the conditions for successful coordination by rural communities and their effects on the efficiency of farmland use based on a quantitative analysis.

The rest of this paper is organized as follows. In Section 2, we briefly explain the policy background of farmland consolidation. In Section 3, we propose a conceptual model to consider the conditions needed for successfully coordinating farmland use. In Section 4, we propose four models for coordinating land utilization and conduct a case study on a rural community. In section 5, we conduct an econometric analysis. In section 6, we discuss the appropriate relationship between formal and informal institutions. Section 7 concludes the paper.

2. POLICY BACKGROUND

Land reform constitutes the important precondition for the farmland use in Japan. After the Second World War, the government purchased farmland from landlords and transferred it to the tenants. Such land amounted to about 80% of the land under tenancy before the land reform. Although land reform resulted in a considerable change in the distribution of land ownership, the size distribution of operational holdings experienced no basic changes. As a result, the traditional agrarian structure of Japan, characterized by small-scale family farms with an average size of about 1 ha, persists even today. The Agricultural Land Law was established in 1952 in order to secure the results of the land reform. It imposed strict restrictions on the ownership of arable land and protected tenancy. As the price of agricultural land exceeded the present value of agricultural income streams, it became unprofitable for farmers to enlarge their farms through land purchase. The only alternative for expanding the scale of the farm was land leasing. In order to activate a land rental market, the Agricultural Land Law was amended in 1970. The farmland system was further reformed in 2009 to relax the restriction on acquiring land use rights through leasing and to promote effective land use.

The happenings in recent years (discussed in Section 1) have necessitated the creation of a system promoting effective use of farmland, rather than regulating farmland transactions. Public organizations called landholding corporations were established in 1970, but the resources granted by the government were limited.ⁱ The policy direction with regard to institutions considered as appropriate for coordinating farmland use is not yet firmly set.

“Farmers and Farmland Plan” was a policy measure introduced by the Democratic Party

ⁱ Ito et al. (2016) show that landholding corporations served an intermediary role in facilitating the exchange of land use rights.

of Japan administration in 2012. This Plan is intended to specify how farmland may be consolidated for core farms and how it may be developed for community farming. The implementation of the Plan requires collective action by rural communities because the Plan was devised after thorough discussions and periodical reviews among local and regional farmers. If the Plan is adopted by local governments, farmers and communities can receive subsidies such as long-term funding for core farmers. Thus, the “Farmers and Farmland Plan” entrusts the coordination of farmland use to the rural communities.

By contrast, the current policy under the Liberal Democratic Party focuses on new public organizations known as “farmland intermediary management institutions” established in 2014, and known as “farmland banks.” These entities have replaced the former landholding corporations, the aim being the consolidation of the current fragmented ownership of farmland through sub-leasing. When farmland is sub-leased via farmland banks, the landowner can receive payment from the government. The coordination by farmland banks takes the “Farmers and Farmland Plan,” into consideration. The adoption rate of these farmland banks has been far more limited than the policy goal; the rate was approximately 40% of the policy goal in 2014, and 60% in 2015. The government is trying to increase the adoption rate by linking the activities to the distribution of agricultural budgets.

In addition to the institutions noted above, farmland improvement projects, such as maintaining and repairing drainage channels or reshaping fields, contribute to farmland consolidation by improving the physical conditions of the plots and eliminating farmland fragmentation.ⁱⁱ Farmland improvement projects in Japan require collective action among farmers because it is necessary for more than two-thirds of the participants to agree over plot reallocation among farmers, and to determine who bears the cost. The cost of farmland improvement projects is partly funded by the government and prefectures, the remainder being levied from the beneficiaries in districts undergoing land improvement. The subsidy for the projects increases when consolidating land as part of land improvement.

3. CONCEPTUAL MODEL

In order to consider the conditions necessary for coordinating farmland use successfully,

ⁱⁱ See Arimoto (2011) for the impact of farmland improvement projects on structural adjustment and farmland use.

we examine whether the farmers in a rural community cultivate their farmland collectively or individually. We assume the initial condition to be individual use by farmers because of the historical preconditions of the postwar land reform in Japan.

Farmers in the initial condition are assumed to receive profit b_i from individual farming. In this case, they would be able to retain property rights to the land or lend it to a person of their choice. Thus, farmers would be able to preserve their land assets independently. On the other hand, farmers cannot gain from farm size expansion and farmland consolidation.

If farmers decide to conduct collective farming, their profits are equal to the revenue from collective farming a_i minus the transaction costs for collective farming c_i . These parameters are explained below.

a_i : Revenue from collective farming

If farmers choose collective farming, farm size expansion and farmland consolidation become easier. These can result in increased productivity through economies of scale and elimination of farmland fragmentation. It would also enable efficient provision of public goods such as managing water for irrigation and preserving the rural landscape. These effects result in increasing returns to scale for the participating farmers; the effects become larger as the number of farms increases. However, collective utilization can lower the capital value of the farmland owing to the uncertainty stemming from not knowing who is responsible for cultivation. The landowners may fear that the value of the farmland will decrease because of improper management and that they would lose the chance to convert the farmland to non-agricultural uses if the cultivators refuse to return the farmland.

c_i : Transaction costs of collective farming

These costs are accrued through the collective utilization of land. They include the costs associated with negotiating, surveying, enforcing, and so on. In addition, the collective use of farmland requires continuous collective action within the rural community with regard to the reallocation of land rights and management of resources. These transaction costs depend on the form of the collective utilization of land.

The benefit structure shown above can be understood as a multi-person game, where the provision of the local public good shows increasing returns to scale. Runge (1986) and Baland and Platteau (1996), for example, study this kind of game theoretical situation. There are several scenarios under which individual community members might decide whether to

cultivate their farmland collectively or individually.

1) When $a_i - c_i < b_i$ for each member, even if all other members of the village participate in collective utilization of farmland, such collective use will not be an option for these members.

2) When $a_i - c_i > b_i$ for a portion of farmers if a certain number of community members participate in the collective utilization of land. We assume that the revenue from collective cultivation has increasing returns to scale with respect to the participating farmers. Therefore, if a farmer does not participate in collective farming when only a few farmers do so, the farmer may choose to participate once the majority of members also join in. This kind of situation can be understood as a coordination game or an assurance game in game theory. In a coordination game, both the initial situation (that all farmers are involved in individual farming), and the situation that a portion of farmers will switch to collective farming, are Nash equilibriums. The latter equilibrium, if it exists, is more Pareto efficient than the former. The community may even fail to switch to the more efficient equilibrium if it cannot coordinate with regard to the shift from the initial condition. This failure is a variant of the “tragedy of the commons” proposed by Hardin (1968), although the profit structure of the coordination game differs from that of the prisoners’ dilemma in Hardin’s discussion.

The management of common property resources shows the profit structure of a coordination game in a number of cases. White and Runge (1995) study voluntary collective action in Haiti, in which small watersheds are the common responsibility of a group of users, and they express the situation as an assurance game. Hodge and McNally (2000) study the issue of restoring wetland areas, and argue that the problems of collective action can be overcome by an external agent that facilitates communication between farmers, provides information, and incurs transaction costs.

Some researchers, such as Baland and Platteau (1996), propose conditions that determine whether cooperation occurs under a coordination game. For example, if the rural community has a strong leadership, then this leader can induce cooperation by mobilizing a certain number of collaborators. In addition, if there is adequate communication within the community, the awareness about the profit structure of the other members will prompt the farmers to cooperate. Another factor for successful corporation is the level of social capital accumulated in the community. Social capital contributes to coordination because it offers spaces for communication and reduces transaction costs of collecting information. Else, social capital would lead to coordination through sanctions and peer pressure against uncooperative

members.

4. MODELS OF FARMLAND CONSOLIDATION AND A CASE STUDY ON FARMLAND CONSOLIDATION

4.1 Models of farmland consolidation

In this section, we consider the institutions that are essential for consolidating farmland based on the current state of Japan's farmland usage. The forms of farmland consolidation can be classified into four simplified models. We compare the four models in terms of (1) change in profits from individual to collective farmland use, (2) transaction costs for farmland consolidation, (3) need for collective action, and (4) the ability to coordinate community interests. This discussion is summarized in Table 1.

Table 1: Comparison of four models from the perspective of farmland consolidation

Models	Change in profits to landowners	Change in profits to cultivators	Transaction costs	Need for collective action	Coordination of community interests
Model 1: Individual transaction	Large	Large	Large	No	No
Model 2: Intermediary institutions	Small	Large	Small	No	No
Model 3: Community farming	Large	Small	Small	Yes	Yes
Model 4: Community coordination	Large	Large	Small	Yes	Yes

Model 1: Consolidation through individual transactions

In Model 1, landowners and cultivators make individual transactions for farmland consolidation. In this case, as the landowners can lend their farmland at will to cultivators, they receive land rent while attaining the capital value of their farmlands. Moreover, should consolidation be achieved through negotiation, the cultivators will also enjoy increased profits. However, under individual transactions, the landowner and cultivator must bear the transaction costs associated with consolidation. In addition, the cultivators must coordinate with other

landowners and cultivators by themselves, as the rural community is not involved in coordinating these interests. For this reason, it is extremely difficult to bring about consolidation through individual transactions. Arimoto et al. (2016) point out that individual transactions cannot accomplish sufficient consolidation because the occurrence of “double-coincidence-of wants,” which is necessary for voluntary exchanges, is too rare.

Model 2: Consolidation through an intermediary institution

Model 2 denotes a system in which landowners entrust their land to an external intermediary institution, which then sub-leases the consolidated farmland to core farmers. In Model 2, the transaction costs associated with transferring land rights are reduced compared to Model 1 because these costs are externalized. The cultivators can receive greater profits from the consolidation. However, Model 2 poses a problem; the relationship between the farmland owner and cultivator is vulnerable owing to the presence of an intermediary institution, as it is possible that the landowner may evade transferring land rights, fearing the loss of the capital value of farmland. Moreover, it is difficult for the intermediary institutions, especially those that have been established recently, to coordinate the interests of community members. Furthermore, the farmland consolidation can proceed only gradually because the intermediary institutions collect farmlands individually from landowners.

Model 3: Consolidation through community farming

In Model 3, the farmers in a village form community farming units and practice collective cultivation. Generally, farmland can be totally consolidated under community farming. This can be accomplished at once, while preserving cordial relations between the landowners and cultivators. In this pattern, transaction costs are minimal as there is no need for coordination between landowners. In addition, the coordination by the rural village is maintained as the members continue to be the utilizers of the farmland. However, collective action is required in order to form a community farming unit. In addition, profits to cultivators shrink under community farming owing to the moral hazard problem; cultivators can receive only a part of the profits from their efforts. Nakajima and Tahara (2009) show that incentive problems due to team production can arise in community farming in Japan.

Model 4: Consolidation through community coordination

In Model 4, rural communities coordinate among each other and work as intermediary institutions for farmland consolidation. Such coordination is relatively easier, as the interests of the members continue to be reflected in the rural community. Coordination by the rural community can result in rapid consolidation. As the landowners are the members of the rural

community, they can partially preserve the relationship with cultivators, reducing the anxiety about the capital value of their farmlands. This is in contrast with Model 2, where the intermediary institutions are external bodies from the perspective of the landowners. Additionally, as the consolidation is achieved rapidly, the transaction costs for the cultivators are considerably reduced. The biggest issue posed by Model 4 is that the transaction costs associated with the collective action convert the rural community into a kind of intermediary body. As Shobayashi et al. (2011) argue, the key question here would be whether the transaction costs associated with organizing farms are lower than the reduction in transaction costs.

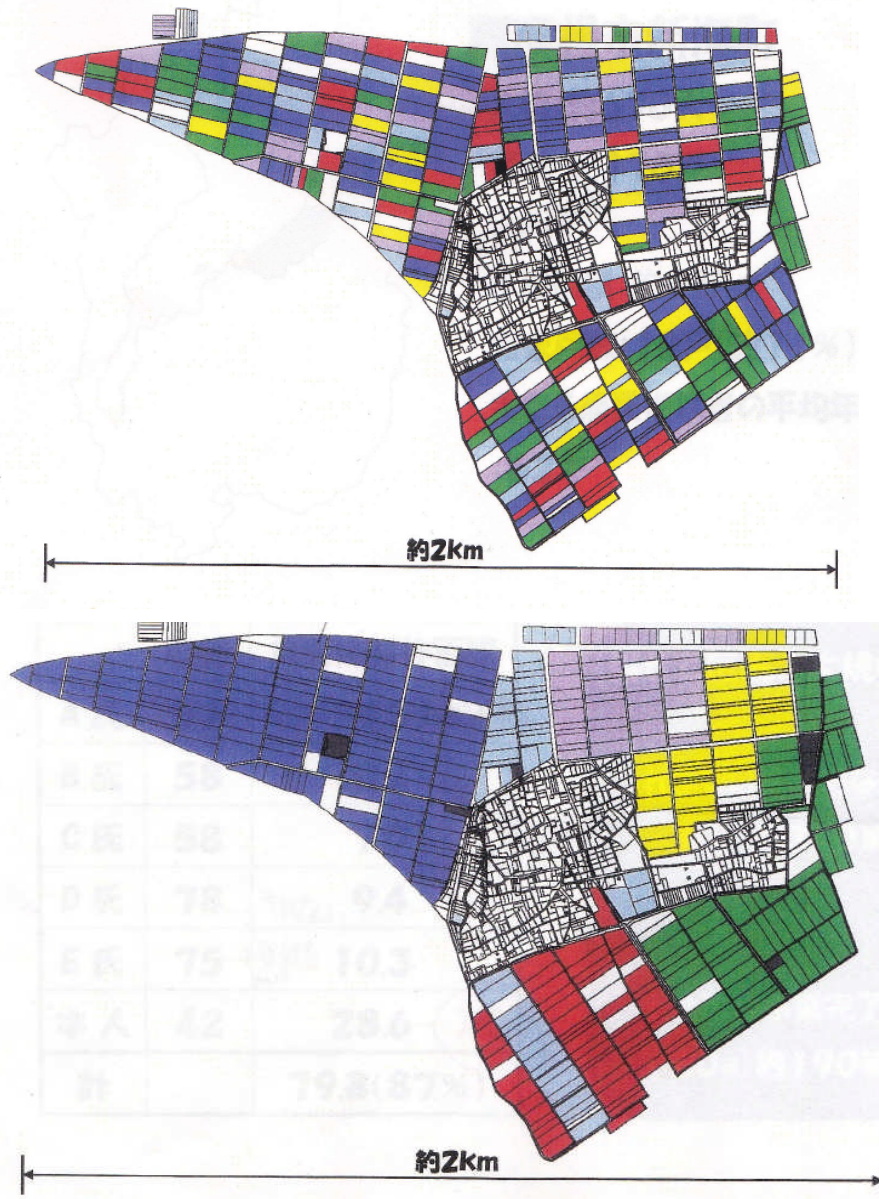
A comparison of the above models shows that Model 1 is difficult to implement owing to the transaction costs associated with land consolidation, while Models 2, 3, and 4 have both advantages and disadvantages. Model 4 is the most advantageous if the problem of transaction costs associated with collective action is dealt with. In the following section, we present a case study along the lines of Model 4, to investigate the process of land consolidation and the conditions for successful collective action.

4.2 Case study: Shingai community

The Shingai community in Hikone City, Shiga Prefecture, is analyzed as an example of farmland consolidation that matches Model 4. The most distinctive geographic feature of Shiga Prefecture is Lake Biwa, the largest lake in Japan. Hikone City is located to the east of Lake Biwa, and Shingai community is located against the shore of the lake. According to the Agricultural Census of 2010, the community consists of 273 households, of which 16 are unincorporated farmers.

Of the 90 ha of farmland in Shingai community, around 80 have been cultivated by 6 individual farmers; however, their plots are highly fragmented. Now, the land use rights that had been dispersed among those six individual cultivators have become consolidated through discussions within the community. The management areas of the six cultivators (Figure 1) show that the scale of the consolidation achieved is significant. The largest manager operates an area of about 30 hectares, which has been consolidated.

Figure 1 Land consolidation in Shingai community



Source: Association to improve farmland utilization, Shingai

The primary driver for this consolidation was the association established by around 130 landowners to improve farmland utilization based on the territorial relationships within the community. This association was established on the basis of the Promotion of Agricultural Land Use Act, which coordinates farmland use. The association in Shingai community has established rules about raising objections to landowners' transferring rights and coordinating the interests of cultivators and landowners.

Why was the Shingai community able to establish the landowners' association? One reason is that the division between use and ownership was largely complete, and there was no competition among the six cultivators with regard to the provision of new farmland. Also, these six cultivators are residents of the community, and thus, the landowners had a low level of anxiety with regard to transferring land use rights.

Another important point is the role of informal organizations in the community. Prior to the establishment of the landowners' association, the community relied solely on an informal organization, the neighborhood council. This council is engaged in local activities such as organizing festivals and preserving the environment. Such a body is a common feature in most of Japan's agricultural communities. The Shingai community has a history of over 700 years, and the neighborhood council has had a large role in maintaining the community's activities. Before the establishment of the landowners' association, the cultivators rented land through individual transactions with landowners. When farmland was offered after the owner retired from cultivation, there was competition among cultivators, which disrupted the relationship among the community members. Thus, to preempt such problems, the neighborhood council became a consultant and cemented the process of distributing the farmland.

The landowners' association also oversaw repairs to drainage channels that had been built during an earlier farmland improvement project. In Shingai, land improvements are promoted primarily by the representatives of the neighborhood council, landowners, and cultivators. In order to attain increased subsidies for such projects, the community decided to form the association to improve farmland utilization and assume unconditional authority from the landowners.

The above experiences of the Shingai community show the importance of social capital within the rural community. In this case, the landowners' association is founded upon the informal organization with a long history, neighborhood council, but has the new role that the neighborhood council cannot play, coordination of farmland uses in the community.

5. ECONOMETRIC ANALYSIS OF FARMLAND COORDINATION

This section undertakes a quantitative analysis of the data from Shiga Prefecture in order to validate the above-mentioned model of land coordination.

5.1 Source of the data

This study uses data collected by the Shiga Prefecture during its “Survey of Community Farming.” This survey was conducted in 280 rural communities in the Prefecture, and of these, 267 submitted responses (equaling a response rate of 95%). The survey was conducted between October 2013 and February 2014 in the form of interviews with community representatives.ⁱⁱⁱ

Uniform sampling was conducted across different regions and agricultural areas in Shiga Prefecture. In addition to the “Survey of Community Farming,” we use data from the Agricultural Census conducted in February 2010 to control for the demographic and geographic conditions.^{iv}

ⁱⁱⁱ It is important to bear in mind that the farmland intermediary management institutions had not yet been established at the time these meetings were conducted.

^{iv} Certain dates of the community interviews for the “Survey of Community Farming” do not match with those of the Agricultural Census. We proxied such data using the average value for the community in the administrative district in which that community was located.

5.2 Analytical framework

The two major variables explaining farmland use and its coordination are the level of social capital and experience in farmland improvement projects.

We use the proportion of collective activities in the community as a means of measuring the community's level of social capital. We refer to a list of 10 activities undertaken to preserve and manage local resources, and include the choices “are always done together” and “have been included recently.” The activities include management of regional resources, such as roads and ponds, and preservation of the village's traditional activities, such as weddings and funerals^v. The management of regional resources and preservation of traditional activities can be interpreted as showing the accumulation of social capital within a community. Matsushita (2009) investigates whether communities participate in resource management policy, using the presence of collective activities as a proxy variable for social capital. The collective activities included in the survey largely relate to activities undertaken by the community, and therefore, they can be taken as a proxy variable for the bonding social capital of the community.

As stated previously, we also consider the experience in farmland improvement projects as a dummy variable. As Arimoto (2011) notes, collective actions such as plot exchanges are necessary for implementing farmland improvement projects. Farmland improvement projects, therefore, do not just improve the physical condition of the farmland, but also serve to provide the community with the experience of joint participation in collective actions. Consequently, experience in farmland improvement projects can be interpreted as a variable showing both the physical state of the land and the community's social capital.

Demographic conditions also explain farmland use and its coordination. We consider the proportions of farming households in the community and of the working-age farming population. The former variable is calculated as the ratio of farming households to total households in the community, the data for which are obtained from the “Survey of Community Farming.” This variable represents the relative number of the farmers in the community. The latter variable is the ratio of farming population under 65 years of age to the total farming population, the data for which are obtained from the Agricultural Census. If the farming population of working age is higher, it is likely that the community has a potential core of farmers and leaders who will coordinate members' interests.

^v The list of these activities is in Appendix.

Furthermore, we introduce control variables for the geographical conditions in the community in order to prevent omitted-variable bias^{vi}. These data are obtained from the Agricultural Census. We also include regional dummies at the community level.

Using the explanatory variables noted above, we analyze the community coordination of farmland use and the state of farmland use in the community.

1) Community coordination of farmland use

We study whether there was coordination of farmland use in the community. It is assumed that coordinating farmland involves either individual cultivators and/or community farming. Coordination with individual cultivators corresponds to Model 4, while community farming corresponds to Model 3. Furthermore, we analyze whether the community has devised a “Farmers and Farmland Plan.” The Plan would support the utilization of land based on the community’s voluntary coordination. The results of these analyses will show the conditions necessary for successful community coordination of farmland use when coordination through an external intermediary organization is not possible (Model 2).

2) State of farmland use in the community

In order to assess the effect of the explanatory variables on the state of farmland use, we conduct an analysis using the following three variables.

- a) Farmland concentration into the hands of large-scale cultivators, which refers to the share of cultivator-managed farmland exceeding 5 ha
- b) Proportion of abandoned farmland, which is denoted by the area of abandoned farmland to the sum of the areas of cultivated and abandoned farmland
- c) Outlook for community farmland use: The survey asked, “Can farming in the community be preserved and continue even if the number of farms are reduced in the future?” Respondents who answered “it will continue” were assigned the score of 1, while those answering “it can continue to some extent although it would be difficult” were assigned a score of 0.5. Those who responded “it is difficult to continue at the current level” were assigned a score of 0.

Thus far, we argue that social capital in rural communities contributes to the effective utilization of farmland through means such as farm size expansion, not abandoning farmland,

^{vi} The list of these geographical variables is in Appendix.

and reducing the transaction costs of coordination within the community.^{vii} The effective utilization of farmland will also determine the outlook for the community's future farmland use. Takahashi and Honma (2015) show the association between the community variables and proportion of land under tenancy, but the mechanism by which this occurs remains unclear.

5.3 Estimation results

The analysis is conducted using Ordinary Least Squares with heteroscedasticity robust standard errors. When the explained variables are 0/1, the estimation model is a linear probability model. The regression coefficients for the geographical variables are omitted. Tables 2 and 3 report the results of the estimation.

^{vii} Unfortunately, we could not obtain data on the level of farmland fragmentation.

Table 2: Estimation results regarding the types of community coordination on farmland use

	Coordination with individual cultivators		Coordination with community farming		Farmers and Farmland Plan	
	Coefficient	<i>t</i>	Coefficient	<i>t</i>	Coefficient	<i>t</i>
Geographic variables (not shown)						
% of farming population	-0.114	-1.26	0.090	0.84	0.098	0.77
% of working-age population	0.055	0.37	-0.126	-0.65	0.268	1.13
Farmland improvement projects	0.038	0.47	0.154	2.35 ***	0.214	2.15 **
Level of collective activities	0.515	1.93 *	0.106	0.38	0.544	2.07 **
R^2	0.125		0.117		0.129	

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 3: Estimation results regarding the state of farmland use

	Share of large-scale cultivators (over 5 ha)		Share of abandoned farmland		Outlook for community's farmland use	
	Coefficient	<i>t</i>	Coefficient	<i>t</i>	Coefficient	<i>t</i>
Geographic variables (not shown)						
% of farming population	-0.093	-1.18	0.019	0.69	0.024	0.30
% of working-age population	0.155	0.97	-0.097	-2.23 **	0.484	3.03 ***
Farmland improvement projects	0.186	2.90 ***	-0.055	-1.95 *	0.087	1.17
Level of collective activities	0.451	2.68 ***	-0.092	-1.66 *	0.495	2.60 ***
R^2	0.131		0.339		0.174	

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

The level of collective activities significantly affects coordination among individual cultivators. We do not observe the effects of the other variables. Regarding community farming, the only significant variable is experience with farmland improvement projects, while the level of collective activities has an insignificant effect. Both experience with farmland improvement projects and the level of collective activities affect the formation of the Farmland Plan positively. These results demonstrate the importance of social capital in rural communities in coordinating individual cultivators. Notably, the demographic variables do not affect these three kinds of coordination of farmland use.

Regarding the share of large-scale cultivators (for areas over 5 ha), the share increases

when the level of collective activities is high and when the community has experience in farmland improvement projects. The level of collective activities, experience with farmland improvement projects, and share of the working-age farming population significantly reduce the proportion of abandoned farmland. The level of collective activities, experience with farmland improvement projects, and share of the working-age farming population significantly improve the outlook for community farming.

6. DISCUSSION

We proposed four models for farmland consolidation and compared their advantages through econometric analysis for a specific case. The current policy of farmland consolidation matches Model 2, and focuses solely on coordination by farmland intermediary management institutions that are external to the community. There are historical, social, environmental, and cultural differences as to how farmlands are managed. It would be meaningless to ignore these differences and impose the same institutions across the whole country. While this study reviewed the feasibility of the four models, we recognize that having an institutional framework that offers a variety of options and allows farmers to make their own choices is essential. For example, if the level of social capital in a rural community is high, as in the case of the Shingai community, the policy should allow voluntary coordination among individual cultivators.

A stance that emphasizes the autonomy of the community, such as in Models 3 and 4, differs from one that completely entrusts land coordination to the community. Rather, the government should introduce appropriate formal institutions in order to achieve farmland consolidation through community autonomy. The typical example is experience with farmland improvement projects. Such projects do not merely improve the physical condition of the land but also provide the basis for subsequent land coordination.

The conditions that enable successful coordination by public institutions, such as farmland intermediary management institutions, deserve more detailed study. However, if a public institution incorporates the rural community's role, the problems posed by the external intermediary institutions can be avoided. In reality, the farmland intermediary management institutions have generally considered the Farmers and Farmland Plan when devising consolidation plans. However, the legal status of the relationship among "Farmers and Farmland Plans", and the farmland intermediary management institutions is unclear. If the role of the community is more clearly defined within formal institutions, the implications of Model

2 would be different.

Farmland consolidation through coordination by the community, and the founding of landowners' associations, as seen in the Shingai community, hold significance for the social responsibility of the landowners and cultivators. Farmland consolidation increases efficiency for cultivators, and landowners can earn increased rents while imposing conditions on cultivators from the standpoint of long-term environmental sustainability. This kind of consolidation through collective actions may lead to the establishment of a new normative consciousness for utilizing farmland as a local resource, and to the spontaneous emergence of rules for coordinating farmland usage in Japan.

7. CONCLUSION

This study proposed an appropriate system for coordinating farmland use in Japan. We briefly explained the policy background of farmland consolidation in the country. Then, we proposed a conceptual model to identify the conditions for successful farmland use coordination. We proposed four models for coordinating farmland utilization and conducted a case study on a rural community. The findings revealed possibilities for farmland consolidation through coordination among individual cultivators by establishing an informal organization within the community. We conducted an econometric analysis and proved that the promotion of collective actions increases the likelihood for communities with a high level of social capital to coordinate farmland use, concentrate farmland into the hands of large-scale cultivators, and prevent farmland abandonment. We also discussed the appropriate relationship between formal and informal institutions. Overall, the results of this study point to the importance of social capital accumulation in rural communities, and we provide recommendations on how to convert this social capital into informal institutions to promote farmland consolidation.

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APPENDIX

The list of local activities in the “Survey of Community Farming” is as follows.

Management of community roads / management of irrigation canals, drains and reservoirs / mutual assistance of farming activities / management and upkeep of shrines, temples, and graveyards / management of the community square and assembly facility / management of the land and forests owned by the community / preservation of the village’s traditional festivals and events / mutual assistance of the ceremonies (weddings and funerals, etc.) / holding sports days and other recreational activities / activities related to farming such as harvest festivals and workshops

The list of geographical variables is as follows.

- Type of agricultural region: urban/plains/hilly/mountainous agricultural region (dummy variables)
- Distance to a densely inhabited district (DID): less than 15 minutes/15–30 minutes/30 minutes–1 hour/1–1½ hours/over 1½ hours; coded from 1–5
- Urbanization promotion area: Whether part of the community has been designated as an urbanization promotion area
- Agricultural promotion area: Whether part of the community has been designated as an agricultural promotion area
- Proportion of farmland area to the total area

- Proportion of paddy-filled area to the total farmland area