Meikai University Discussion Paper 2014-001

Impact of Participatory Development Projects on Social Capital: Evidence from Farmland Consolidation Projects in Japan

Taisuke Takayama
(Meikai University)

Tomoaki Nakatani
(Hokkaido University)

September 2014; revised in May 2017

Impact of Participatory Development Projects on Social Capital: Evidence from Farmland Consolidation Projects in Japan

Taisuke Takayama* **Tomoaki Nakatani†**

Abstract

This study examines the impact of Japan's participatory development projects, in which communities design proposals for farmland consolidation projects (FCPs), on community-level social capital. The analysis uses large-scale community data that include detailed information on social capital for 48,197 communities (of which 14,007 communities implemented the project and 34,190 did not). We provide propensity score matching estimates. The results reveal a positive impact on bonding social capita, although there is limited evidence of a negative effect on bridging social capital. Further, FCPs increase the number of community meetings held. Treated communities opt for governance that requires higher cooperative levels for irrigation management. Focusing on social ties outside the community, FCPs negatively affects the holding direct sales of agricultural products among urban residents.

* Meikai University; Email: tkymti0923@gmail.com
† Hokkaido University

Introduction

Promoting beneficiary participation through community development projects and local decentralization has become a central tenet of development policy (Mansuri & Rao 2012). During these processes, local communities are involved in the decision making and implementation of project design, which directly impacts their daily lives. Participation is expected to result in better outcomes through improved targeting of the poor, reduced project costs, increased project maintenance, and allocative efficiency (Labonne & Chase 2011). In addition, the projects are expected to enhance social capital in beneficiary communities, a lack of which is considered a major obstacle in economic development (see, for example, Woolcock 1998, Dasgupta & Serageldin 2000, Grootaert & van Bastelear 2002, Woodhouse 2006).

While there is ample literature on the effects of social capital in development projects, few studies analyze the impact of participatory development on social capital. As a result, the determinants of social capital remain poorly understood (Gugerty & Kremer 2002, Miguel et al. 2006). In particular, it is challenging to generalize institutional impact as projects widely vary by their context, objective, design, and the nature and scale of activities (World Bank 2002, Casey et al. 2012). In each project area, the effects of participatory development on social capital are mixed (Gugerty & Kremer 2002, World Bank 2002, Vajja & White 2008, Labonne & Chase 2011, Casey et al. 2012, Feigenberg et al. 2013).

This study explores the impact of farmland consolidation projects (FCPs)—a participatory development project in Japan—on community-level social capital. Under this project, farmers in rural communities must prepare farmland consolidation proposals that aim at improving labor and land productivity by physically merging and reshaping several small plots of farmland into one large-scale plot. If more than two-third of landowners in the project area agree, the project is implemented by the central or prefectural government as a public project. FCPs require farmer involvement at in all stages from project design to implementation.

A major contribution of this research is the quantitative analysis of Japan's experiences, which can have implications for developed countries facing decreasing social capital in rural areas. Rural communities in Japan accumulate social capital through collective action such as maintaining irrigation facilities for rice production. However, the recent trend of population decline in rural areas and changes in group coordination (e.g., farmer and non-farmer) among rural communities have led to the deterioration of social capital. Rural communities must recover social capital because the combination of social capital accumulation and agriculture productivity improvement is relevant for community development (Woodhouse 2006). However, the extent to which FCPs help rural communities accumulate social capital is largely unknown in the literature, particularly in the abovementioned circumstances. Therefore, this research examines the relationship between FCPs and social capital. Moreover, in most cases, irrigation canals and farm roads are improved as part of FCP implementation. Therefore, it is also possible that FCP implementation deteriorates social capital since the opportunities for collective action for irrigation maintenance and water allocation decline when irrigation canal maintenance schemes are simplified as part of the process. Thus, the possible reduction of social capital induced by FCPs warrant a new policy to ameliorate this decrease in rural areas.

Farmland Consolidation Projects and Social Capital

1. Farmland Consolidation Projects Background

Japanese agriculture faces several problems such as declining core farmers and farmland, aging farmers, and increasing abandoned farmland. Therefore, the concentration of farmland among core farmers and effective utilization of farmland are needed for the sustainable development of Japanese agriculture. From 1990 to 2011, a farmer's average operational size increased from 1.1 to 2.2 ha. However, the problem of farmland fragmentation remains unresolved. According to a 2006 survey conducted by the Ministry of Agriculture,

Forestry and Fisheries (MAFF), the average core farmers' operational size was 14.8 ha, but farmers' plots were divided into 28.5 separate blocks on average. The average distance between farmlands was 3.7 km, which was the farthest distance.

Thus, farmland fragmentation and small operational size are the key causes of low productivity in Japanese agriculture. Economies of scale are not achieved on operationally small farms and farmland fragmentation increases both labor and travel costs owing to the need to move among plots. Major obstacles in increasing operational farm size are drawbacks in agricultural product pricing, increase in transaction cost as a result of farmland fragmentation, and the expectation of farmland being converted into residential properties or industrial sites (see Arimoto 2011, Kawasaki 2010, 2011). In addition, farmland fragmentation induces increased production costs if the expansion of operational farm size is promoted without the resolution of farmland fragmentation. Therefore, realizing the importance of resolving farmland fragmentation and thereby, increasing farm size (MAFF 2007), the Japanese government began implementing FCPs.

2. Farmland Consolidation Projects

FCPs' key objective is to improve labor and land productivity by physically merging and reshaping several small plots of farmland into one large-scale plot (Fig. 1). In most cases, infrastructures such as irrigation canals, drainage, and farm roads are improved or developed as part of FCP implementation. FCPs are based on proposals made by farmers in a rural community. If more than two-third of landowners in the project area agree on project implementation, the project is implemented by the central or prefectural government as a public project. The central government primarily funds such projects and the remainder is sponsored by prefectures, municipalities, and farm households. Following the initial implementation of the FCPs, farmers must undergo a thought reallocation process in which they negotiate ownership

of the new plots and the previously dispersed plots are consolidated into one large-scale plot. FCPs require farmers' involvement in all stages from project design to implementation.

3. Effects on Social Capital

(1) Definition of Social Capital

FCPs have no intention to interact with social capital within communities. In fact, FCPs could change community social capital or promote changes in the management governance of common pool resources such as irrigation systems through the implementation process. However, it is challenging to examine the relationship between FCP implementation and community social capital. The literature comprises not only various definitions on social capital (Durlauf & Fafchamps 2005) but also a lack of consensus. Social capital is a broad concept that includes formal and informal institutions that facilitate community members' collaboration through existing networks along with shared norms, values, and understandings (Labonne & Chase 2011).

This study defines social capital as the ease with which community farmers act collectively, although social capital has various definitions (Durlauf & Fafchamps 2005). Our social capital indicator will include measures of collective action performed by a community as well as those of the ties between the community and stakeholders outside of the community. We divide social capital into bonding and bridging social capital. We define the former as the ease with which farmers within a community act collectively and the latter as the ease with which community farmers act collectively with other communities or stakeholders.

(2) FCPs and Social Capital

FCPs not only improve agricultural productivity but also encourage meetings to discuss the future use of rural farmland within the project area during the implementation phase. Therefore, FCPs are expected to contribute toward the accumulation of bonding social capital

through landowners' agreement on project implementation and holding of meetings regarding future land use as well as the reallocation process of new plots. However, it is also possible for the FCP implementation to deteriorate bonding social capital because the opportunities for collective action for irrigation maintenance and water allocation reduce when irrigation canal maintenance schemes are simplified as part of the process. Therefore, FCPs can have positive or negative effects on bonding social capital. It is possible that FCPs also affect the accumulation of bridging social capital because they require cooperation with other communities and administrative bodies to implement such projects.

(3) Effects on Bonding Social Capital

FCPs are implemented as public projects under landowner agreements in project areas, including rural communities. This is because if a farmland is reshaped as part of an FCP, one cannot avoid reshaping adjacent farmlands owned by other farmers. In addition, if a parcel of farmland is expanded by merging small plots in a project area, coordination among a large number of landowners is required to negotiate individual ownership of the new plots once the farmland is readjusted. Consequently, bonding social capital may be accumulated through consensus building in the project area during project implementation and post-FCP reallocation. While the primary objective of FCPs is to improve productivity, nurturing the development of core farmers in the project area and concentrating farmland among them have been major objectives since 1992. Further, the program encourages communities to hold meetings to establish a consensus on future farmland use to resolve issues such as fragmentation in the project area. This could also strengthen links within a community, leading to accumulation of bonding social capital.

However, FCPs may also negatively impact bonding social capital. In Japan, irrigation systems generally supply water to parcels of paddy fields in succession. Many farmers are beneficiaries of one irrigation system and because paddy fields are small and fragmented, it

is difficult to adjust water allocation (i.e., timing and amount) without interactions among landowners. Thus, direct and indirect networks are formed between the paddy field owners in the area. If FCPs are implemented, the size of the average parcel of farmland is expanded and fragmentation is resolved. In this case, a consensus is no longer necessary among neighboring farmers in a project area when adjusting water allocation. Following an FCP implementation, the coordination of water allocation involves only one farmer's paddy field. Thus, it is also possible that bonding social capital could deteriorate; however, it is unclear whether the positive or negative effects of FCPs on bonding social capital will dominate.

(4) Effects on Bridging Social Capital

In most cases, FCPs are implemented as a joint project in an entire district, covering more than one community. In this case, consensus building must occur between communities in the project area. Further, close relationships with relevant organizations, such as municipalities and governments, are essential for FCP implementation. These community activities during the project implementation enhance ties between the concerned and other communities or local governments. As a result, the community accumulates bridging social capital through FCP implementation.

Data and Identification Strategy

1. Data

The data used in this analysis are from the *Rural Community Card, World Census of Agriculture and Forestry 2000*. This census has been conducted every five years since 1950 and includes information on agriculture and forestry at the prefecture, municipality, old municipality (area of municipality in 1950), and rural community (smallest unit of regional society in rural villages) levels. FCPs are targeted at the rural community level and their effects are strongly reflected in the rural community-level agricultural data. Hence, we use the

community as a unit of observation. We then employ FCP-related data from 1990 to 2000.

The indicator of FCP implementation in a rural community is a dummy variable if an FCP was implemented between 1990 and 2000, enabling us to compare treated and untreated communities. Following Arimoto (2011), the dummy variable is set to one if the area of readjusted farmland increases *and* the ratio of readjusted farmland increases by more than a specific number of percentage points (at least 50 percentage points) during 1990–2000; otherwise, it is zero. We adopt a 50 percentage point threshold because it is necessary for the ratio of readjusted farmland to be a certain degree larger in the treated communities to observe the effects. For a robustness check, we create indicators for FCP implementation by assessing the increase rate (percentage points) and ratio of readjusted farmland in the following four ways.

(1) The variable is set to one if the area of readjusted farmland increases *and* the ratio of readjusted farmland rises during 1990–2000 and zero otherwise.

(2) The variable takes the value of one if the area of readjusted farmland increases *and* the ratio of readjusted farmland rises by more than 50 percentage points between 1990 and 2000 and zero otherwise.

(3) The variable is set to one if the area of readjusted farmland increases *and* the ratio of readjusted farmland rises by more than 75 percentage points between 1990 and 2000 and zero otherwise.

(4) The variable takes the value of one if the area of readjusted farmland increases *and* the ratio of readjusted farmland rises by 100 percentage points during 1990–2000 and zero otherwise.

The outcome of FCPs are bonding and bridging social capitals. However, these concepts are intangible and thus, difficult to quantify. We begin by developing a measurement of the degree of bonding and bridging social capital in a community. Bonding and bridging social capital in a community is measured in terms of collective activities performed by community

members.

Community collective activities for bonding social capital include (a) the number of meetings held by farmers to practice collective activities (b) number of agriculture-related organizations for the youth, women, and elderly (e.g. collective organizations that supply agricultural products, produce processed agricultural products, and directly sell agricultural products), and (c) governance of collective activities for the management of common pool resources such as irrigation canals and farm roads (coded as follows: all residents = 4, only farmers = 3, employees = 2, not implemented = 1, and non-existent = 0). These variables are used as indicators of bonding social capital because they are treated as a proxy for collective action taken by a community. Additional bonding social capital is accumulated if a community has many collective organizations involving farmers. Moreover, the management of common pool resources is simply a collective action. The level of collective action is the highest for the management of common pool resources by all residents in a community: all community members are required to participate in the operations and maintenance of these facilities. The management of common pool resources by farm households is characterized by a lower level of collective action since non-farm households are excluded. In the case of management of common pool resources by employees and "not implemented," intensive cooperation is not essential. In particular, the ranking of "not implemented" is lower because management is not executed or controlled by the community.

Bridging social capital in a community is measured in terms of whether a community engages in collective activities for urban residents. Community collective activities for bridging social capital are a binary variable for (a) whether the community offers a program that allows urban residents to experience agriculture, forestry, and fisheries (b) whether the community undertakes the direct sale of agricultural products to urban residents, and (c) whether the community provides study-away opportunities for urban residents in the community. Additional

bridging social capital, which represents connections between community and different stakeholders, can be accumulated if communities conduct more collective activities for urban residents. The definitions and descriptive statistics for these variables are presented in Table 1 and Table A-1.

Following Fujiie et al. (2005), we obtain proxy variables for bonding and bridging social capital by applying a principal component analysis (PCA). The principal component scores are calculated after normalizing each variable by subtracting the average from each individual observation and dividing these differences by the standard deviation. We use the first component score as a composite measure of bonding and bridging social capital. Thus, we use the principal component score, which captures the eigenvalues from one or more components within each category, as a measure of social capital.

We exclude rural communities in the Hokkaido and Okinawa prefectures, which considerably differ from other prefectures in terms of agricultural conditions, as well as Tokyo, Kanagawa, and Osaka, which are mainly urbanized. In addition, we exclude rural communities in which upland farming without paddy fields was the mainstay of agricultural production in 1990 because rural community origin and agricultural production environment significantly differ from those in rural communities with paddy fields. Further, following Arimoto (2011), we only include rural communities whose ratio of readjusted farmland in 1990 was 0% for the following two reasons. First, the impact of FCPs on social capital does not appear immediately. Hence, if the treated communities completed their FCPs before 1990, we would be unable to separately identify the effects of the FCPs implemented before and after 1990. Second, if the untreated communities implemented FCPs before 1990, their effects might appear after 1990. In this case, the communities can no longer be considered “untreated.” Consequently, rural communities are limited to those in which FCPs were not yet implemented in 1990. Next, we measure the impact of FCPs on social capital by comparing the rural communities without FCPs

to those with FCPs post-1990. The sample size (treated and untreated communities) is presented in Table 2.

2. Identification Strategy

The objective of this study is to explore the impact of FCPs on social capital in Japan. Thus, we estimate the average treatment effect on the treated (ATT), which is defined as

$$ATT = E\left(Y_i(1) - Y_i(0) \middle| D_i = 1\right) = E\left(Y_i(1) \middle| D_i = 1\right) - E\left(Y_i(0) \middle| D_i = 1\right), \qquad (1)$$

where $Y_i(D_i)$ is the outcome variables (social capital indicator) in community i and D_i is a dummy variable equal to one if community i implements an FCP and zero otherwise.

ATT is defined in such a way that, given the participation of community i in an FCP, the difference in the expected values of social capital that community i would have achieved with or without the FCP. Therefore, the first term on the right-hand side of equation (1), $E\left(Y_i(1) \middle| D_i = 1\right)$, is observable, whereas the second term, $E\left(Y_i(0) \middle| D_i = 1\right)$, is not. If FCPs were randomly assigned to communities, we could replace the second term on the right-hand side of equation (1) with the outcome for a community that has not implemented FCPs. However, as described above, FCPs have not been randomly implemented. To address this problem, we use the propensity score matching (PSM) method (Rosenbaum & Rubin 1983). This method involves matching each project participant with a similar non-participant by calculating probability of participation based on observable pre-project characteristics. In this way, we can match a treated community with an untreated one with a similar probability of implementing FCPs. The probability of implementing FCPs, $P(X_i)$, is the propensity score and estimated using a probit or logit model. If X_i denotes community characteristics, the PSM estimator of

the ATT is defined as

$$ATT = E\left(Y_i(1)\middle|D_i = 1, P(X_i)\right) - E\left(Y_i(0)\middle|D_i = 0, P(X_i)\right). \quad (2)$$

In addition, given the common support condition, that is, a common support or overlap condition that can be relaxed to $P(D_i = 1 | X_i) < 1$ in the ATT estimation (Khandker et al. 2009), equation (2) can be rewritten as

$$ATT = \frac{1}{N}\sum_{i \in T}\left[Y_i(1) - \sum_{j \in C} w(i,j) Y_j(0) \right], \quad (3)$$

where N is the number of observations for treated communities, T and C are the treated and matched untreated communities, and $w(i,j)$ is a weight determined based on the propensity score. Various matching techniques have been proposed using this weight. We apply one-to-one nearest neighbor, radius, and kernel matching as matching methods.

Empirical Results

1. Propensity Score Matching

Table 3 presents the marginal effects of the determinants of FCP implementation. Independent variables include a measure of bonding social capital in 1990 to control for the effects of social capital accumulated in rural community on FCP implementation. This measure is the principal component score obtained on the basis of the number of meetings held by farmers and the management method of irrigation canals and farm roads.

The probit regression results can be summarized as follows. First, communities in mountainous, urban, and city planning areas have a lower probability of implementing FCPs, while those with flat slopes or located far from a densely inhabited district (DID) in an agriculture promotion area have a higher probability of doing so. Communities without favorable agricultural conditions are less likely to implement FCPs. Second, communities with a high number of elderly farmers have a lower probability of implementing such projects, whereas

those with many farmers and part-time farm households have a higher probability of doing so.

We match treated communities with untreated ones with a similar probability of implementing FCPs using the propensity score derived from the probit regression. When matching, we apply one-to-one nearest neighbor, radius, and kernel matching, imposing the common support condition. We adopt the distribution as the kernel function and set the bandwidth to 0.06. If the difference between the treatment and control groups in terms of propensity score is within a radius of 0.01, we match it by applying radius matching. Then, we perform a balancing test to check whether the matched treated and untreated communities are similar in terms of their distributions of community characteristics. We perform Sianesi's (2004) balancing test and find no difference between the treated and untreated communities after matching, that is, our matching strategy is successful.

2. Aggregate Indices

Tables 4 lists the PSM estimates for the ATT from equation (3). The standard errors are obtained by bootstrapping with 100 replications. The results can be summarized as follows. First, regardless of the matching methods, FCPs positively impact bonding social capital. It is robust to the rate of increase in readjusted farmland between 1990 and 2000. However, note that this result captures the overall effect of FCPs. Because the effect of FCPs on bonding social capital has both positive and negative aspects, the result implies that the positive effects are larger than the negative effects. If FCPs are implemented in all paddy areas (100% readjustment dummy), the reduction in bonding social capital that is larger than the other indicator: in other words, the positive effect reduces because irrigation maintenance and water allocation are simplified in the treated community. Second, there is limited evidence of a negative impact on bridging social capital. This set of results is not robust to the matching methods and the rate of increase in readjusted farmland for 1990–2000. Dasgupta (2005) indicates that the accumulation

of bonding and bridging social capital is negatively correlated. Therefore, bridging social capital deteriorates as a result of social capital accumulation through FCP implementation.

3. Specific Outcomes

We now focus on specific outcomes in terms of bonding and bridging social capital (Table 5). We only report the results for the readjustment dummy because the estimates are similar in sign and size, regardless of the treatment indicator. Notwithstanding the matching methods, FCPs positively affect the number of meetings. Prior to FCPs being implemented, communities have the opportunity to establish an agreement among landowners in the project area and determine the nature of future farmland use in the project area. These opportunities can lead to the activation of a treated community and increased meetings in treated communities as a result of project implementation.

While there is evidence of a positive effect on management governance for irrigation systems, it remains limited for the negative effect on the management governance of farm road. Treated communities opt for governance that requires higher cooperative levels for irrigation management and lower levels for farm road management. In case of irrigation management, as a result of FCPs implementation, operation and maintenance activities of irrigation systems are more simplified. Nevertheless, collective activities for operation and maintenance by community members are required as before because both cannot be performed by few farmers, particularly for irrigation systems and water allocation. In addition, that treated communities select governance that requires higher cooperative levels for irrigation management results from community revitalization through FCP implementation. On the other hand, the implementation of FCPs simplifies farm road structure. Collective activities for farm road management are not required because farmers will only manage the farm road that comes in contact with the farmland.

Focusing on the elements for bridging social capital, FCPs negatively affect the

holding direct sales of agricultural products. It is possible that FCPs ameliorate low agricultural productivity and increase production of agricultural products and farmers ship agricultural products to an agricultural cooperative association for cooperative marketing, making it unnecessary to directly sell agricultural products to the consumer.

Concluding Remarks

In this study, we examined the impact of farmland consolidation projects (FCPs), a participator development project, on social capital in Japan by applying a propensity score matching estimation to a community-level dataset. Our results indicate that FCPs led to change in community-level social capital and institution dynamics. In addition, we find evidence of a positive impact on bonding social capita but limited evidence of a negative impact on bridging social capital. Further, FCPs increase the number of community meetings held. Treated communities opt for governance that requires higher cooperative levels for irrigation management. Focusing on the social ties outside the community, FCPs also negatively affect the holding direct sales of agricultural products. Our findings suggest that communities need ways to strengthen social ties with those outside of the community while maintaining bonding social capital along with FCP implementation, because the combination of social capital accumulation and agriculture productivity improvement is relevant for community development (Woodhouse 2006).

There are two caveats regarding the results of this study. First, our study is limited to a sample in which the ratio of readjusted paddy fields is zero in 1990. However, FCPs were implemented before 1990 and the results do not account for the effect of these FCPs. Second, treated communities have varying exposure periods between the completion of their FCPs and the evaluation in 2000; however, we were unable to identify this owing to data limitations. Despite this, our results offer useful insights for the future design of participatory agricultural

development programs.

References

Arimoto, Y. (2011) The impact of farmland readjustment and consolidation on structural adjustment: the case of Niigata, Japan. Center for Economic Institutions Working Paper Series, 2011-3. Hitotsubashi University, Kunitachi, Japan.

Dasgupta, P., & Serageldin, I. (2000) *Social capital: a multifaceted perspective*. World Bank, Washington, D. C.

Casey, K., Glennerster, R., & Miguel, E. (2012) Reshaping institutions: evidence on aid impacts using a pre-analysis plan. *Q. J. Econ*. **127**, 1755-1812.

Dasgupta, P. (2005) Economics of social capital. *Econ. Rec.* **81**, 2-21.

Durlauf, S.N., & Fafchamps, M. (2005). Social capital. *In* Handbook of economic growth, Vol. 1B., eds., Aghion, P. & Durlauf, S., North-Holland, Amsterdam.

Feigenberg, B., Field, E., & Pande, R. (2013) The economic returns to social interaction: experimental evidence from microfinance. *Rev. Econ. Stud*. **80**, 179-189.

Fujiie, M., Hayami, Y., & Kikuchi, M. (2005) The conditions of collective action for local commons management: the case of irrigation in the Philippines. *Agric. Econ*. **33**, 179-189.

Grootaert, C., & van Bastelear, T. (2002) *The role of social capital in development: an empirical assessment.* Cambridge University Press, Cambridge.

Gugerty, M., Kremer, M. (2002) The impact of development assistance on social capital: evidence from Kenya. *In* The role of social capital in development: an empirical assessment. eds., Grootaert, C. & van Bastelear, T. eds., Cambridge University Press, Cambridge.

Khandker, S.R., Koolwal, G.B., Samad, H.A. (2009) *Handbook on impact evaluation: quantitative methods and practices.* World Bank, Washington D. C.

Kawasaki, K. (2010) The costs and benefits of land fragmentation of rice farms in Japan. Aust. J.

Agr. Resour. Ec. **54**, 509-526.

Kawasaki, K. (2011) The impact of land fragmentation on rice production cost and input use. *Jpn. J. Rural Econ*. **13**, 1-14.

Labonne, J., & Chase, R.S. (2011) Do community-driven development projects enhance social capital? Evidence from the Philippines. *J. Dev. Econ.* **96**, 348-358.

Mansuri, G., & Rao, V. (2012). *Localizing development: does participation work?* World Bank, Washington, D. C.

Miguel, E., Gertler, P., & Levine, D. I. (2006). Does industrialization build or destroy social networks? *Econ. Dev. Cult. Change.* **54**, 287-317.

Ministry of Agriculture, Forestry, and Fisheries (2007). Annual Report on Food, Agriculture and Rural Areas in Japan FY2007. MAFF, Tokyo [In Japanese].

Rosenbaum, P.R., Rubin, D.B. (1983) The central role of the propensity score in observational studies for causal effects. *Biometrika.* **70**, 41-55.

Sianesi, B. (2004). An evaluation of the Swedish system of active labor market programs in the 1990s. *Rev. Econ. Stat.* **86**, 133-155.

Vajja, A., & White, H. (2008) Can the World Bank build social capital? The experience of social funds in Malawi and Zambia. *J. Dev. Stud.* **44**, 1145-1168.

World Bank (2002) *Social funds: assessing effectiveness.* World Bank, Washington, D. C.

Woodhouse, A. (2006) Social capital and economic development in regional Australia: a case study. *J. Rural Stud*. **22**, 83-94.

Woolcock, M. (1998) Social capital and economic development: toward a theoretical synthesis and policy framework. *Theor. Soc*. **27**, 151-208.

Table 1 Descriptive statistics of variables

Variable	Obs.	Year	Mean	S.D.
Characteristics				
Agricultural area (urban)	48,197	1990	0.264	
Agricultural area (intermediate)	48,197	1990	0.362	
Agricultural area (mountainous)	48,197	1990	0.197	
Distance to DID (0.5- 1 hr)	48,197	1990	0.250	
Distance to DID (more than 1 hr)	48,197	1990	0.064	
Ratio of elderly farmers	48,197	1990	39.980	15.20
Ratio of part-time farm households	48,197	1990	71.585	21.21
Number of farm households	48,197	1990	18.335	15.04
Gradient (flat)	48,197	1990	0.536	
Gradient (gentle)	48,197	1990	0.321	
Agricultural promotion area	48,197	1990	0.875	
Agricultural promotion area (farmland)	48,197	1990	0.741	
City planning area (urbanization promotion area)	48,197	1990	0.163	
City planning area (urbanization control area)	48,197	1990	0.251	
City planning area (not designated)	48,197	1990	0.256	
Social capital ('90)	48,197	1990	0.033	1.23
Readjustment dummy	48,197	1990,2000	0.291	
Specific outcomes (bonding social capital)				
Number of meetings	36,492	2000	7.979	6.24
Number of agriculture-related organizations for youth	36,492	2000	0.021	0.17
Number of agriculture-related organizations for women	36,492	2000	0.127	0.44
Number of agriculture-related organizations for elderly	36,492	2000	0.030	0.22
Irrigation management	36,492	2000	2.744	1.22
Farm road management	36,492	2000	2.811	1.34
Specific outcomes (bridging social capital)				
Experience program for agriculture, forestry, and fisheries	36,492	2000	0.020	
Direct sale of agricultural products	36,492	2000	0.049	
Program for temporary transfer to rural community	36,492	2000	0.005	

Table 2 Sample size (treated and untreated communities)

	Readjustment dummy	Readjustment dummy (more than 50%)	Readjustment dummy (more than 75%)	Readjustment dummy (100%)
Treated	14,007	10,998	8,691	5,803
Untreated	34,190	34,190	34,190	34,190
Total	48,197	45,188	42,881	39,993

Note: Rates of increase in readjusted farmland between 1990 and 2000 are in parentheses.

Table 3 Probit estimates of project placement

	Marginal effects		S.E.
Agricultural area (urban)	-0.108	***	0.006
Agricultural area (intermediate)	-0.052	***	0.006
Agricultural area (mountainous)	-0.047	***	0.007
Distance to DID (0.5-1 hr)	0.047	***	0.006
Distance to DID (more than 1 hr)	0.031	***	0.010
Gradient (flat)	0.129	***	0.007
Gradient (gentle)	0.066	***	0.007
Agricultural promotion area	0.054	***	0.009
Agricultural promotion area (farmland)	0.110	***	0.006
City planning area (urbanization promotion area)	-0.025	***	0.008
City planning area (urbanization control area)	-0.038	***	0.006
City planning area (not designated)	-0.028	***	0.005
Ratio of elderly farmers	-0.001	***	0.000
Ratio of part-time farm households	0.001	***	0.000
Number of farm households	0.004	***	0.000
Social capital ('90)	0.002		0.002
Observations	48,197		
LR $chi^2(16)$	3,233.65		
Log likelihood	-27,431.78		
Pseudo R^2	0.056		

Note: *** denotes significance at the 1% level.

Table 4 Project effects on bonding social capital (propensity score matching estimates)

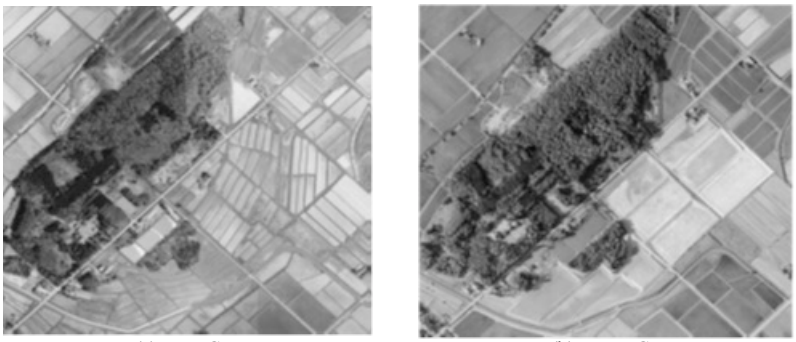
	Before matching	One-to-one NN matching	Radius matching	Kernel matching	Obs.
Bonding social capital					
Treated vs. untreated	0.177*** (0.014)	0.125*** (0.023)	0.138*** (0.013)	0.141*** (0.014)	36,492
Treated (more than 50%) vs. untreated	0.179*** (0.014)	0.115*** (0.022)	0.137*** (0.016)	0.140*** (0.014)	33,874
Treated (more than 75%) vs. untreated	0.173*** (0.014)	0.104*** (0.026)	0.127*** (0.018)	0.131*** (0.015)	31,887
Treated (100%) vs. untreated	0.138*** (0.018)	0.099*** (0.026)	0.095*** (0.021)	0.098*** (0.019)	29,305
Bridging social capital					
Treated vs. untreated	-0.005 (0.011)	0.011 (0.018)	-0.001 (0.012)	-0.002 (0.014)	36,492
Treated (more than 50%) vs. untreated	-0.017 (0.013)	-0.001 (0.021)	-0.012 (0.013)	-0.014 (0.013)	33,874
Treated (more than 75%) vs. untreated	-0.030** (0.015)	-0.010 (0.021)	-0.023* (0.014)	-0.025* (0.014)	31,887
Treated (100%) vs. untreated	-0.027 (0.018)	-0.003 (0.029)	-0.021 (0.020)	-0.022 (0.018)	29,305

Note: *, ** and, *** denote significance at the 10%, 5%, and 1% level, respectively. The standard errors (in parentheses) are obtained from bootstrapping with 100 repetitions.

Table 5 Project effects on bonding social capital, specific outcomes (propensity score matching estimates)

	Before matching		One-to-one matching		Radius matching		Kernel matching	
Bonding social capital								
Number of meetings	1.162	***	0.858	***	0.908	***	0.928	***
	(0.072)		(0.108)		(0.081)		(0.074)	
Number of agriculture-related organizations for youth	0.003	*	0.004		0.001		0.001	
	(0.002)		(0.003)		(0.002)		(0.002)	
Number of agriculture-related organizations for women	-0.004		-0.008		-0.005		-0.005	
	(0.005)		(0.007)		(0.005)		(0.005)	
Number of agriculture-related organizations for elderly	-0.005	***	-0.003		-0.003		-0.004	
	(0.002)		(0.003)		(0.002)		(0.002)	
Irrigation management	0.147	***	0.093	***	0.106	***	0.110	***
	(0.014)		(0.019)		(0.014)		(0.015)	
Farm road management	-0.017		-0.053	**	-0.027	*	-0.027	
	(0.018)		(0.024)		(0.014)		(0.019)	
Bridging social capital								
Experience program for agriculture, forestry, and fisheries	0.001		0.004	*	0.002		0.002	
	(0.001)		(0.002)		(0.002)		(0.001)	
Direct sale of agricultural products	-0.006	**	-0.002		-0.008	***	-0.008	***
	(0.002)		(0.004)		(0.003)		(0.003)	
Program for temporary transfer to rural community	0.001		-8.5E-05		0.001		0.001	
	(0.001)		(0.001)		(0.001)		(0.001)	

Note: *, **, and *** denote significance at the 10%, 5% and 1% level, respectively. The standard errors (in parentheses) are obtained from bootstrapping with 100 repetitions.



(a) Pre-FCPs (b) Post-FCPs

Fig. 1. Farmland Consolidation Projects in Japan.

Source: Taisetsu Land Improvement District.

Table A-1 Definition of Variables

Variable	Definition
Characteristics	
Agricultural area (urban)	Dummy = 1 if agricultural area is clasified as urban area and 0 otherwise
Agricultural area (intermediate)	Dummy = 1 if agricultural area is classified as intermediate agricultural area and 0 otherwise
Agricultural area (mountainous)	Dummy = 1 if agricultural area is classified as mountainous agricultural area and 0 otherwise
Distance to DID (0.5-1 hr)	Dummy = 1 if the time distance to a densely inhibited district (city/town/village) is 0.5- 1 hour and 0 otherwise
Distance to DID (more than 1 hr)	Dummy = 1 if the time distance to a densely inhibited district (city/town/village) is more than 1 hour and 0 otherwise
Ratio of elderly farmers	Denominator = total population engaged in farming
Ratio of part-time farm households	Denominator = total number of farm households
Number of farm households	Total number of farm households
Gradient (flat)	Dummy = 1 if gradient is smaller than 1/100 and 0 otherwise
Gradient (gentle)	Dummy = 1 if gradient is between 1/100 and 1/20 and 0 otherwise
Agricultural promotion area	Dummy = 1 if the community is in an agricultural promotion area and 0 otherwise
Agricultural promotion area (farmland)	Dummy = 1 if the community is in an agricultural promotion area and designated as a farmland area and 0 otherwise
City planning area (urbanization promotion area)	Dummy = 1 if the city planning area is an "urbanization promotion area" and 0 otherwise
City planning area (urbanization control area)	Dummy = 1 if the city planning area is an "urbanization control area" and 0 otherwise
City planning area (not designated)	Dummy = 1 if the community is in a city planning area but not designated as an urbanization promotion or control area and 0 otherwise
Social capital ('90)	Social capital of the community in 1990
Readjustment dummy	Dummy = 1 if the area and ratio of readjusted farmland increased between 1990 and 2000 and 0 otherwise
Specific outcomes (bonding social capital)	
Number of meetings	Total number of meetings held by farmers
Number of agriculture-related organizations for youth	Total number of agriculture-related organizations for youth
Number of agriculture-related organizations for women	Total number of agriculture-related organizations for women
Number of agriculture-related organizations for elderly	Total number of agriculture-related organizations for the elderly
Irrigation management	All residents = 4, only farmers = 3, employees = 2, not implemented = 1, nonexistent = 0
Farm road management	All residents = 4, only farmers = 3, employees= 2, not implemented = 1, nonexistent = 0
Specific outcomes (bridging social capital)	
Experience program for agriculture, forestry, and fisheries	Dummy = 1 if an experience program related to agriculture, forestry, and fisheries is offered and 0 otherwise
Direct sale of agricultural products	Dummy = 1 if direct sale of agricultural products is undertaken and 0 otherwise
Program for temporary transfer to rural community	Dummy = 1 if study trips are offered to the rural community and 0 otherwise