Would Religious Social Capital Affect Farmland Transactions? A Spatial Autoregressive Analysis in Taiwan

by Tsaiyu Chang

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ABSTRACT

This study aims to empirically determine whether social capital affects farmland transactions in Taiwan. It uses a geographic information system to link the village-level data of the largest national farmland survey with the village-level data of religious groups, which are the most widely distributed civil society organizations. The combined data are analyzed using a spatial self-retrogression model. After controlling for farmland spatial adjacency, an increase in social capital brought an increase in the percentage of active leased farmland and a drop in the percentage of fallow farmland. Analysis of the 2015 cross-sectional data revealed that social capital was strongly conducive to the efficient allocation of farmland resources. While belong to irrigation associations can help to allocate farmland resources (as expected), this allocation is more greatly facilitated by the combination of religion and other traditions. Social capital in Taiwan helped to reduce the density of abandoned farmland, especially Daoist temples in religious communities. This study also used panel data to examine changes in within-village farmland tenancy rates. This analysis found that the identified effects of social capital may decline over time.

KEYWORDS

Spatial models, Land use, Panel data, Religion, Social capital

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WOULD RELIGIOUS SOCIAL CAPITAL AFFECT FARMLAND TRANSACTIONS? A SPATIAL AUTOREGRESSIVE ANALYSIS IN TAIWAN

1. RESEARCH PURPOSE

Taiwan is limited in size and crowded in population; therefore, agricultural farmland is traded at prices far above the discounted present value in the expectation of diversion for non-agricultural purposes. Chang (2012) found that the determinants of farmland price are estimated by the hedonic approach, whereby not only the quality of farmland but also factors related to farmland conversion (population density and zoning regulations) influence this price.

Due to the inescapably high price of agricultural land in Taiwan, leasing is preferred by most farmers that need to expand their farmland or commence novel agricultural operations. Chang (2018) empirically revealed three main drivers of reduced supply in the farmland-leasing market: the increase in the theoretical price of farmland, owing to expectations of farmland diversion in areas with low farmland improvement and lenient diversion regulations; quality improvement; and participation barriers in the market. If non-market factors drive up farmland rents, it is relatively difficult to rent land, thus inhibiting new belong to agriculture and, thereby, significantly impeding the development of new agricultural innovations.

Social capital has been identified as a vital factor in agricultural land transactions. In the United States, Katchova and Ahearn (2014) found that young farmers tend to lease farmland as a way to enter agriculture, while also emphasizing that, to lease reasonably priced land, young farmers must build social capital with the local community. Robison et al. (2002) defined social capital as “a person’s or group’s sympathy toward another person or group that may produce a potential benefit, advantage, and preferential treatment for another person or group of persons beyond that expected in an exchange relationship” (p.6). This definition shows that social capital may change the terms of trade between people, including farmland trade. Observing farmland leases in various countries, including Taiwan, reveals that many farmers rent a proportion of their farmland, often at prices not necessarily based on formal market rents. Informal negotiation to obtain agricultural farmland leases relies heavily on the relationship between farmland owners and landowners. Such leases may also be extended to future generations. Under a long-term lease, the landlord can observe whether the tenant will take proper precautions to protect the soil. The relationship between the two sides is expected to be stable under a long-term lease. In some empirical analyses of the non-market factors influencing land rent, social capital is also emphasized. Robison et al. (2002) found that social capital influences the terms of farmland trade. They showed that farmland owners sell land at lower prices to friends and good neighbors but require higher prices from strangers. Social capital relationships have also proven critical to the industrialization of agriculture by influencing contracts between suppliers, processors, and labor. Siles et al. (2000) surveyed 1,500 farmland owners in Illinois, Michigan, and Nebraska in the United States to determine the impact of interpersonal relationships on farmland transactions. The results revealed that relationships between people change the conditions and patterns of

agricultural land transactions. Prior results thus suggest that research on agricultural land markets should consider the importance of social capital.

However, among the East Asian countries that have developed based on agriculture, Japan has the most relevant empirical studies on the link between farmland tenancy and social capital (e.g., Takahashi et al., 2018). By contrast, few empirical studies have been conducted in Taiwan. Some studies in rural sociology, such as Hoshi (2020), have shown that, unlike Japan, Taiwan has weak village cohesion. This may imply that the social capital of villages in Taiwan is rather weak. However, empirical studies are lacking due, in part, to the limitations of national statistical data. This study is the first to use a geographic information system to link the village-level data of the largest national farmland survey in Taiwan with the village-level data of religious groups, which are the country's most influential civil society organizations (Shieh, 2010), and to conduct analysis using a spatial self-retrogression model.

2. RESEARCH METHODS

In Robison et al.'s (1999) and Taylor and Featherstone's (2018) models, which simplify the impact of social capital on farmland transactions, the farmland owner's choice of tenant can be modeled as maximizing utility U in the following terms:

$$\max U = U(r, l(m(K)) \quad (1)$$

where r is the market rental rate of the farmland, l is the intrinsic productivity of the farmland, and m is the cost of monitoring the tenant's behavior in protecting the soil and otherwise affecting the land's long-term productivity. The tenant may offer high rent for the land but also abuse it to maximize revenue. Thus, landowners will maximize utility by weighing higher rents against the cost of monitoring to protect the value of their land. One possible alternative to monitoring is the social capital K built between tenant and landlord. However, if the landowner needs to find a new farmland tenant, there will be search costs n: $\partial \mathrm{m}/\partial K < 0$ where m is the monitoring costs and K is the social capital of the current tenant. These studies posit that landowners' choices can be made by analyzing two key points: the revenue r and the monitoring cost m of their land. They examined the hypothesis that greater social capital would lower rent and lead to more farmland transactions. In their empirical studies, rent received was the dependent variable in the regression, while the explanatory variables were leasing relationship duration and characteristics of the landowner and farmland.

In this study, the data are agricultural records for all villages in Taiwan. Farmland transaction variables in this study are the area of farmland leased in each village, and the variables representing social capital are the number of religious organizations in the village and the area of village farmland affiliated with irrigation associations.

2.1 Religion

Other studies have used religious affiliations as social capital variables with potential influence on

farmland transactions. Raup and Philip (2003) noted that the transfer of farmland for agricultural purposes is mainly owing to death or retirement and that people tend not to sell inherited farmland. There is a cultural element behind the farmland market, such as transfer based on religious beliefs and practices. Villages with a strong religious influence have a strong commitment to rural lifestyles and the ability to motivate resident families. Therefore, agricultural markets in religious-based societies are driven by factors other than the economy.

As Hoshi (2020) noted, the family is the most basic social unit of society in Taiwan. Ishida (1981, 1984a, 1984b) found that in agricultural communities far from the district and administrative center, the blood ties between families are still high. However, in religious rituals, there is often a close social unit that goes beyond the family. In traditional rituals, the core members of a family must be represented and take turns performing the rituals; however, adult males with families in other areas are exempt. For example, when praying to the God of Heaven, it is necessary to read out the names of each family in a memorial to the gods, and through these religious activities, a bond is created between families.

Beliefs in Taiwan are liberal. Temples generally belong to folk beliefs, so temples do not state that the temples belong to Taoism and Buddhism, but believers often consider their religious beliefs to be Buddhism or Taoism. The authorities also classified them as such for convenience. Buddhism is the more spiritual ministry, and Taoism the more social ministry. Taiwan's popular beliefs, which are often divided into Taoism, ,and a few are considered Buddhism, are often very regional and also known as folk beliefs. The customs and habits of folk beliefs are closely related to those of the agrarian society. Although urbanization has led to the departure of young people, the older generation has become more attached to folk beliefs. They also share the same common sense of community in performing rituals together. Religious rituals are followed by a feast, which in Taiwanese is called eating "*bai-bai*"; when there is a feast, there is also sumptuous food, which symbolizes a good harvest. Farmers believe that the land is under the care of the Lord of the Earth, and is the source of all crops and plants. Therefore, if they want a good harvest, they have to rely on the blessing of the Lord of the Earth. Another connection between agriculture and religion is the use of water for irrigation. Especially in an agricultural society dominated by rice cultivation, people used to fight for water, so religious activities were used to unite people who shared a canal. Many of these traditions still remain in the area. There are also rituals to commemorate those who die when digging a canal.

The management of temples in Taiwan is nowadays quite responsive to modernization because temples perform rituals for the people but do not require the direct participation of the faithful. Hsieh (2010) calls this the "separation of human and religious work." Taoist monks usually practiceasceticism, and people have a strong contact with the monks during rituals, but the people work for their own life after the rituals. During the rituals, people make donations. Although participation in Taiwanese temples has become less obligatory, believers often organize activities and take bus trips together, mainly to visit famous temples in other areas to worship and burn incense (i.e., "*Jing-shian*"). In this type of tour, believers spend time

socializing on the bus, dine in a restaurant near the temple, stay in a hotel together, and pay only for the tour. It has become an important service for Taiwan's tourism industry. There are also links between temples located close to one another. In Taiwan, where the family is the basic unit, religion is an important mechanism for connecting families and is a key factor in defining the bonds above the family level. Religion is also an indispensable element in the study of agricultural activities. However, it is not easy to quantify this factor in empirical studies. This study will also contribute to the literature with respect to the religious dimension by quantitative methods.

2.2 Irrigation association

Taiwan is an island with high mountains in the center and very uneven rainfall distribution in time and space, resulting in fierce competition over irrigation water. Hence, the presence of irrigation associations is critical. As an important agricultural production factor, the irrigation association emerged in Taiwan in 1922. There are currently 17 irrigation associations, organized directly by farmers. Each is a public corporation, and participation is semi-compulsory. These associations have employed several irrigation engineers to design the construction of water reservoirs to control the water supply and improve water collection. In addition, water engineers have been directly or indirectly involved in educating farmers to use and control these irrigation technologies.

This relationship between irrigation association and farmers undoubtedly forms a social network. This study considers the rate of membership calculated by area in irrigation associations as an important social capital variable. In recent years, irrigation associations have been facing increasing practicality in financial autonomy because of the fiscal deficit; from October 2020, they became fully managed by a government department: the Irrigation Agency, Council of Agriculture, Executive Yuan. The suspension of dues due to government subsidies could solve the financial deficit. The suspension of dues due to government subsidies could solve the financial deficit. The staff of the water utility would also become civil servants and would no longer have the nature of a mutual aid society. Members would not have to pay to maintain water facilities, but all members would benefit from irrigation. This may reduce the social network function of irrigation facilities.

2.3 Study subject: villages

The main unit of study is the village ("*Tsuen-ri*"). Villages exist as subordinate units of towns. They are generally united by territory, lineage, religion, etc. In Taiwan, the village is an administrative unit that has been merged since the Japanese rule era through reform of the neighborhood administrative system. In other words, the prototype of the present village was not formed naturally. The natural village and the administrative village do not always overlap. However, under Japanese rule, the village had its own community ties that developed for more than a hundred years, thereby gaining a community function.

To promote community formation, the Taiwanese government enacted laws on the formation of

autonomous units. The scope of the community was defined in the 1983 Regulations on Community Development Work, which stipulated that "the community areas shall be allocated according to such factors as historical relationship, cultural background, geographic status, population distribution, ecological characteristics, resources, modality of houses, and development of agriculture, fishing, industry, mining, and commerce as well as the intent, interest, and common needs of the residents." However, the board of directors of Regulations on Community Development Work was reorganized in 1991. While the board considered the history, cultural background, and wishes of residents, the scope of the community was defined as organizations that could operate within the administrative district. In other words, the boundaries of an administrative village were set to roughly correspond with the activities of a social area, entailing not only spatial but also human overlap. Nevertheless, Taiwanese settlements have been studied around religious orders and temples, thus lacking a cohesive spatial or regional unit (Shieh, 2010). A village contains about 100 households in a low-density area but as many as 1,000 to 4,000 households in a densely populated area.

Brekke et al. (1993) surveyed residents of Minnesota over 40 years, from 1953 to 1992, and found that about two-thirds of farmland purchases were made by buyers who lived less than 10 miles from the tract of land purchased. Further, purchases by buyers who did not live locally were concentrated in high-risk areas that were farther from the market or had poorer soils. Therefore, this study considered spatial self-correlation to be important in farmland trade.

3. METHODS OF ESTIMATION

This study uses a spatial weighting matrix W in Stata 16.1 with a generalized spatial two-stage least squares (GS2SLS) estimator to estimate a spatial autoregressive model of y_i with a specified spatial lag. In Equation (2), y_i is the use of land in each village; $K_{i,j}$ are social capital factors; $x_{i,j}$ is local farmland and employment status and industry status in the village *i*; and $\delta_i Wy_i$is the spillover effect of farmland usage status to nearby villages. Because farmland is connected, if one wants to lease land, one will also seek to lease land in nearby villages. Because the errors are not always normally distributed, this study used the GS2SLS instead of maximum likelihood estimation to estimate a more robust standard error.

$$y_i = \alpha + \beta_{i,j} K_{i,j} + \gamma_{i,j} x_{i,j} + \delta_i Wy_i + \epsilon_i \quad (2)$$

Here, *i* is area, numbers 1 to N; y_i is the dependent variable in area *i*; $K_{i,j}$ is the *j*th independent social capital variable in area *i*; $x_{i,j}$ is the *j*th independent variable in area *i*; and ϵ_i is the error (residual) in area *i*.

This study estimated two models, one distinguishing Daoist and Buddhist temples and the other using the total number of temples as an explanatory variable:

$$\begin{aligned}\text{Rentalarea}_{\text{Rt}} = \alpha + \beta_{\text{i},1} daoism_{Rt,i} + \beta_{\text{i},2} buddhism_{Rt,i} + \beta_{\text{i},3} waterassociation_{Rt,i} + \\ \gamma_{\text{i},1} arableland_{Rt,i} + \gamma_{\text{i},2} outemp_{Rt,i} + \gamma_{\text{i},3} rice_{Rt,i} + \gamma_{\text{i},4} cereal_{Rt,i} + \\ \gamma_{\text{i},5} industrial_{Rt,i} + \gamma_{\text{i},6} vege_{Rt,i} + \gamma_{\text{i},7} fruit_{Rt,i} + \gamma_{\text{i},8} mushr_{Rt,i} + \gamma_{\text{i},9} flower_{Rt,i} +\end{aligned}$$

$$\gamma_{i,10} othercrop_{Rt,i} + \gamma_{i,11} cattle_{Rt,i} + \gamma_{i,12} pig_{Rt,i} + \gamma_{i,13} chicken_{Rt,i} + \gamma_{i,14} duck_{Rt,i} + \gamma_{i,15} leisure_{Rt,i} + \gamma_{i,16} cc_i + \delta_i Wy_i + \epsilon_i \quad (3)$$

$$\text{Rentalarea}_{Rt} = \alpha + \beta_{i,0} temple_{Rt,i} + \beta_{i,3} waterassociation_{Rt,i} + \gamma_{i,1} arableland_{Rt,i} + \gamma_{i,2} outemp_{Rt,i} + \gamma_{i,3} rice_{Rt,i} + \gamma_{i,4} cereal_{Rt,i} + \gamma_{i,5} industrial_{Rt,i} + \gamma_{i,6} vege_{Rt,i} + \gamma_{i,7} fruit_{Rt,i} + \gamma_{i,8} mushr_{Rt,i} + \gamma_{i,9} flower_{Rt,i} + \gamma_{i,10} othercrop_{Rt,i} + \gamma_{i,11} cattle_{Rt,i} + \gamma_{i,12} pig_{Rt,i} + \gamma_{i,13} chicken_{Rt,i} + \gamma_{i,14} duck_{Rt,i} + \gamma_{i,15} leisure_{Rt,i} + \gamma_{i,16} cc_i + \delta_i Wy_i + \epsilon_i \quad (4)$$

Table 1 shows the definitions of the variables.

Table 1. Definitions of the variables

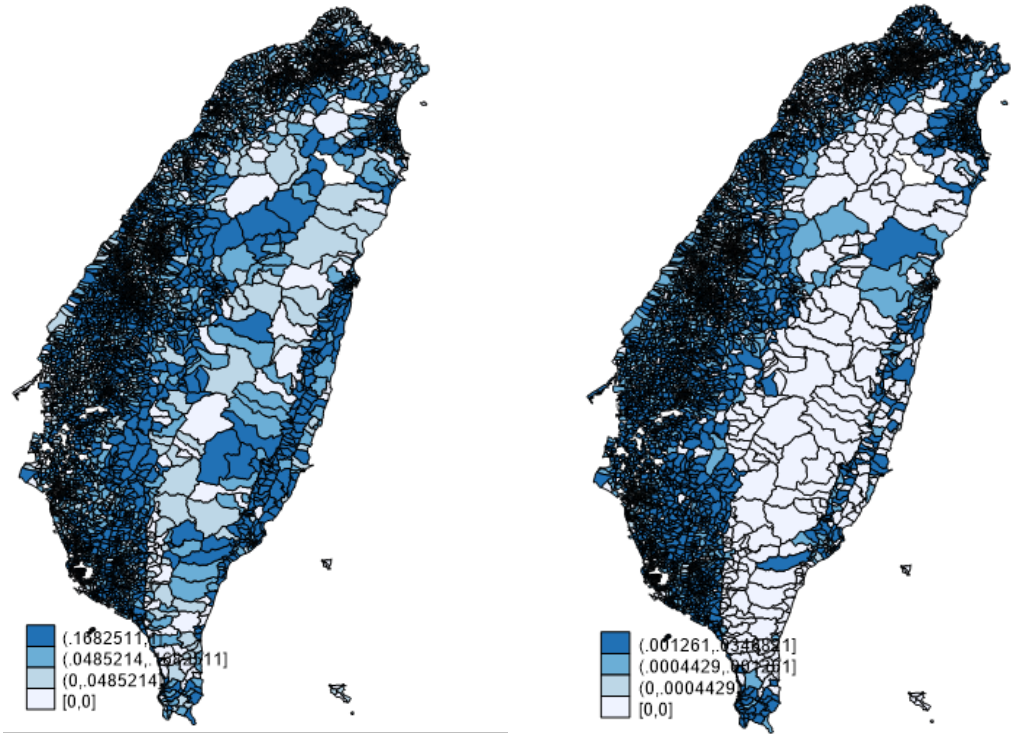
Rentalarea_Rt	The area of arable land of farmers and ranchers which is leased in the village/ the farm area in the village
temple_Rt	The number of temples in the village/ the population in the village
daoism Rt	The number of Daoism temples in the village/ the population in the village
buddhism Rt	The number of Buddhism temples in the village/ the population in the village
Waterassociation_ Rt	The water supply area from irrigation association in the village/ the farm area in the village
arableland Rt	The average area of arable land in the village/ the number of the agricultural household
outemp Rt	The number of households with non-farm work in the village / the number of farm household in the village
rice_Rt	The number of farmers who mainly grow rice in the village / the number of farm household in the village
cereal Rt	The number of farmers who mainly grow miscellaneous cereals / the number of farm household in the village
industrial_Rt	The number of farmers who mainly grow industrial crop / the number of farm household in the village
vegetable Rt	The number of farmers who mainly grow vegetable / the number of farm household in the village
fruit Rt	The number of farmers who mainly grow fruit trees / the number of farm household in the village
mushr Rt	The number of farmers who mainly grow mushroom / the number of farm household in the village
flower Rt	The number of farmers who mainly grow flower growers / the number of farm household in the village
othercrop Rt	The number of farmers who mainly grow other crop / the number of farm household in the village
cattle Rt	The number of farmers mainly engaged in cattle / the number of farm household in the village
pig Rt	The number of farmers mainly engaged in pig farming / the number of farm household in the village
chicken Rt	The number of farmers mainly engaged in chicken farming / the number of farm household in the village
duck Rt	The number of farmers mainly engaged in duck farming / the number of farm household in the village
leisure Rt	The number of farmers mainly operating leisure agriculture / the number of farm household in the village
cc	The city or the county which village belongs to

This study connects the village-level data of the 2015 Census of Agricultural, Forestry, Fishery, and Animal Husbandry with the temple data of the National Religion Information Network collected in April 2014 by the Ministry of the Interior. There were 7,851 villages in the original data. However, since the major farmers are located on the main island of Taiwan, this study excluded the village data of the islands of Kinmen, Matsu, and Penghu. Furthermore, census records were excluded if there were missing data or if the number of participants was too small for the village to be identified. Finally, the data were merged into the Taiwan map provided by government in 2019. The final sample size for spatial analysis was 7,078 villages (Table 2). Figure 1 plots the spatial distributions of the agricultural land lease ratio and temple density on a map of Taiwan.

Table 2. Rental farmland density and temples density, categorized by zone

zone	Freq.	Percent	Rentalarea_Rt	temple_Rt	daoism Rt	buddhism Rt

			Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max	Mean	Mean
1. North Taiwan	2,492	35.21	.0575687	.115299	0	.98	.00060	.0014486	0	0.02	.0004413	.0001455
2. Mid Taiwan	2,132	30.12	.1381869	.1564624	0	1	.00090	.0010511	0	0.01	.0006903	.0001891
3. South Taiwan	2,139	30.22	.1402904	.1802534	0	1	.00141	.0019134	0	0.03	.0011387	.0002447
4. East Taiwan	315	4.45	.2906871	.2375249	0	.94	.00082	.0012508	0	0.01	.0005392	.0002604
Total	7,078	100.00										



Rentalarea_Rt = (Area of arable land of farmers and ranchers that is leased in the village/ farm area in the village)

Temple_Rt = (Temple number in the village/ village population)

Figure 1. Rental farmland density and temples density in the 7,078 villages

As Table 2 shows, the highest percentage of land area rented within villages was in eastern Taiwan, followed by southern Taiwan; the lowest percentage was in central Taiwan. However, southern Taiwan had the highest temple density, followed by eastern Taiwan; again, central Taiwan has the lowest density. Concerning the nature of temples, Taoism had the highest temple density in southern Taiwan, followed by central Taiwan, while Buddhism had the highest temple density in eastern Taiwan, followed by southern Taiwan.

Taiwan's folk beliefs are open, and believers often assume that they are Buddhist or Taoist. Officially, they are also categorized as Buddhist or Taoist for convenience. Most land-related beliefs, such as the Earth

God or the "*Ma-Tsu*" beliefs that bless the crossing of the sea, are classified as Taoist. Most Taoist temples have village activities (Hsu, 1978; Okada, 1937). Buddhism, by contrast, does not necessarily have a center of worship activity bounded by a certain area, owing to the Buddhist principle of universal access to all beings. Many temples, such as those that are privately owned or dedicated to nature worship, do not have a common worship circle for villages. However, the data only distinguish between Taoist and Buddhist temples, and most are Taoist. However, this does not affect the use of temple density as a factor to represent the activity intensity of village communities in our explanatory variables.

4. FINDINGS

4.1 Analysis of 2015 data

The spatial lag coefficient of the estimated proportion of leased land was significant at the 1% level. This means there was a positive correlation between the percentage of leased land in one village and the percentage of leased land in a neighboring village. Because of the significance of this spillover effect, spatial autoregressive analysis is more suitable than multiple linear regression (LeSage & Pace, 2009).

According to the cross-sectional results in Column (1) of Table 3, the social capital factors that have a significant positive impact on the percentage of arable land leased to farmers within a village were the density of temples per capita in that village and the ratio of the area of the village irrigation association. When distinguishing between Buddhist and Daoist temples, only the density of Daoist temples in the village had a significant positive impact on the percentage of land rented by village farmers; the density of Buddhist temples was non-significant. This may be influenced by the nature of the religion and the field of activity. This is because Taoist rituals are usually more frequent and have a stronger regional dimension.

At the 1% significance level, the percentage of rented land in the village was higher if the average farmer in the village had a larger area under cultivation, and a higher percentage of farmers employed in non-farm work in the village had a negative impact on the percentage of rented land in the village.

By industry, a higher proportion of farmers growing rice, cereals, industrial crops, vegetables, fruit trees, flowering plants, and other crops in a village indicates a higher proportion of rented land in the village. Mushroom cultivation, however, had no significant effect. This could be because mushrooms are mainly grown in crop factories. Concerning livestock farming, the percentage of farmers who manage cattle, pigs, and chickens was also positively and significantly related to the percentage of leased land in the village, while the percentage of duck farmers was non-significantly related. The percentage of farmers operating in leisure farming was also non-significantly related to the percentage of leased land in the village, but Buddhism is less territorial.

Table 3. Cross-sectional results of rental area rate using village-level data in 2015

	Column (1)	Column (2)	Column (3)
Explained variable	Rentalarea_Rt	Rt_customarea (the percentage of custom farming land in the village)	Rt_setasidearea (the percentage of set aside farmland area in the village)

	Coef.		Std. Err.	Coef.		Std. Err.	Coef.		Std. Err.	Coef.		Std. Err.	Coef.		Std. Err.	Coef.		Std. Err.
temple_Rt				4.38	**	1.08				0.37		0.34				-1.44	*	0.70
daoism Rt	5.20	**	1.34				0.21		0.43				-1.78	*	0.87			
buddhism Rt	0.95		2.70				0.66		0.84				-0.48		1.74			
Waterassociation_Rt	0.01	**	0.01	0.01	**	0.01	0.00		0.00	0.00		0.00	0.01		0.00	0.01	**	0.00
arableland Rt	0.11	**	0.00	0.11	**	0.00	0.01	**	0.00	0.01	**	0.00	0.00		0.00	0.00		0.00
outemp Rt	-0.06	**	0.01	-0.06	**	0.01	0.00		0.00	0.00		0.00	0.04	**	0.01	0.04	**	0.01
rice_Rt	0.10	**	0.02	0.10	**	0.02	0.01	*	0.01	0.01	*	0.01						
cereal Rt	0.04	*	0.02	0.04	*	0.02	0.01	*	0.01	0.02	*	0.01						
industrial_Rt	0.10	**	0.02	0.10	**	0.02	0.00		0.01	0.00		0.01						
vegetable Rt	0.13	**	0.02	0.13	**	0.02	0.00		0.01	0.00		0.01						
fruit Rt	0.12	**	0.02	0.12	**	0.02	0.00		0.00	0.00		0.00						
mushr Rt	-0.04		0.16	-0.05		0.16	0.03		0.05	0.03		0.05						
flower Rt	0.56	**	0.08	0.56	**	0.08	0.01		0.02	0.01		0.02						
othercrop Rt	0.16	**	0.04	0.16	**	0.04	-0.01		0.01	-0.01		0.01						
cattle Rt	0.74	**	0.20	0.74	**	0.20	-0.06		0.06	-0.06		0.06						
pig Rt	0.29	**	0.11	0.29	**	0.11	0.08	*	0.04	0.08	*	0.04						
chicken Rt	0.39	**	0.10	0.39	**	0.10	-0.01		0.03	-0.01		0.03						
duck Rt	0.18		0.16	0.19		0.16	0.08		0.05	0.08	+	0.05						
leisure Rt	0.02		0.14	0.01		0.14	-0.01		0.04	-0.01		0.04						
cc	0.00	**	0.00	0.00	**	0.00	0.00		0.00	0.00		0.00	0.00	*	0.00	0.00	*	0.00
_cons	-0.08	**	0.01	-0.09	**	0.01	-0.01	**	0.00	-0.01	**	0.00	-0.02	**	0.01	-0.02	**	0.01
W×yi	0.41		0.03	0.40		0.03	0.76	**	0.06	0.73	**	0.06	0.88	**	0.04	0.88	**	0.04

*Note: **, * and $^{+}$ represents significance at the 99, 95, and 90 percent confidence level, respectively.*

To compare the impact on other farmland utilization and leasing, the target variable was changed to the proportion of farmland under custom farming (*Dai-Geng*), referred to in Table 3 as "Rt_customarea." The scale of operations increase through not only farmland purchase but also the provision of custom farming services. Custom farming is a particular type of contract farming in Taiwan: small farmers outsource all large-scale mechanical work to farmers or organizations that manage contractors and agricultural machinery. The machine work involved in custom farming includes raising seedlings, leveling the ground, transplanting rice, and harvesting crops. The person receiving the custom farming cultivates others' farmland and gains labor and machinery operating costs. In Taiwan, full custom farming is very common (Chang, 2018). Basically, landowners who rent out their land can not entrust the same land to others through custom farming; thus, there is a trade-off between rented land and contracted land.

In Column (2) of Table 3, the spatial lag coefficient of the estimated proportion of custom farming was significant at the 1% level. When the dependent variable was the ratio of the area subjected to custom farming, no social capital factors had a significant positive impact.

The higher the percentage of rice and cereal crops in a village, the higher the percentage of custom farming land in the village. In contrast, there was no significant relationship between custom farming and the percentage of farmers growing special crops, vegetables, fruit trees, flowering plants, mushrooms, and other crops. This result reflects the situation in Taiwan, with rice farming at the center and farmers consigning their land to other people's operations. As for livestock production, villages with a higher percentage of pig and duck farmers had a higher percentage of custom farming land; however, there was no significant relationship with the percentages of cattle, chicken, and leisure farming operations. In addition, Taiwan's farmland use includes areas that are voluntarily fallowed by farmers. Under Taiwan's Belong to Direct Payment Measure for rice farming, there is a set-aside premium that allows farmers to obtain a fallow subsidy by resting their land.

In Column (3) of Table 3, the target variable is changed to the percentage of fallow farmland in the village ("Rt_setasidearea"). The spatial lag coefficient of the estimated proportion of fallow farmland was

significant at the 1% level. Since fallowing is a policy related to rice farming, this analysis did not include industry-specific factors. The results showed that among the social capital factors, a higher density of temples per capita in a village negatively influenced the percentage of fallow land in the village at the 5% significance level. However, the effect of the participating ratio by area of the irrigation associationwas not significant. The density of Taoist temples in the village was significantly negatively related to the fallow farmland proportion in the village, whereas the relationship with the density of Buddhist temples was not significant. These results are similar to those for the effects on leased land in Column (1). In addition, at the 1% significance level, a larger proportion of farmers in a village with off-farm work indicated a higher proportion of fallow farmland in the village; however, the average acreage of farmland in the village did not have a significant impact.

4.2 Analysis of the difference between 2005–2010 and 2010–2015

The section used data for each of the villages from 2005, 2010, and 2015 to compare the change in farmland usage between 2005–2010 and 2010–2015. Data were processed using the variation in area (see Equation (4) below), rather than the ratio of the area. After matching villages in the panel data of 2005, 2010, and 2015, the sample was reduced to 5,710 villages. As data on social capital were only available for a single year (2015, or 2014 for the temples), these factors were fixed, assuming that neither the number of temples nor the rate of joining irrigation associations were likely to change significantly in 2005-2010 or 2010-2015 years. The subscript *D* shows the difference between the two years in the numerator of Table 1.

$$\begin{aligned}\text{Rentalarea}_D = \alpha + \beta_{i,1} daoism_{Rt,i} + \beta_{i,2} buddhism_{Rt,i} + \beta_{i,3} waterassociation_{Rt,i} + \\ \gamma_{i,1} arableland_{D,i} + \gamma_{i,2} outemp_{D,i} + \gamma_{i,3} rice_{D,i} + \gamma_{i,4} cereal_{D,i} + \gamma_{i,5} industrial_{D,i} + \\ \gamma_{i,6} vege_{D,i} + \gamma_{i,7} fruit_{D,i} + \gamma_{i,8} mushr_{D,i} + \gamma_{i,9} flower_{D,i} + \gamma_{i,10} othercrop_{D,i} + \\ \gamma_{i,11} cattle_{D,i} + \gamma_{i,12} pig_{D,i} + \gamma_{i,13} chicken_{D,i} + \gamma_{i,14} duck_{D,i} + \gamma_{i,15} leisure_{D,i} + \gamma_{i,16} cc_i + \\ \delta_i Wy_i + \epsilon_i \end{aligned} \quad (4)$$

As Table 4 shows, when the change in the proportion of leased farmland area was the dependent variable, the spatial lag coefficient of the estimated change was significant at the 1% level during both 2005–2010 (Column (1)) and 2010–2015 (Column (2)). Regarding social capital, both the density of Daoist temples and the density of Buddhist temples had a significant (1% level) positive impact on the leased land area of farmers in the village. However, the ratio of the area provided by the irrigation association was not significantly related to the proportion of leased land. At the 1% significance level, a larger increase in the average farmer's acreage(arableland_D) in the village resulted in a larger increase in the area of leased land in the village. By contrast, the number of farmers employed in the village, even outside the agricultural and pastoral industries, had a significant effect at the 10% level on the area of leased land in the village in 2005–2010.

Table 4. Effect on change in leased farmland area during 2005–2010 and 2010–2015 (5,710 observations)

Column (1)	Column (2)

	2005 to 2010						2010 to 2015					
	Rentalarea$_D$						Rentalarea$_D$					
	Coef.		Std. Err.	Coef.		Std. Err.	Coef.		Std. Err.	Coef.		Std. Err.
temple_Rt				2464.82	**	347.36				-157.84		213.98
daoism Rt	1444.24	**	431.59				-65.87		272.52			
buddhism Rt	5291.43	**	856.33				-574.77		547.74			
Waterassociation_Rt	-1.75		1.72	-2.12		1.76	0.38		1.08	0.49		1.08
$arableland_D$	0.34	**	0.02	0.35	**	0.03	0.13	**	0.03	0.13	**	0.03
$outemp_D$	0.01	+	0.00	0.00	+	0.00	0.01		0.01	0.01		0.01
$rice_D$	0.00		0.02	0.00		0.02	-0.05	**	0.02	-0.05	**	0.02
$cereal_D$	0.04		0.05	0.04		0.05	0.02		0.03	0.02		0.03
$industrial_D$	-0.07	*	0.04	-0.07	*	0.04	-0.10	**	0.03	-0.11	**	0.03
$vege_D$	0.00		0.03	0.00		0.03	0.02		0.03	0.02		0.03
$fruit_D$	0.09	**	0.02	0.08	**	0.02	0.25	**	0.02	0.25	**	0.02
$mushr_D$	-0.23		0.42	-0.25		0.43	1.71	**	0.57	1.70	**	0.56
$flower_D$	-0.01		0.17	0.00		0.18	0.29		0.21	0.30		0.21
$othercrop_D$	-0.02		0.17	-0.03		0.17	0.12		0.11	0.12		0.11
$cattle_D$	2.27	*	0.95	2.22	*	0.97	2.23	*	0.71	2.22	**	0.71
pig_D	0.54	+	0.31	0.57	+	0.31	-0.11		0.36	-0.11		0.36
$chicken_D$	-0.11		0.35	-0.17		0.36	0.46		0.30	0.46		0.30
$duck_D$	0.72		0.71	0.76		0.72	0.17		0.56	0.17		0.56
$leisure_D$	1.38	**	0.40	1.36	**	0.41	0.58		0.37	0.58		0.37
cc	1.48	**	0.11	1.50	**	0.11	-0.02		0.07	-0.01		0.07
_cons	-79.18	**	1.93	-82.87	**	2.02	1.04		0.77	0.96		0.77
W×yi	0.21	**	0.02	0.15	**	0.03	0.65	**	0.09	0.63	**	0.09

*Note: **, * and + represents significance at the 99, 95, and 90 percent confidence level, respectively.*

In each industry, the increase in the number of farmers growing fruit trees in the village predicted a high increase in the area of leased land in the village, at the 1% significance level. If the number of village farmers cultivating industrial crops decreased, the area of leased land in the village increased, at the 5% significance level. However, rice farming, cereals, vegetables, flowering plants, mushroom cultivation, and other crops were not significantly associated with the area of leased land. The increase in the proportion of cattle, pig, and leisure farming operations significantly increased the area of leased land within the village, but the proportions of chicken and duck operations had no significant effect.

The fruit tree, cattle, pig, and leisure industries are among the higher value-added industries in Taiwan; thus, the increase in the number of these farmers has increased the demand for farmland, and these higher value-added farmers can afford to rent land, which also increased the amount of land that village farmers could rent from 2005 to 2010.

When the change in leased farmland area was the dependent variable in 2010–2015, the spatial lag coefficient of the estimated change in leased land area was significant at the 1% level, as shown in Column (2) of Table 4. No social capital factor had a significant positive impact, which may mean that the influence of temples on society was lower than during 2005–2010. In addition, at the same 1% significance level as 2005–2010, a greater increase in the average farmer's acreage in the village from 2010–2015 indicated a greater increase in the area of leased land in the village. The number of village farmers employed in off-farm work no longer had a significant effect on the area of leased farmland in the village in 2010–2015. By category of industry, the extent of fruit trees and mushroom cultivation were positively associated with the area of leased land in the village at the 1% significance level from 2010 to 2015. Moreover, a fall in the number of village farmers cultivating rice and industrial crops was associated with a high increase in the area of leased land in the village, at the 5% significance level. By contrast, farming of cereals, vegetables,

flowering plants, and other crops had no significant impact. An increase in the proportion of cattle operations was associated with a significant increase in the area of leased land within the village, but the proportions of pig, chicken, duck, and leisure farming operations had no significant effect.

Different from 2005-2010, the proportions of cattle, fruit tree, and mushroom operations positively affected the area of leased land in the village in 2010–2015; however, rice cultivation was negatively associated with the area of leased land. Rice is the sector that uses most of Taiwan's farmland. To increase the number of small-scale farmland leases, Taiwan implemented a policy of small landlords and large tenant farmers for rice farming in 2010; however, it was largely ineffective. The leisure industry, which increased demand for farmland leases in 2005–2010, is saturated in Taiwan and was not significantly affected on leased land during 2010–2015.

Next, the dependent variable was changed to the area of custom farming by the area of farming operations in the village, referred to as "customarea$_D$" in Column (1) of Table 5.

Table 5. Effect on change in custom farming area within 2005–2010 and 2010–2015 (5,710 observations)

	Column (1)						**Column (2)**					
	2005to 2010						2010 to 2015					
	customarea$_D$						customarea$_D$					
	Coef.		Std. Err.	Coef.		Std. Err.	Coef.		Std. Err.	Coef.		Std. Err.
temple_Rt				-518.22	**	121.95				65.45		70.15
daoism Rt	-412.09	**	148.30				46.74		89.29			
buddhism Rt	-602.39	*	305.60				134.92		176.41			
Waterassociation_Rt	1.07	*	0.61	1.49	*	0.62	0.10		0.36	0.08		0.35
$arableland_D$	-0.06	**	0.01	-0.07	**	0.01	0.01	+	0.01	0.01	+	0.01
$outemp_D$	0.01	**	0.00	0.01	**	0.00	0.00	**	0.00	0.00	**	0.00
$rice_D$	0.00		0.01	0.00		0.01	-0.01		0.01	-0.01		0.01
$cereal_D$	-0.01		0.02	-0.01		0.02	-0.01		0.01	-0.01		0.01
$industrial_D$	0.02	+	0.01	0.02	+	0.01	0.01		0.01	0.01		0.01
$vege_D$	0.05	**	0.01	0.05	**	0.01	0.00		0.01	0.00		0.01
$fruit_D$	0.01		0.01	0.01		0.01	0.00		0.01	0.00		0.01
$mushr_D$	0.09		0.15	0.08		0.15	0.09		0.19	0.09		0.19
$flower_D$	0.17	**	0.06	0.17	**	0.06	-0.05		0.07	-0.05		0.07
$othercrop_D$	-0.02		0.06	-0.02		0.06	-0.02		0.04	-0.02		0.04
$cattle_D$	-0.14		0.33	-0.20		0.33	-0.09		0.23	-0.09		0.23
pig_D	0.05	*	0.10	0.03		0.11	0.25	*	0.12	0.25	*	0.12
$chicken_D$	0.11		0.12	0.12		0.12	0.04		0.10	0.04		0.10
$duck_D$	-0.44	+	0.24	-0.46	+	0.25	0.13		0.18	0.13		0.18
$leisure_D$	0.25	+	0.14	0.25	+	0.14	-0.10		0.12	-0.10		0.12
cc	-0.17	**	0.04	-0.20	**	0.04	0.00		0.02	0.00		0.02
cons	-2.73	**	0.45	-3.12	**	0.47	-0.08		0.25	-0.07		0.25
W×yi	0.62	**	0.04	0.51	**	0.05	1.05	**	0.10	1.04	**	0.10

*Note: **, * and $^+$ represents significance at the 99, 95, and 90 percent confidence level, respectively.*

In 2005–2010, the estimated spatial lag coefficient of the change in the area of custom farming was significant at the 1% level. The density of temples per capita in the village, including all temples, Daoist only, and Buddhist only, had a significant negative impact on the area of custom farming within the village. As noted earlier, landowners who rent out their land can not entrust their same land to others through custom farming; thus, while religion had a positive effect on the area of leased land in 2005–2010, its effect on the

area of custom farming land was negative in 2005–2010. However, the change in the area of work contracted by the irrigation association had a significantly positive impact on the change in the area of custom farming.

A larger increase in the average farmer's acreage in the village between 2005 and 2010 was negatively related to the village's area of custom farming. The change in the number of village farmers employed in off-farm work had a significant positive impact on the village's area of custom farming. The industries that significantly positively affected the area of custom farming within the village from 2005 to 2010 were industrial crops, vegetables, flowering plants, pigs, ducks, and leisure agriculture.

Finally, when the change in the area of custom farming in the village during 2010–2015 was the dependent variable (Column (2) of Table 5), the spatial lag coefficient of the estimated change was significant at the 1% level. No social capital factor had a significant impact, nor did the density of temples or the irrigated area of the water association, unlike in 2005–2010. The increase in the area of custom farming in the village was significantly larger if the increase in the average farmer's acreage in the village was greater or if the number of farmers employed in off-farm work was greater. In addition, pig farming was the only industry to have a significant impact on the change in the area of custom farming in the village from 2010 to 2015.

5. DISCUSSION

The main finding of this study is that social capital helps farmland transactions. After controlling for farmland spatial adjacency, an increase in social capital was associated with a rise in the percentage of leaded farmland leased in each village and a fall in the percentage of fallow farmland. These results are consistent with the conclusion of previous studies of social capital's impact on farmland rents (Tan et al., 2018; Taylor & Featherstone, 2016, 2018; Teshome et al., 2016), namely that social capital benefits the efficient allocation of farmland resources. In particular, analysis of the 2015 cross-sectional data revealed that social capital was strongly conducive to efficiently allocating farmland resources. Agricultural and irrigation associations, for example, are a more direct form of social capital for agriculture. While the contribution of irrigation associations can help allocate farmland resources, as expected, the traditional combination of religion and other traditions was more effective in helping farmland resources allocation. The social capital that religions represent is often ignored. When examining the change in within-village farmland tenancy area from 2005 to 2010, the effect on tenancy area was significant, although it declined between 2010 and 2015. Conversely, social capital either had no impact on or negatively affected contracts for custom farming that did not require farmland leases. In addition, social capital helped to reduce the density of abandoned farmland, with the density of Daoist temples in religious communities especially influential. This finding suggests that social capital in the village plays an active role in the allocation of arable land resources.

Many reforms have been conducted in Taiwan's rural areas. In the post-war period, a policy known

as 3-7-5 rent reduction was implemented in 1949 and Land-to-the-Tiller Program in 1953, which deprived landlords of their farmland at cheap prices and gave it to tenant farmers. This later resulted in farmers being very careful when deciding whether/how to lease out their farmland.. Although, the government has recently promoted policies known as “Small Landlords and Big Tenants” from 2009, and farmers have taken advantage of these policies; however, they still establish farmland leases through their own relationships in the village. Strong interpersonal relationships within the village can also effectively prevent the growth of fallow land. In addition, because the influence of social capital is declining, new farmers who had no chance to connect to the old social capital still have the opportunity to lease farmland by investing social capital in landowners through policies and good communication. This study also supports the idea that the government should continue supporting the establishment of farmland markets in rural areas, as well as helping farmers use social capital to find suitable tenants for their farmland.

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