Applied Economics Journal Vol. 25 No. 2 (Demember 2018): 70-88

ISSN: 2586-9124 (PRINT)
ISSN: 2586-9132 (ONLINE)

Received: 6 September 2018
Received in revised form: 12 December 2018
Accepted: 20 December 2018

Succession Decisions and Inherited land Size: An Evidence of Family Farms in Nakhon Si Thammarat Province, Thailand

Kanjana Kwanmuang[1]

Office of agricultural economics zone 8, Office of agricultural economics, Thailand

Abstract

The issue of small size of farm holding is of concern to Thai agriculture for future farming, especially as farm sizes will become smaller by way of inheritance. Since succession decision is not randomly assigned thus, this study applied Propensity Score Matching (PSM) to address and correct the problem of self-selection. The purpose is to investigate the difference in farm size per child between households with and without successors, in Nakhon Si Thammarat province, The South of Thailand. The findings indicate that farm size per child was not significantly different between the households, whether or not a successor existed. Farmland will be transferred to secure the highest value of asset for all children in the future. The findings increased awareness of concerns, especially for successors who will inherit small farms. Thus, the program for supporting and enhancing ability for small-scale farms is needed in the future.

Keywords: inheritance of farmland, land market, propensity score matching, succession decision, Thailand
JEL Classification: Q12, Q15,

[1] Corresponding author*: 131 Office of agricultural economics zone 8, tharathipbodee rd., Tharkarm, PhunPhin, Suratthani, Thailand, 84130. Tel.: 66-897276604; fax: 66-77311641 E-mail address: mam_econ@hotmail.com

1. Introduction

The decisions related to the succession of family farms are becoming an important social issue for the sustenance of the agricultural sector. Therefore, farms without successors will gradually cease to exist. Additionally, possession of farmland is one of the main requirements for a farming career. The body of literature, particularly from the United States and European countries, has mostly focused on the aspects of the probability of succession and discussed the relationship between farm size and the probability of succession. Most of the studies found that the larger farms are more attractive for succession than smaller farms (Kimhi & Lopez,1999; Mishra &El-Osta, 2008; Glauben, Tietje& Weiss ,2002). Kimhi & Nachlieli (2001) conducted a study in Israel and found a contrasting result: farms with more land had lower probabilities of having a successor. However, these results of farm size and influence on positive and negative succession decisions are based on the following context: the entire farmland is transferred to a successor by inheritance (Kimhi & Nachlieli, 2001; Otomo&Oedl-Wieser, 2009) or purchasing from parents (Mishra & El-Osta, 2008).

By contrast with the inheritance patterns in those studies' countries, Asian countries, especially in Thailand, farmlands are divided and passed on to more than one child through inheritance. Family farming and farm succession have been the predominant patterns in agriculture for many generations, but cultural (Slagter&Kerbo, 2000) and legal inheritance systems (USAID,2011) have shown that parents will share farmland with all their children, whether the child was a successor or not, resulting in a small-sized farm for successors (Kwanmuang, 2015). However, there was still a limitation of the study to demonstrate the relationship between farm size and the probability of succession in the case of sharing farmland among all children.

Thus, when we reviewed the combined results of the reviewed studies on farm size on succession probability, we found that this relationship can also be queried from the opposite direction, that is, "do farm households who cannot find the farming successor(s) among their children transfer a smaller size of farmland to the child(ren) than the farms households who have successor(s)?" This question can be derived from the simple reason that land is an important asset for farming. However, it is not easy to post this hypothesis because there has been much evidence of combined factors that affect farmers' inheritance decision to discuss and support this statement.

The first reason is the apparent inverse relationship between land size and productivity: small farms offer greater productivity than larger farms. Many differences in factor endowments between small and large farms are explained this inverse relationship. In the 1960s, because small farms used their own labor and had lower transaction costs than large farms, small farms had greater land productivity (Sen,1962). Small farms also used their resources more efficiently than large farms (Banerjee, 1985). In the 1990s, for example, Heltberg (1998) found that small farms produced more per unit of land. Raghbendra et al. (2000) asserted that by using farm labor, small farms had lower labor transaction costs compared with large farms. Also, small farms had the advantage in diversifying products into high value-commodities compared with large farms (Fan & Chan-Kang, 2005). The evidence regarding small farm sizes being more productive than larger farms was also found in

Thailand (Wattanutchariya & Jitsanguan ,1992; Bureau of Agricultural Economic Research ,1997, 2007, & 2015) due to the use of farm labor and management. This inverse relationship between land size and productivity may demonstrate that a farmer can find an optimal land size for farming. This means that a farmer may not always hope to transfer larger portions of land to their children to ensure more efficient farming in the future.

Secondly, the land market is not fully functioning (Nabangchang-Srisawalak, 2006; Phelinas, 2001; Rigg et al., 2016) in Thailand. This disfunction results in relatively higher transaction costs for the search, negotiation, and evaluation of the quality of land and difficulty finding new land. This phenomenon has a disincentive effect: to invest in the land for the farmers who cannot find successors because the investment cost would not be fully recovered from their land sales after quitting farming. This investment in the land includes increasing the size and improving productivity. Thus, the differences in the transferred size and in the productivity between types of farmers are investigated in this study.

Thirdly, farmland represented one of the highest valuable assets with values increasing overtime, and a plot of land represented accumulated wealth (Phelinas, 2001) with the best guarantee for any loan's requirement (Rigg et al., 2016). These results imply that the farmer prefers retaining land for their children. For these reasons, there is also the possibility of finding support for the following: a farmer with a successor will not transfer larger land sizes than a farmer without a successor.

Thus, the issue of size of farmland per child between households with a successor and households with no successor must be examined, especially in the case when land is transferred to more than one successor. This subject should be examined empirically for the following reasons. First, the land size per farm household is decreasing throughout Thailand. This phenomenon could be a concern for the sustainability of Thai agriculture even if smaller farms are more efficient. Second, if a new farmer does not begin with a larger portion of land, a different approach is required to improve the income or livelihood compared with the case where a farmer's career starts with a larger portion of land.

Notably, a direct or simple comparison of the land size per child between farmers with successors and without successors would not be appropriate. This simple comparison may lead to inconsistencies due to selectivity bias because a successor is not randomly assigned, it is a process based on farmers' self-selection. In other words, characteristics of farm households with and without successors are expected to differ significantly and non-randomly. For these reasons, this study adopted propensity score matching (PSM) to analyze the present question.

The structure of this paper is as follows. In section two, the characteristics of farmland in Thailand are described, especially the details of titling, characteristics of the land market, and inheritance customs. Section three introduces the empirical approach, PSM, and describes the data collection survey in this study. The results are provided and the study is discussed in sections four and five, respectively.

2. Land Titling, Land Market, and Inheritance Custom in Thailand

2.1 Farm Size in Thailand: Southern and Nakhon Si Thammarat province

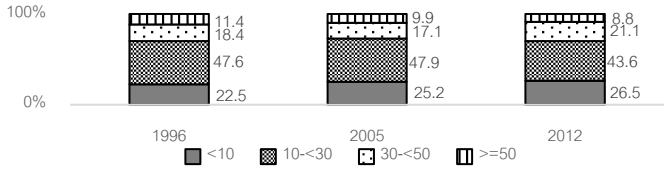
The farm sector in Thailand is facing a decrease in small-scale farms, and this phenomenon is an agriculture concern. Half of the total land (46.54%), or 149.26 million rai, is used for agriculture, and the vast majority of agricultural production in Thailand occurs on small-scale farms. There are 5.9 million farms with an average farm size of 4.04 hectares (or 25.26 rai), and the average age of the head of the farm was 56 years (Office of Agricultural Economics, 2016). However, the structure of farm holdings in Thailand from 1993 to 2016 showed an increasing number of farm households with smaller-sized farmland holding.

Thailand had a gradual decline in average farm size in every region, especially in this study's target area. From 1993 to 2016, the annual average size of farm per household decreased as follows: 0.66% across the country, 0.69% in the South, and 1.34% in Nakhon Si Thammarat province.

Over the same period, by contrast with the average farm size, the number of farms gradually increased by 0.59%, 1.03%, and 1.19% per year in Thailand, in the South, and in Nakhon Si Thammarat province, respectively. In 1993, Thailand had 5.1 million farms, and the number gradually increased to 5.9 million farms in 2016 (Office of Agricultural Economics, 2016).

Moreover, of the 5.9 million total farm households in 2012, 43.6% of farms had land areas from 10 to < 30 rai (or 1.6 to < 4.8 hectares), and 26.5% of farm households had less than 10 rai (1.6 hectares) of land. Additionally, the share of farm holdings of the land less than 10 rai or of the smallest size increased from 22.5% in 1996 to 26.5% in 2012. But in the same period, the share of large-sized farms over 50 rai (i.e., 8 hectares) decreased from 11.4% to 8.8% (Figure 1.) (Bureau of Agricultural Economics Research, 2015). This evidence revealed that the share of farm households holding the smallest-sized farms (less than 10 rai) increased.

Figure 1. Share of the total number of farm holdings by size of farm, 1996, 2005, and 2012 (% of total)



Source: Bureau of Agricultural Economics Research. Office of Agricultural Economics.

1 rai = 0.16 hectare

This declining average size has been influenced by many factors, including institutionalization, industrialization, urbanization, land and labor markets, land policy, and property rights (Fan & Chan-Kang, 2005). However, in Thailand's case, in addition to these factors, the custom of dividing the land for inheritance led to the reduction in farm size for the next generation (Kwanmuang, 2015; Mizuno, 1978).

Although the reverse relationship between farm size and productivity still exists in Thailand (Wattanutchariya & Jitsanguan,1992; Bureau of Agricultural Economic Research,1997, 2007, & 2015), the

declining scale of farm size over time increases the concerns regarding the survival of small farms. Small-scale farms may struggle due to different conditions in the future, for instance, economic development, environmental prospects, and the difficulties of trading in global markets (Rigg et al., 2016; Wattanutchariya & Jitsanguan,1992; Pookpakdi,1992; Jitsanguan,2001). Therefore, issues related to farm size are of concern to Thai agriculture. The size of farm holdings is also related to the farmland inheritance custom, and this factor is important for succession decisions as described below.

2.2 Land Inheritance Custom

In Thailand, family farms have been the predominant pattern of agricultural production, and farm successions have passed through many generations. Farms without successors will therefore gradually cease to exist. A succession plan is a long process of transferring management and control over farm resources' (Mishra & El-Osta, 2008; Barclay, Foskey& Reeve, 2007). And the process of succession starts when a potential successor is young. Inheritance is referred to as the legal transfer of ownership of farm assets, especially farmland. Because farmland is not only important due to farming input but is also one of the main requirements of a farming career and declared as the highest asset value, inheritance of farmland is important under the succession decision process.

Historically, in Thai farming families, the traditional pattern of the inheritance of farmland was generally equal shares to all the children regardless of age or gender (Slagter&Kerbo, 2000), or whether the child was a successor or not (Kwanmuang,2015). The sharing in this inheritance pattern is also strongly supported by Thai formal inheritance law. The law declares equal shares of land, undistinguished between genders, to children after the death of their parents (USAID, 2011).

This sharing inheritance pattern is also practice in the southern region. Kwanmuang (2015) studied inheritance, transaction, and transfer of farmland in the southern part of Thailand, including Nakhon Si Thammarat province, and mentioned that the declared successor received at least one parcel of land and continued to run the farm with a smaller portion of farmland than their parents unless they married spouses who also inherited farmland, thus increasing the total land size of the new family farms, but spread over many plots of land. Farmland expansion has also occurred by purchasing land after 10 to 20 years of started farm households. Only a few farmers started farming by buying and managing farms by themselves. In the case of non-successors, they could use inherited land for various purposes such as a rental property or allowing siblings (the successor) to farm on the land. Some who inherited land asked their parents to continue farming on the land until their retirement or death. Non-successors who settled in places far away from their homeland, might sell the inherited land to family members (most often), relatives, or other villagers.

Thus, the cultural and legal inheritance systems are factors that contribute to the increase in the number of farm households and the decrease in farm size, especially during transitions in the inheritance of land between generations. These systems are still in practice nowadays by Thai farming families.

2.3 Land market, Land Titling, and Transaction

In this section, the combined reasons and the relations between the characteristics of land markets, inheritance decisions of farmers, and farm productivity are discussed.

Some of the aspects of Thailand's land market has led to the indication that the land market is not fully functional (Phelinas, 2001; Nabangchang-Srisawalak, 2006; Rigg et al., 2016). The weak land market was caused by many factors, for instance, nonfunctional and an absence of land titling. Many landowners hold a legal title that offers full possession legally, these titling (NS-4 or "Chanott," NS-3 or "Nor Sor Sam" and NS-3K or "Nor Sor Sam Kor") can conduct a transaction and transfer or mortgage land legally and freely while offering a higher price for the land. Many farmers still hold other land titling that cannot be sold or transferred, or that does not have legal titles (Cabrera, 2002). Having no land titling affects the evaluation of land, changes the price of the land, and shows significance in less farm productivity. Farmers with properly registered titles have greater access to formal sources of credit, invest more, and achieve higher productivity (Feder et al., 1988).

This weak market has been demonstrated by evidence of the low turnover of land—there are few land sales (Phelinas, 2001; Rigg et al., 2016). Many explanations backup the evidence. Land is an important primary input and holding, and land is the form of collateral available to farmers who want to access to credit (Rigg et al., 2016). Rigg et al. (2016) also reported that the reason for holding the land is that "even though returns to smallholders farming maybe low, there is security in continuing to have a foothold on the land." Additionally, land represents accumulating wealth; thus, farmers are reluctant and unsecure if they become landless (Phelinas, 2001). Therefore, on family farm, land is also declared an asset/property that has the highest value. This study survey also supported this point: the highest value of an asset on a farm or 73.98% is the value of farm land, 21.84% is value of non-agricultural assets (house, non-farm machinery and equipment, and household appliances) and, 4.19% is the value of other agricultural assets (farm machinery & equipment, breeding stock, farm buildings). Moreover, holding land makes good financial sense due to the increasing land value overtime (Rigg et al., 2016).

The low turnover of farmland makes farmers are more hesitant to engage in land transactions because there is no any guarantee they will buy new land if they sell. This low turnover is also the reason to make transaction costs higher and it is more difficult for farmers to complete the process of transaction. Thus, farmers prefer to hold farmland than transact and will transfer land by sharing it with children as asset in the future, whether with successor who will utilize it as a farm or with a non-successor use for other purposes. The history of inheritance and land transactions was also supported by the discovery that transferring farmland is predominantly performed by inheritance rather than transactions (Kwanmuang, 2015).

Therefore, under this weak land market, there is a possibility that a farmer with a successor will not transfer larger land sizes compared with a farmer without a successor.

Moreover, the limited existence of other purposes of investment in agricultural land, and the limitations of the values/quality of land information for investors which relative to higher transaction cost, are also other reasons of low turnover in land market (Phelinas, 2001). Because of these limitations, especially for outside

investors, the vast majority of the few farmland sales mostly occurred among kinship relationships or neighbors who were farmers and continued using the land for farming purposes (Kwanmuang, 2015). This evidence is also observed in this study's survey. The kinship relationship is common and quite strong in Thai society (Kitahara, 1996; Kuwinpant, 2002), some behaviors could influence farmers based this relationship, especially farming activity.

In general, enlarging the land and improving productivity require investment. If the cost of investment is not fully recovered (sunk) from the sale of the land because of the transaction cost, it results in less investment for the family without a successor. But farmers with a successor can obtain a reward from this investment properly if they are entitled to the land (Feder, et al., 1988). Therefore, the farmer without a successor would transfer less land or have less incentive for productivity improvement. However, a discussion of evidence on weak land markets reported that the actual transaction commonly occurs between kinships, siblings, or relatives. Among the kinship relationships, the farmers past efforts on the land could be easily shared, then, the disincentive effect would be weakened or mitigated. This phenomenon could be another reason that supports the following: it is possible that both farm types transfer indifferent size or have indifferent productivity.

3. Data and Methodologies

3.1 Description of Study Area

This study was conducted in Nakhon Si Thammarat province. This area was selected because of its importance in the agricultural sector of southern Thailand. This area also has the largest population (approximately 1.5 million) in the south of Thailand; and it has the largest number of farmers (781,446) and farm households (192,011) in the south of Thailand (Information Center of Agriculture, 2015). This province is subdivided into 23 districts (amphoe), 165 subdistricts (tombon), and 1,551 villages (muban) (Governor's Office of Nakhon Si Thammarat Province, 2018). The farmers of Nakhon Si Thammarat province grow a variety of crops. The main cash crops are rubber in the west; perennial crops, oil palm tree, and timber in the center; rice in the east; and shrimp and fish on the coast. Vegetables and livestock are raised in small areas. Under the province development plan, the agricultural area has been divided according to suitable production zones to implement suitable policies, plans, and projects in each area.

This province faced many challenges: decreasing farm size, fragmentation of land by inheritance, decreasing average farm labor in households by 0.21% between 2002 and 2017 (Information Center of Agriculture, 2017), and the decline in the number of younger people who want to work in farming (Kwanmuang, 2015). Studying this area can thus contribute to the understanding of the features of farm size for successors.

3.2 Data

The data used in this study was collected from a household survey administered in Nakhon Si Thammarat province. To obtain farmers' behavior regarding farm succession from all types of farmers, the sample household heads were selected by using a stratified two-stage sampling approach. Farm villages were grouped according to their major types of products (e.g., Rice, Perennial crop, Fisheries) as the primary

sampling unit. The province development plan provides the information regarding number of villages by crop zone type; next, surveyed farming villages were proportionally extracted. Six households were then randomly selected from a list of all of the farming households in the village (Table 1).

Table 1 Samples household selection

Farm types/ Population, sample	Rice zone		Perennial crop zone		Fisheries zone	Others (forest)	total
	Rice for commercial zone	Rice for consumption zone	Palm zone	Rubber-fruits zone			
Total farming villages	384	121	133	86	89	88	901
Sample farming villages	13	5	13	4	4	3	42
Sample farming households	78	30	78	24	24	18	252

Source: Author's survey and provincial development plan.

A total of 252 heads of farm households were interviewed in depth by using questionnaires. The process began during the harvest season of 2009 and, 2012 for socio-economic analysis purposes. These farm household interviews were again conducted in the 2014 crop year, including the question about the history of farmland holding of head, with all issues being observed in the context of changes in farm size since the beginning of the farm household. The household heads' plan for transferring farmland (inheritance planning) and successor designation were also included. Moreover, the household heads' attitudes toward government policy and passion or love for farm work were also asked. The survey of each crop year was conducted from May to July (the end of crop year).

Of all the samples, 177 were completed and used for analysis in this study. The remainder of the samples were incomplete or screened out because they were not the criterion of succession decision. Because the focus was on succession decision and farm size per child, the following groups were excluded from the estimation: households with no children and two households whose first child was younger than 13 years of age (i.e., their children would be too young for successor designation). The first child at age 13 was used as reference for state of successor designated, instead of 15 years (i.e., the age of official farm labor) because in practice from focus group, and question from the survey, by age of 13, the child started to help with farming and farmers could make observations to designate a successor.

The household heads' plans for transferring farmland were asked about to confirm the inheritance pattern. With or without a successor designated, most of the respondents (89.3%) reported that they planned to share farmland with all the children: equal parts (56.5%) or unequal parts (32.8%). Notably, 10.7% of farm households planned to transfer farmland to one child (70% of these households were transferring farmland to one child because they only had one child in the family). And no other plan of inheritance was reported.

The considerations for succession were designated by the focal question of "children who are designated to continue on inherited farmland." Households with a successor indicated at least one child was

designated to continue on the inherited farmland, and households without a successor indicated, as there was no successor designated, to continue on the inherited farmland. In sum, there were 124 households (70.0%) where at least one child was expected to continue with inherited farmland (i.e., there is a successor). These households consisted of children who will be and will not be the successor. The average number of children in these households is 3.97. And, on average, each child in this household will inherit 7.54 rai.

Fifth-three households (30.0%) had no potential successor for continued farmland inheritance (i.e., there is no successor). The average number of children in non-successor households is 2.83. The respondents' inheritance strategy was to share farmland equally among all the children, and each child received on average 9.21 rai of farmland, which was larger than the amount of farmland of those households with a designated successor.

3.3 Propensity Score Matching

PSM is a quasi-experimental method used for non-experiment methods of evaluation for the different program impacts. Many studies in agricultural economics have applied the PSM method to remove self-selection problems created from the treatment of not being randomly assigned, from different impact evaluation. For example, estimating the impact of farm training, agricultural technology adaptation (Mendola, 2007; Wu, Ding, Pandey&Tao,2010; Udomwitid& Praneetvatakul,2010), participation in farmer field school (David, Nkonya, Kato, Mekonnen, Odendo, Miiro&Nkuba,2010), and rice policy implementation (Attavanich, 2016).

In this study, the purpose is to estimate the effect of succession decision on the farm size per child and productivity. However, because succession decision is a process based on farmers' self-selection or it is not randomly assigned, with or without succession designated in a family is determined by a set of covariates such as socioeconomic variables; thus, a comparison of the differences in outcomes or farm size per child between farms with and without successors as experimental method did, may not be accurate.

Based on Rosenbaum & Rubin (1983), regarding the framework of the treatment effect, $\tau = y_i^1 - y_i^0$, treatment effect was defined as the difference in outcome or farm size per child between two groups of farmers indexed by successor designated status: S, (i) farm without a successor (S = 1) or treatment group; and (ii) farm with a successor (S = 0) or the control group. In other words, y_i^1= size of farmland per child and is conditional on a household without a successor, and y_i^0 = size of farmland per child and is conditional on a household with a successor. This direct estimation is available for experiment data, but will cause the problem of selection bias in the case of estimated non-experimental data, in which succession decision is not randomly assigned.

This study is following the commonly used evaluation parameter of interest to manage the problem of self-selection bias, that is, the average treatment of the treated (ATT) is given by $ATT = E(y_i^1 - y_i^0 | s_i = 1) = E(y_i^1 | s_i = 1) - E(y_i^0 | s_i = 1)$. ATT in this study is defined as the difference in expected farm size per child between farm without a successor and farm without a successor if they have successor.

Here, data on $E(y_i^1|s_i = 1)$ can be observed and are available from households without a successor. Evaluations' problem to find is the term of $E(y_i^0|s_i = 1)$, because enable data on household with a successor is only on $E(y_i^0|s_i = 0)$. The difference between outcomes cannot be observed from the same household by the successor decided for $E(y_i^1|s_i = 1)$ and $E(y_i^0|s_i = 1)$.

Thus, the solution is to find the control group's households similar to the treatment group's households, or to identify households with a successor, which have statistically similar characteristics to those without a successor by applying the matching approach. To apply the matching approach, two assumptions are required to identify the succession effect: conditional independence assumption (CIA) and the overlap condition or common support.

First, CIA states that given a set of observation covariates X that are not affected by treatment (no successor designated), potential outcomes y_i^1 and y_i^0 are independent (⊥) of treatment assignment, S; $(y_i^1, y_i^0) \perp S|X$, (Khandker, Koolwal& Samad, 2010). Hence, after matching and adjusting for observable differences, the mean of the outcome or size of farmland per child is the same for S = 1 and S = 0. This result allows the use of matched successor farms (control group) to measure the outcome of the group of farms without a successor and farm without a successor if they have successor. The second assumption is overlap condition or common support: $0 < P(T = 1|X) < 1$. This common support ensures the positive probability of succession designated of farm with and without successor. Additionally, this condition confirms that characteristics observed in farms without a successor can also be observed in among farms with a successor. This assumption can also improve matching quality by excluding farmers whose distribution propensity scores are outside the region. Under these two assumptions, the PSM estimator for estimating the ATT of farm size per child between two groups can be specific as follows:

$$\tau_{ATT}^{PSM} = E\left[(y_i^1 - y_i^0|S = 1\right] = E\{E\left[y_i^1|S = 1, P(X)\right] - \left[y_i^0|S = 0, P(X)\right]|S = 1\}$$

Application of PSM method to this study

The first step is to calculate propensity score (PS score) for each observation by using a probit model. PS is probability of farmers who have no successor designated conditional on covariates X; $P(X) = Prob(S = 1|X)$. This condition probability is the PS, which allows us to identify similar farmers (Wu, Ding, Pandey& Tao,2010).

The one important part of this process of the PSM method under CIA is that explanatory variables selected here should be correlated with succession decision and significant determinants of size of farmland per child and productivity. Additionally, these variables should not be affected by succession decision. Thus, the set of qualified covariates in this study were selected from the succession studies by considering the succession issue and the area context in which the same survey and source of data were conducted to reduce the bias in PSM (Khandker, Koolwal& Samad, 2010).

Next, we choose a matching algorithm to match farmers in farms with no successor with farms with a successor, and thus estimate the effect of succession decision on size of farm land and productivity. Here,

nearest neighbors matching (NNM), which is based on the closeness of their PS, was employed. Three ratios nearest neighbors was chosen and do matching. For ratio 1, or 1-to-1, indicted that every treatment case was matched with one control case. The number of control cases was increased to each treatment case for 2- to- 1 and 3- to- 1 NNM (ratio 2 and 3). An NNM estimator was chosen because in the final analysis, it yields statistically equal covariate means between farms with no successor.

To check the matching quality, in sum, the balancing test will be satisfied, or meet the balance requirement if there is no significant difference in the PS between two groups of farms, conditional on X. Finally, ATT can be estimated to determine the differences in sizes of farmland per child between two groups of farmers.

3.4 Treatment/control group and covariates

In the targeted area, most of the farmers can find their successor, and this is reflected the surveyed results. And the study's concern regarding the disincentive effect on investment in land for farmers who cannot find any successors under the land market imperfection. Based on these reasons, this study introduces the settings: a farm who has successor will be treated as the control group (124 households), and the farm with no successor will be treated as the treatment group (53 households).

There are two outcomes of interest to estimate: farm size per child indicated by amount of land a child will receive from the inheritance pattern, and productivity measured in average profit per farm size from 2009, 2012, and 2014, which deflates the market value into real value by the GPP deflator of agriculture (base year 2002=100)

Additionally, the set of covariates expected to be correlated with non-succession designated (treatment) were also conducted and derived from the data, which considered the CIA of PSM procedure. Independent variables consisted of farm operations, household and farms' characteristics, level of education of the children in the family, attitudes of the household head toward government policy, and attitudes of passion or love toward farm work.

Regarding farm operations, household and farms' characteristics are age of household head, and farm households with a son in the family are expected to be negatively correlated with non-succession designated. Higher educated of household head, and also farms who have a higher number of children who have graduated from an institution of learning higher than primary school are more likely to have no successor appointed. Additionally, farm characteristics, including the variable of ratio of plots that hold legal land titling per total plot, farms with good quality land in terms of physical features (flat land, good quality of soil), and farms whose average farm profit is sufficient to support household expenditures are expected to have a negative effect on non-successors designated or may decrease the probability of having no successor.

The other two variables of interest regarding farm size are also expected to correlate with non-succession designated. First, inherited farm size is expected to influence the probability of succession decision in either way. Farmland represented one of the highest valuable assets, and plot of land represents accumulated wealth with the best guarantee for any loan's requirement. Therefore, with their wealth, their child

will have more opportunities in school, resulting in various chances to choose future careers and a potential increase in the probability of having no successor. However, the larger inherited size is also attractive for being farm successor because it may take less risk to start a farm career on a larger-sized farm than a smaller farm; thus, the possibility of having no successor decreases.

The second variable is the amount of farmland that farmers bought before their first child was 13 years old. This amount of land transaction variable was used as a proxy for farm management ability and attitude toward farming management. The validity of this variable is that farm operators decided to buy farmland before they could determine who would be the successor. If the amount of all transactions is included, or after their first child becomes 13 years old, it is possible that they purchased more land due to succession occurring. In other words, to ensure that the covariant would be not affected by succession decisions under the CIA of the PSM process. Thus, farms with a larger amount of bought farmland in the mentioned period are more likely to have fewer no-successor appointed.

The positive attitude of farm operators regarding farming and good experiences and attitudes toward agricultural policy are also hypothesized to affect treatment or no-successor appointed in a negative manner, or these types of farms decrease the possibility of having no successor. Farm types, such as a rice farm or a perennial crop operation (rubber, palm, fruit), are also expected to affect farm succession. The details of the dependent and explanatory variable of households with and without a successor is demonstrated in Table 2.

4. Results

4.1 Descriptive statistics of Characteristics of Household with and without a Successor, and simple comparisons of outcomes

Table 2 is a summary of descriptive statistics for households with and without a successor regarding the set of the selected covariates. The result showed a significant difference (p value = 0.000) in outcome of interest, farm size per child, and real value of average farm profit per land size, in which a household without a successor has a larger farm size per child and higher productivity than a household with a successor (Table 2). These results may possibly be raised due to self-selection problems created from a succession decision not being randomly assigned, as aforementioned. The statistical result regarding farm operations and household characteristics between two farms is shown in terms of the mean difference and p value. The following results of the PSM were estimated on statistic software R by MatchIt package (Ho, Imai, King& Stuart, 2011).

Table 2 Summary Statistics of Characteristics of Household with and without a Successor

Variables	Total (n=177)		household who have a successor (n=124)		household who have no a successor (n=53)		p-value
	mean	(SD)	mean	(SD)	mean	(SD)	
Dependent variables							
Outcome Size of farmland per child(rai)	8.04	8.79	7.54	8.64	9.21	9.13	**0.0000**
real value of average farm profit per land size (average in year 2009, 2012, and 2014) (1,000 baht)	2.70	2.70	2.42	2.61	3.34	2.83	**0.0000**
Explanatory variables							
Age of household head (year)	58.78	12.36	61.45	11.80	52.53	11.43	0.1101
Education of household head, dummy variable (1= Vocational/High Vocational Certificate and higher, 0=otherwise)	0.04	0.20	0.02	0.15	0.08	0.27	**0.0000**
Ratio of child graduated higher than primary per total children	0.79	0.32	0.73	0.34	0.94	0.18	**0.0000**
Farm households with a son, dummy variable (1 = farm household with a son, 0 = otherwise)	0.88	0.33	0.92	0.27	0.77	0.42	**0.0069**
Total land at starting farming household (Inherited land size: rai)	15.18	19.76	15.04	22.54	15.52	10.98	**0.0334**
Bought land before first child age 13 years old (rai)	5.93	12.88	6.55	12.93	4.46	12.78	0.3842
Ratio of plot that holds legal land titling per total plot	0.74	0.35	0.77	0.34	0.68	0.37	0.1489
Land physical quality, dummy variable (1= land is in good quality, 0=otherwise)	0.93	0.25	0.96	0.20	0.87	0.20	**0.0262**
Attitude/experience toward agricultural policy, dummy variable (1 = farmer believes/experience agricultural policy does affect the farm, 0 = otherwise)	0.51	0.50	0.58	0.50	0.36	0.48	**0.0066**
Attitude toward passion or love to work on farm and see farming as a stable career (1 = strongly disagree, 2 = disagree, 3 = undecided or neutral, 4 = agree, 5 = strongly agree)	3.95	0.84	4.01	0.75	3.81	1.02	0.11547
Average farm profit is sufficient to support household expenditure, dummy variable (1 = farm that average farm profit is sufficient to respond household expenditure, 0 = otherwise)	0.21	0.41	0.23	0.42	0.19	0.39	0.5842
Rice farm, dummy variable (1 = farm with rice operation, 0 = otherwise)	0.16	0.37	0.16	0.37	0.17	0.38	0.8892
Perennial crop farm (rubber, palm, fruit), dummy variable (1 = farm with perennial crop operation, 0 = otherwise)	0.50	0.50	0.54	0.50	0.42	0.50	0.1284

Source: Author's survey

Note: households with no successor are treated as the treatment group, and households with a successor are treated as the control group

4.2 Result of Probit analysis for Propensity Score

In the first stage, probit model is employed in order to calculate the propensity score. The probit results reported in Table 3 demonstrated that household head age, ratio of having a child who graduated higher than primary school per total children, the attitude/experience toward agricultural policy, and land physical quality were significant determinants of probability of succession decision. As expected, awareness of a desire for a successor by older-age household heads decreases the probability of having no successor on farms. Farm households who have a number of children with high education are more likely to have more non-successors because the child may have more chances to work in non-farm occupations or to be a non-successor. Farm households who experienced agricultural policy affecting their farms have a positive attitude toward farming, and consequently, household heads encourage their children to pursue farming, which decreases the

possibility of having no-successor. Additionally, farms with good quality land suitable for farming are more attractive for a successor than farms with low quality land.

Table 3 Estimation Results of Probit Model

Dependent variable: Successor or what type of farmer is likely to have no successors (1= household with no successor decided, and 0 =household with successor decided)

Dependent variables	Basic equation	
	Coefficient	Std.err.
Education of household head	0.452	(0.588)
Age of household head	-0.033***	(0.012)
Ratio of child graduated higher than primary per total children	1.006**	(0.503)
Farm household who has a son in the family	-0.435	(0.341)
Total land at starting a farming household	5.559	(261.553)
Bought land before first child age 13 years old	-0.195	(0.273)
Ratio of plot that hold legal land titling per total plot	-0.240	(0.353)
Land physical quality	-0.931**	(0.469)
Attitude/experience toward agricultural policy	-0.694***	(0.243)
Attitude toward passion or love to work the farm	-0.209	(0.140)
Average farm profit is sufficient to support household expenditure	-0.143	(0.308)
Rice farm	-0.111	(0.356)
Perennial crop farm (rubber, palm, fruit)	-0.363	(0.264)
Constant	-2.163	(261.555)
Observations	177	
Log Likelihood	-78.756	
Akaike Inf. Crit.	185.513	

Note: *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

Source: Author's estimation

4.3 Balancing of Covariate

Because there is a difference in the set of covariates between the treatment and control groups, the outcome (farm size per child and productivity) cannot be compared unless observable differences have been adjusted. Matching by nearest-neighbor matching algorithm ratio 1-to-1, 2-to-1 and 3-to-1 were employed based on the closeness of their propensity score. Here, the balancing t-test was employed to check matching quality. And under the conditional independent assumption, qualified variables should satisfy the balance requirement by showing no evidence of significant differences in the mean between two groups of farms.

In all nearest-neighbor matching method ratios, the results of the balancing test indicated that the covariates of the two matched group were well balanced and satisfactory after applying the nearest-neighbor matching method. Before matching, the summary of the balancing test for the all data showed that there were some covariates with significant differences between households with and without successors. After matching, the results reported similarity in terms of all variables. Further, those mean differences reduced dramatically between the treatment and control group after matching. However, nearest-neighbor matching ratio 3 showed

the best matching quality among the 3 ratios[2], because it showed the lowest mean difference after matching. the results are shown in Table 4.

Table 4 Balanced t-test results before and after matching 3-to-1

	Mean of Diff (Unmatched)	SE	t value	Mean of Diff (Matched)	SE	t value
Education of household head	0.0513	0.0319	1.6058	0.0000	0.0490	0.0000
Age of household head	-8.9233***	1.9183	-4.6516	-1.7234	2.2333	-0.7717
Ratio of child graduated higher than primary per total children	0.2087***	0.0500	4.1735	0.0048	0.0393	0.1225
Farm household who has a son in the family	-0.1458**	0.0533	-2.7336	-0.0071	0.0783	-0.0905
Total land at starting a farming household	0.0806*	0.0376	2.1440	0.0000	0.0000	1.1207
Bought land before first child age 13 years old	-0.0665	0.0762	-0.8724	0.0426	0.0872	0.4881
Ratio of plot that hold legal land titling per total plot	-0.0833	0.0574	-1.4498	-0.0279	0.0726	-0.3847
Land physical quality	-0.0918*	0.0409	-2.2429	-0.0284	0.0510	-0.5558
Attitude/experience toward agricultural policy	-0.2222**	0.0808	-2.7507	0.0851	0.0958	0.8882
Attitude toward passion or love to work the farm	-0.1967	0.1376	-1.4294	0.0638	0.1678	0.3803
Average farm profit is sufficient to support household expenditure	-0.0371	0.0677	-0.5483	0.0355	0.0718	0.4942
Rice farm	0.0085	0.0611	0.1395	0.0851	0.0656	1.2965
perennial crop farm (rubber, palm, fruit)	-0.1252	0.0820	-1.5276	-0.0213	0.0989	-0.2152

Source: Author's estimation

4.4 Average Treatment Effects on the Treated.

Finally, the ATT was estimated by utilizing the PSM method, which compares the two outcomes, farm size per child, and productivity indicated in terms of the real value of average farm profit per land size of a household without a successor with those of matched farm households with a successor. Table 5 and Table 6 show the estimation results of ATT with two different standard errors by Lechner (2001); Abadie, Drukker, Herr&Imbens (2004).

The results of the ATT for all nearest-neighbor matching ratios indicated that no significant differences in both outcomes of the groups, implying that the farm size per child for a household with and without a successor was not different. Farmland will be transferred as a highest asset to secure a child's future. Moreover, the ATT results in Table 6 found that there was no difference in productivity measured by the real term of average farm profit per land size. As aforementioned, land trading occurred mostly between siblings and relatives or neighbors who lived nearby. To sell the farm for a reasonable price under a weak land market, farms with no successor must maintain their productivity/farm profit. With this kinship relationship, the disincentive effect would be weakened or mitigated for farms with no successor. Additionally, whether or not the farms have a successor, farm profit or productivity presents the ability to support households. Thus, higher productivity is required to provide income support for the household.

[2]Because of the limitation of space, the results from matching ratio 1 and 2 are not shown in the text. But the results are consistent with the case of ratio 3, that is, all covariates are balanced after matching.

Table 5 Result of estimating the ATT of farm size per child using different nearest-neighbor matching methods (1-to-1, 2-to-1 and 3-to-1)

	ATT	SE (Lechner)	T value	SE (Abadie and Imbens)	T value
Ratio 1	0.2195	2.8527	0.0770	2.2553	0.0973
Ratio 2	1.0429	2.2377	0.4661	1.7186	0.6068
Ratio 3	-0.3425	2.2610	-0.1515	2.1972	-0.1559

Source: Author's estimation

Table 6 Result of estimating the ATT on real value of average farm profit per land size (average in 2009, 2012, and 2014) using different nearest-neighbor matching methods (1-to-1, 2-to-1 and 3-to-1)

	ATT	SE (Lechner)	T value	SE (Abadie and Imbens)	T value
Ratio1	0.9280	0.7782	1.1925	0.8439	1.0997
Ratio2	0.8499	0.7010	1.2123	0.6978	1.2179
Ratio 3	0.7935	0.6642	1.1946	0.7042	1.1267

Source: Author's estimation

5. Discussion

The findings of this study that employed the PSM method indicate that farm size per child and productivity was not significantly different between households, whether or not a successor existed. This result may be interpreted as follows: Although a farm is without a successor, the land is kept as an asset for their footage security in the future, and all children will receive the land and use it for their purpose. Non-successors keep the same productivity under the weak market. When the land market is imperfect and derives the transaction cost in the land sales, farmers would hesitate to invest in their land to enlarge the size or to improve the productivity, because the cost of investment cannot be recovered if they need to sell the land after quitting farming. However, actual transaction of land can be observed in the kinship, sibling, and relative relationships where the investment effort by farmer can be shared well. The land transaction among kinship relations might complement the land market.

The findings increased awareness of concerns, especially for successors who will inherit small farms. In other words, in the agriculture sector, the average scale of farming will decrease. This phenomenon may increase the unbalanced growth between agriculture and non-agriculture and increases more concerns regarding the sustainability of agriculture. Therefore, to sustain those succeeding to small farms and the agricultural sector, supporting strategies preparing for new small-scale farmers are required. Additionally, specific supporting strategies for increasing the productivity are required to improve the balance of income between sectors.

It is also possible that this sharing pattern may increase the number of small farmers with scatter farm size and a chance for non-successors, who tend to work in non-farming occupations, to return to work on the farm at any time in the future if they face difficulties in their non-farming occupations. These non-successors will become part-time farmers or old-age farmers, but will have insufficient farming experience. And if so, the

number of households with small farms and the insufficient farming experience will further increase concerns. Hence, the government should also prepare to manage with this issue.

Acknowledgment

The author expresses gratitude to the farmers in Nakhon Si Thammarat province for their cooperation and responses to the questionnaire. Every statement expressed in this article is that of the author and does not reflect any opinions of anyone affiliated to the authors.

Funding

This research was partly financed by the Agricultural Research Development Agency (ARDA).

References

Abadie, A., Drukker, D., Herr, J. L., & Imbens, G. (2004). Implementing matching estimators for average treatment effects in Stata. *The Stata Journal, 4(3),* 290–311.

Attavanich, W. (2016). Did the Thai rice-pledging programme improve the economic performance and viability of rice farming?. *Applied Economics. 48*(24), 2253-2265.

Banerjee, B. N. (1985). Concepts of farm size, resource-use, and productivity in agriculture—a case study. *Economic Affairs,30*(1),17–22.

Barclay, E., Foskey, R., & Reeve, J. I. (2007). Farm succession and inheritance–Comparing Australian and international trends. (Research report). Barton, A.C.T.: Australia: Rural Industries Research and Development Corporation.

Bureau of Agricultural Economic Research. (1997). *Production efficiency by farm type and farm size in crop year 1995/96*. (Research report). Bangkok, Thailand: Office of Agricultural Economics. [in Thai]

Bureau of Agricultural Economic Research. (2007). *Factor affects labor efficiency in crop year 2004/2005.* (Research report). Bangkok, Thailand: Office of Agricultural Economics. [in Thai]

Bureau of Agricultural Economic Research. (2015). *Farm efficiency by farm size and farmland holding and income inequality office of Agricultural Economics in crop year 2011/12*. (Research report). Bangkok, Thailand: Office of Agricultural Economics. [in Thai]

Cabrera, J. (2002). Bumpy ride for land reform. Economic News and Article 64. Chulalongkorn University, Faculty of Economics. http://www.geocities.com/econ_10330/articles.html

David, E. K., Nkonya, E., Kato, E., Mekonnen, A. D., Odendo, M., Miiro, R., &Nkuba, J. (2010). *Impact of farmer field schools on agricultural productivity and poverty in East Africa*. (Discussion Paper). The International Food Policy Research Institute (IFPRR).

Fan, S. & Chan-Kang, C. (2005). Is small beautiful? Farm size, productivity, and poverty in Asian agriculture. *The journal of the International Association of Agricultural Economists*, *32(s1)*, 135–146.

Glauben, T., Tietje, H., & Weiss, C. (2002). *Intergenerational succession on family farms: evidence from survey data.* (Working Paper). University of Kiel, Germany: Department of Food Economics and Consumption Studies.

Governor's Office of Nakhon Si Thammarat Province (2018). Provincial Development Plan (2018–2021), Nakhon Si Thammarat province. [in Thai]

Heltberg, R. (1998). *Rural market imperfections and the farm size-productivity relationship: evidence from Pakistan*. World development vol.26(10): 1807-1826.

Ho, E. D., Imai, K., King, G., & Stuart, A. E. (2011). MatchIt: Nonparametric Preprocessing for parametric causal inference. *Journal of Statistical Software*, *42*(8), 1–28.

Information Center of Agriculture (2017). *Research on Economic, Social, Household, and Agricultural Labor Situations for FY 2016/2017*. Bangkok, Thailand: Office of Agricultural Economics. [in Thai]

Jitsanguan, T. (2001). *Sustainable agricultural systems for small-scale farmers in Thailand: Implications for the environment*. Retrieved from http://www.agnet.org/library.php?func= view&id=20110718190247.

Khandker, R. S., Koolwal, B. G., & Samad A. H. (2010). *Handbook on impact evaluation: Quantitative methods and practices*. Washington, D.C: World Bank.

Kimhi, A. & Lopez, R. (1999). A note of farmers' retirement and succession consideration: Evidence from a household survey. *Journal of Agricultural Economics*, *50*(1), 154–162.

Kimhi, A. &Nachlieli, N. (2001). Intergenerational succession on Israeli family farms. *Journal of Agricultural Economics, 52(2)*, 42–58.

Kitahara, A. (1996). The Thai Rural Community Reconsidered: Historical Community Formation and Contemporary Development Movements. Bangkok: Political Economic Centre, Faculty of Economics, Chulalongkorn University.

Kuwinpant, P. (2002). Thai Society and Culture. Presenting paper, Graduate School of International Development (GSID) Nagoya University. Japan.

Kwanmuang, K. (2015). Farmland inheritance, transaction and transference: A case study in the southern region of Thailand. *The Japanese Journal of Rural Economics, 17(*6), 46–51.

Mizuno, K. (1978). Change and development of two rice-growing villages in Thailand-Don Daeng and KhokChyak. *South East Asian Studies*, *16*(3), 354–377.

Lechner, M. (2001). Identification and estimation of causal effects of multiple treatments under the conditional independence assumption. In M. Lechner & F. Pfeiffer (Eds.), *Econometric Evaluation of Labour Market Policies*,(pp.43–58).Physica-Verlag: Heidelberg.

Mehl, C. B. (1986). *Social and cultural aspects of land inheritance and transactions in rural Thailand*. (Discussion Paper). Washington, D.C: World Bank.

Mendola, M. (2007). Agricultural technology adoption and poverty reduction: A propensity-score matching analysis for rural Bangladesh. *Food Policy, 32(3)*, 372–393.

Mishra, A. K. & El-Osta, H. S. (2008). Effect of agricultural policy on succession decisions of farm households. *Review of economics of the household*, *6*(3), 285–307.

Nabangchang-Srisawalak, O. (2006). *Thailand land tenure data and Southeast Asia*. Retrieved from https://www.fig.net/resources/proceedings/fig_proceedings/fig2006/papers/ts81/ts81_02_napangchangsrisawalak_0885.pdf.

Office of Agricultural Economics (2016). Agricultural economics indicator of Thailand. Bangkok, Thailand: Office of Agricultural Economics. [in Thai]

Otomo, Y. &Wieser, O. T. (2009). Comparative analysis of patterns in farm succession in Austria and Japan from a gender perspective.*The Jahrbuch der Österreichischen Gesellschaft fürAgrarökonomie*, *18*(2), 79–92.

Phelinas, M. P. (2001). Chapter 1: Access to land: pattern of land holding and land ownership. In S. Boriotti, & D. Dennis (eds), *Sustainable of rice production in Thailand*. New York, NY: Nova Science Publishers, Inc.

Pookpakdi, A. (1992). *Sustainable agriculture for small-scale farmers: A farming systems perspective*. Retrieved from http://www.agnet.org/library.php?func=view&id= 20110721152329.

Raghbendra, J., P. Chitkara, & S. Gupta. (2000). Productivity, technical and allocative efficiency and farm size in wheat farming in India: a DEA approach. Applied Economics Letters vol.7: 1-5.

Rigg,J., Salamanca,A. &Thompson,E.C. (2016). The puzzle of East and Southeast Asia's persistent smallholder. *Journal of Rural Studies,43*(1).118-33.

Rosenbaum, P.R. & Rubin, D.B. (1983). The central role of the propensity score in observational studies for causal effects, Biometrika, *70*(1), 41–55.

Sen, A. K. (1962). An aspect of Indian agriculture. *Economic Weekly*, 243–246.

Slagter, R. &Kerbo, R. H. (2000). *Modern Thailand: A Volume in the Comparative Societies Series.* Michigan: McGraw-Hill.

Udomwitid, S. &Praneetvatakul, S. (2010). Assessment of Farmer Field School on Chemical Pesticide Use in Rice Production of Thailand using Propensity Score Matching and Difference in Difference Model. *Journal of environmental management,6*(2).99-112.

USAID. (2011). *USAID country profile, Thailand-property rights and resource governance profile*. Retrieved from https://www.land-links.org/wp-content/uploads/2016/09/USAID_Land_Tenure_Thailand_Profile.pdf

Wattanutchariya, S. &Jitsanguan, T. (1992). *Increasing the scale of small-farm operations I. Thailand*. Retrieved from http://www.agnet.org/library.php?func=view&id=20110726143050.

Wu, H., Ding, S., Pandey, S., & Tao, D. (2010). Assessing the impact of agricultural technology adoption on farmers' well-being in rural China. Using propensity-score matching analysis. *Asian Economic Journal*, *24*(2), 141–160.