AGRICULTURAL LAND ABANDONMENT IN THAILAND

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A Dissertation Submitted in Partial
Fulfillment of the Requirements for the Degree of
Doctor of Philosophy (Economics)
School of Development Economics
National Institute of Development Administration
2015

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ABSTRACT

Title of Dissertation	Agricultural Land Abandonment in Thailand
Author	Miss Nararuk Boonyanam
Degree	Doctor of Philosophy (Economics)
Year	2015

Thai farmers' poverty stems from several factors such as falling crop prices, high input costs for crop production, shortage of cash for investment, erratic rainfall distribution and all types of land use problems such as landlessness, land rights, land infrastructure and land fragmentation. Although the government has implemented several legislative actions and programs to address these problems, Thai farmers remain largely poor and severe poverty is visible in the form of agricultural land abandonment. Therefore, studying the causes of land abandonment will reflect the causes of poverty and the effectiveness of government agricultural policies. Although the issue of agricultural land abandonment has drawn a lot of attention, rigorous quantification studies are rarely attempted.

The objective of this research is to identify the factors that cause agricultural land abandonment and the appropriate policy measures for effectively addressing the problem. The study area is Khon-Kaen Province where a total of 808 agricultural parcel samples were selected for this study. This study utilizes the optimization method based on duality production theory to derive input demand, output supply and land allocation equations. The Simultaneous Tobit estimation was used to estimate the system of nine equations.

The study identified the major contributing factors for land abandonment as follows: agricultural machinery prices, followed by semi-right of property right, pesticide price, full right of property right, sugarcane prices, land rental laws, water supply, soil quality, parcel size, and distance to city. Based on the findings, this study recommends the following policies (1) land infrastructure development; (2) limited

holding size; (3) community title deeds; (4) agricultural zoning and (5) price subsidy programs with certain adjustments. The existing land rental laws need to be revised while land allocation programs, debt moratorium projects, adverse possession laws and reform of land and property tax act are inconclusive policies.

An implication for farmers based on this study is to recognize that the factor behind their poverty do not come from the lack of property right over the land. In addition, they should consider putting more concern in the water supply and soil quality management, finding most appropriate crop for small plot production as well as take advantage of the Agricultural Land Rental Act of 1981 trough leasing process.

ACKNOWLEDGEMENTS

I would like to express the deepest appreciation to Associate Professor Dr. Adis Israngkura, my advisor, for his forbearance, professional counseling, and encouragement both professionally and personally. The most important lesson I learnt from him is to put my heart into what I am doing, so that our work would be able to touch others' heart. He has been and would always be my role model on how to lead my life.

I would also like to express my appreciation to Assistant Professor Dr. Wisit Chaisrisawatsuk, and Assistant Professor Dr. Anan Wattanakuljarus, my co-advisor, for finding time in their busy schedule to give me valuable advice on the techniques and model employed in this dissertation during my struggling time to find the right methodology for the study.

My deep gratitude goes to Professor Tongroj Onchan, my current supervisor at Kasetsart University for his practical and useful advice on work, study, and other matters. He always treats me with great compassion, and provides me with so many good opportunities to learn and grow professionally and intellectually. He has been really supportive and understanding in every aspect, even in my personal situations.

I thank Assistant Professor Dr. Yuthana Sethapromote, my econometric lecturer at NIDA for his great concern on my research's methodology. He allowed me to sit in every course that may help me to find the right tool for the research. I gain a lot of knowledge in his class more than that I would use in this research.

I am particularly grateful to Assistant Professor Dr. Supachat Sukharom at Kasetsart University, who always read everything I wrote even they have never been properly wrote and organized. I also thank Associate Professor Sri-on Somboonsub, my direct supervisor at Kasetsart University who supports me financially as well as reduces my work burden during the time I had to concentrate on my study.

Nararuk Boonyanam

January 2016

TABLE OF CONTENTS

LIST OF TABLES

Tables **Page**

LIST OF FIGURES

Figures **Page**

CHAPTER 1

INTRODUCTION

1.1 Research Problem

Thai farmers have always been in poverty. They are unable to meet their family‘s basic needs from agricultural production, mainly due to low productivity, low income and inability to manage various risks such as plummeting crop prices, increasing production input prices, shortage of cash for investment, erratic distribution of rainfall and all types of land use problems, including landlessness, land rights, land infrastructure and land fragmentation. Over the years, the Thai government has implemented several legislative actions and programs to address these factors with guarded results. Following are the key agricultural policies adopted in Thailand.

First, Several irrigation projects were constructed in the 1960s in order to solve the water supply problem but their impact at the regional level remains very limited as more than 77% of the agricultural area is still under rain-fed conditions (Royal Irrigation Department, 2011). Without water supply, farmers in these areas are unable to cultivate and produce goods for consumption or sale. The governments’ budget constraints hinder the widespread construction of irrigation systems throughout Thailand. On top of this, the widespread soil acidity in many areas creates a labor transition from the agricultural to the industrial sector with the abandonment of agricultural land, even though several attempts have been made by the government to tackle the soil quality problem by establishing and developing volunteer soil doctors and learning centers at the sub-district level.

Second, The implementation of the Land Code Act of 1954, which contains procedures for issuing land title deeds ranging from full to usufruct rights for farmers, the act encourages the clearance of forest by recognizing three steps of land acquisition: occupancy, use and legal ownership (Cleary & Eaton, 1996). Under this

act, agricultural land size was limited to 50 rai per household with the intention of solving the problems of land distribution and landlessness. On the contrary, however, the limitation lead to production inefficiency for certain crops and created a land fragmentation problem. The Land Institute Foundation revealed that most farmers (87%) are small parcel holders with an average farm size of less than 5 rai. Production costs increased with fragmentation (McClosekey, 1975), because small parcel size did not allow for efficient mechanization and limited choices of farming techniques. As a result, small plots were abandoned due to the complication of working fragmented land (Simon, 1987). Although the land size limit was cancelled in 1960, the fragmented and abandoned land problems remain unsolved. Recently, Reform Thailand proposed that the country revert back to the maximum land holding limit of 50 rai per household and increase land taxes to 5% for abandoned land and land over the maximum holding of 50 rai. However, there is no evidence substantiating why the land holding limit and tax rate are justified at 50 rai and 5% as well as help to improve the well-being of the farmers.

Third, In the 1970's, several government agencies[1] also carried out a land allocation program with limited success. The Agricultural Land Reform Act of 1975 created the Agricultural Land Reform Office (ALRO) in the Ministry of Agriculture and Cooperatives to implement reforms as a means of resolving the landlessness problem. However, the program led to a concentration of land held by the rich. The number of landless farmers from the ALRO program remains at over 800,000 families, while tenancy problems have worsened from 514,717 families in 1996 to 678,077 in 2004, and 1,373,145 families in 2011 (Sajjanand, 2013). Farmers perceived that the cost of production is increased from leasing cropland. Therefore, these farmers lost their motivation to continue production operations due to insecure land rights and unprofitable operations.

[1] Department of Public Welfare (DPW), Department of Land (DOL), Department of Cooperative Promotions (DCP), Royal Forestry Department (RFD), War Veterans Organization of Thailand (WVO), Agricultural Land Reform Office (ALRO).

Fourth, Implementation of the Agricultural Land Rental Act of 1981 aimed to protect tenant farmer rights, but created barriers that prevented agricultural landowners from leasing their land to more productive and efficient farmers instead. Furthermore, the act led to increased land abandonment. The minimum lease period enforced by this act was six years, which is too long. In cases where a landowner desired to sell their land, the act also stated that landowners were required to provide existing tenants with the first opportunity to purchase the land. Since tenant farmers would typically offer a price below fair market value, the land remained with the present owner who ceased agricultural operations while attempting to sell the land. Fifth, Civil and Commercial Code, Section 537-571, prohibits a landowner from evicting a tenant before the lease agreement has expired. While Section 1382 aims to reduce land abandonment by allowing land acquisition through adverse possession when an individual has peacefully enjoyed the land for ten years without the express objection of the landowner, this section has produced heated nationwide debate.

Sixth, The Agricultural Economics Act of 1979 created agro-economic zones based on soil surveys performed by the Department of Lands (DOL). The acts aimed to balance the crop supply with the market demand in order to prevent the low crop price situation. According to this act, each district and sub-district is set for a specific crop production and farmers who participate in the program will receive a guaranteed selling price of the crop through subsidized programs. Although the program can dictate crop type for specific areas, it cannot control the yield or output; crop yield depends on many uncontrollable factors such as rainfall, soil quality, temperature, pest activity and acts of nature, etc. In addition, the crop price in a competitive market cannot be controlled either domestically or globally. Successful agro-zoning in other countries comes from a different set of objectives where the primary goal for agro-zoning is to control the expansion of urban areas into agricultural areas. Therefore, the zones are use-based, not crop-based as in Thailand. Thus far, the results of a pilot project for agro-zoning in 30 provinces remain inconclusive and the crop prices are uncontrollable as previously expected, which discourages farmers from staying in the occupation.

Seventh, The Thai government implemented the Debt Moratorium Program (DMP) in 2001 to alleviate poverty among agricultural households and use a period of

relief to encourage structural changes in farmers' operations. Suchanan Tambunlertchai (2004) indicated that the DMP fell short of its objectives; furthermore, after two years, the program had no significant impact on its participants. While the goal of the DMP was to relieve its participants' credit constraints, its participants faced loan restrictions in the form of taking out new loans during the period of the moratorium. Therefore, these farmers used new loans from illegal lenders to finance agricultural production and end up in a larger poverty cycle. Eighth, The rice mortgage scheme was introduced in 2011 with the objective of assisting farmers by manipulating rice prices, but led to nationwide corruption and price arbitrage. The scheme failed due to enormous subsidy costs, huge amounts of rice in government storage as attempts to manipulate the international commodity market failed, and a majority of the benefits going to the millers and largest farmers who sell the most. It was proof that poor farmers received very little benefit from the scheme (Poapongsakorn, Pantakao, Nanthajit, Arunkong, and Janepeungporn, 2014).

Ninth, The current Thai government is considering the Community Land Title Act to solve landlessness and land abandonment problems with no supporting evidence on how to put the act into action and whether or not it is the right measure to be adopted and Tenth. The government is also considering a reform of the Land and Property Tax Act to resolve the issues of landlessness, landownership concentration and land abandonment. The initiative refers to the work of Laovakul (2010) who proposed various tax rates for each category of land use based on the assumption of the annual average increase rate for land prices. It should be noted that various flaws exist when research relies heavily on assumptions.

The aforementioned series of programs and policies were implemented according to the farmers' trouble trends in each period of time, which is not the right way to solve the problem and may increase economic costs associated with policy misspecification as the programs were not based on rigorous, comprehensive quantification study. Obviously, the farmers' poverty factors the Thai government has been trying to solve are the causal factors behind agricultural land abandonment; water supply shortages and inappropriate soil quality create a transition of labor into the industrial sector and the land abandonment. Fragmented parcels have led to the abandonment of agricultural land. Leasing of crop lands increase the sense of

insecurity and unprofitable farming operations which eventually led to land abandonment. Protection of tenant farmer rights led to the land abandonment of agricultural landowners. Shortage of cash for investment and low crop prices led to discouragement about staying in the farming occupation and abandonment of agricultural land. Therefore, solving the core issue of agricultural land abandonment is the way to solve the farmers' poverty problem.

Agricultural land abandonment in Thailand has drawn a lot of attention over the past decade due primarily to the over-exaggerated reporting on the amount of abandoned land. Reports routinely reference the estimate of 48 million rai of abandoned land in Thailand. Further, reports typically state that the amount of abandoned land is increasing each year (Makkarapirom, 2011 and (Manin Sutthiwatthananiti, 2012).

The Land Development Department (LDD)[2] defines abandoned land as

> พื้นที่ที่ถูกปล่อยทิ้งไว้โดยไม่ได้เข้าทำประโยชน์ต่อเนื่องกัน ตั้งแต่ 1 ปีขึ้นไป พื้นที่ร้างดังกล่าวเป็นพื้นที่ที่เคยทำการเกษตรกรรมมาก่อนและปล่อยทิ้งไว้ไม่เข้าทำประโยชน์ด้วยสาเหตุต่างๆ กัน นอกจากพื้นที่ร้างที่เคยทำการเกษตรกรรมมาก่อนแล้ว ยังมีพื้นที่ร้างที่เคยทำเหมืองแร่มาก่อน และที่ลุ่มต่างๆ รวมอยู่ด้วย[3]

The Office of Agricultural Economics (OAE)[4] defines abandoned land as:

> ที่ดินทางการเกษตรที่เคยใช้ทำประโยชน์มาก่อนแต่ปัจจุบันปล่อยทิ้งร้างไม่ได้ทำประโยชน์เป็นเวลาติดต่อกัน 5 ปีขึ้นไป[5]

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[2] LDD collect land use data by using geographic information system: GIS together with the field survey

[3] English translation as "land that was previously used in agriculture, but has been left idle for one year or more years for many reasons. The LLD also recognizes the land committed to a mining operation or lowland/wetland area as abandoned land"

[4] OAE collect land use data by using Satellite Image.

[5] English translation as "agricultural land that was previously used in agriculture, but has been left idle for five or more years.

The LDD definition of land abandonment is broader in scope than the OAE definition. Thailand owns 320 million rai of land. LDD reported that land abandonment in 1998 was 29,896,970 rai and decreased to 9,179,624 rai in 2009 (Table 1).

Table 1.1 Land Use Summary Year 1998 Compare with Year 2009

Land use type	1998		2009	
	rai	(%)	rai	(%)
Community and Building area	4,663,923.00	1.45	15,111,800	4.71
Agricultural area	174,858,853.00	54.52	171,585,556	53.50
Forest area	105,507,602.00	32.90	113,170,136	35.29
Watershed area	3,508,125.00	1.09	8,812,352	2.75
Miscellaneous area	32,158,384.00	10.03	12,017,043	3.74
- Abandoned area	29,896,970.00	9.32	9,179,624	2.86
- Other (mine, gravel pit, sandpit)	2,261,414.00	0.71	2,837,419.00	0.88
Total	320,696,887.00	100.00	320,696,887.00	100.00

Source: Land Development Department, 2013.

Table 1.2 Used Land and Abandoned Land in Agricultural Sector from 1986-2011

(unit: rai)

Year	Abandoned land	(%)	Used land	(%)	Total
1986	3,596,032	2.75	127,302,908	97.25	130,898,940
1987	3,546,687	2.70	127,655,935	97.30	131,202,622
1988	3,845,151	2.92	127,927,608	97.08	131,772,759
1989	3,814,397	2.89	128,016,788	97.11	131,831,185

Table 1.2 (Continued)

Year	Abandoned land	(%)	Used land	(%)	Total
1990	3,679,803	2.79	128,444,606	97.21	132,124,409
1991	3,560,781	2.68	129,515,407	97.32	133,076,188
1992	3,319,692	2.51	128,731,517	97.49	132,051,209
1993	3,238,848	2.39	132,513,039	97.61	135,751,887
1994	3,236,149	2.45	128,597,139	97.55	131,833,288
1995	3,221,465	2.43	129,257,105	97.57	132,478,570
1996	3,151,272	2.39	128,668,234	97.61	131,819,506
1997	3,036,300	2.32	128,071,308	97.68	131,107,608
1998	2,950,814	2.26	127,442,711	97.74	130,393,525
1999	2,864,219	2.18	128,477,165	97.82	131,341,384
2000	2,796,521	2.13	128,399,392	97.87	131,195,913
2001	2,744,835	2.09	128,315,139	97.91	131,059,974
2002	2,920,471	1.93	148,108,813	98.07	151,029,284
2003	2,916,933	1.93	147,880,123	98.07	150,797,056
2004	2,914,536	1.93	147,938,326	98.07	150,852,862
2005	2,914,530	1.93	148,008,504	98.07	150,923,034
2006	2,909,666	1.93	148,230,198	98.07	151,139,864
2007	2,911,890	1.92	148,448,812	98.08	151,360,702
2008	2,933,158	1.93	148,823,461	98.07	151,756,619
2009	2,909,243	1.92	148,933,197	98.08	151,842,440
2010	2,875,871	1.89	149,455,888	98.11	152,331,759
2011	2,879,642	1.89	149,470,172	98.11	152,349,814

Source: Office of Agriculture Economics, 2011.

As of 2011, agricultural land represented 48.51% of the total land area and abandoned land reported by OAE represented only 1.89% or 2,879,642 rai. Further, OAE data shows that at a country level, the amount of abandoned land has steadily declined during the period 1986 through 2011 as presented in Table 1.

Since the LDD definition of land abandonment is broader in scope than the OAE definition, the abandoned land figure of LDD is higher than that of the OAE. However the figure is not as high as 48 million rai that routinely reported. In addition, the figure from both institutions shows the declining trend of abandon area. This paper utilizes the OAE definition because the definition is more specific to the agricultural sector and more appropriate for studying the long-term land abandonment issue. When we took a closer look at the data from the OAE, we found that there was a drastic increase in agricultural land use and abandonment during 2001-2002. Figure 1 presents the graphs that were plotted from the data in Table 1. Since land use and land abandonment has a huge variation in scale, a separate graph showing abandoned land is provided to the right. At the provincial level, three patterns of land abandonment were found; land abandonment was either increasing, decreasing, or remaining constant. Of the seventy-six provinces in Thailand, only the capital city, Bangkok, had a constant pattern of no abandoned land. Fourteen provinces appear to have a declining land abandonment trend, while the balance of sixty-one provinces have an increasing land abandonment trend.[6]

Although the percentage of agricultural land abandonment in Thailand is considered low, most of the area in Thailand has an increasing land abandonment trend and it creates a substantial economic loss each year. In 1998, it was estimated that an economic value added of 26,355.32 million baht was generated from the additional 3% increase in agricultural land use. (Land Institute Foundation, 2001).

[6] See Appendix A, list of provinces that has an increasing pattern of land abandonment in Thailand.

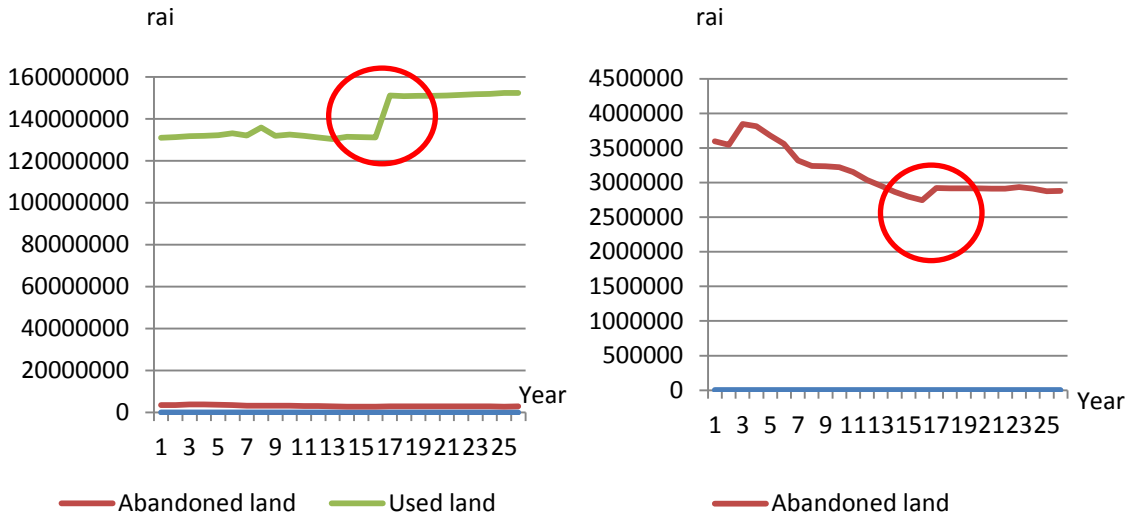

Figure 1.1 Used Land and Abandoned Land in Agricultural Sector from 1986-2011
Source: Office of Agricultural Economics, 2011.

The issue of agricultural land abandonment has drawn a lot of attention in Thailand, however comprehensive quantification study has never been attempted. This research covers all ten government policies previously discussed, namely, land infrastructure development, limited land holding, land allocation program, land rental law, adverse possession law, agricultural-zoning, debt moratorium program, price subsidy program, community land title act and reform of the Land and Property Tax Act. The following section will discuss the research question, followed by the research objective, contribution of the study and data.

1.2 Research Question, Objectives, and Contribution

1.2.1 Research Question

As previously mention, severe poverty of Thai farmer is visible in the form of agricultural land abandonment Therefore, studying the causes of land abandonment will reflect the causes of poverty and the effectiveness of government agricultural policies. Therefore, the study attempts to answer these questions.

1) What are the factors that cause agricultural land abandonment in Thailand?

2) What measures and policies should be adopted by the Thai government to deal with agriculture land abandonment?

1.2.2 Research Objectives

There are two key objectives of this study. They are:

1) Find factors effecting the land owners ‘decision to abandon their agricultural land; and

2) Find appropriate measure that help to enhance agricultural land value or its potential usage.

1.2.3 Contribution of the Research

1) The agricultural land abandonment factor finding would help the country

to reduce an additional economic costs for implementing policy that may aggravate the problem. It provides an alternative direction for policy makers to determine the land use and land abandonment policy based on a rigorous quantitative economic perspective.

2) This research provide methodological contributions that can be adopted by other researchers as it is the first attempts to apply the land use model with the land abandonment problem by taking the presence of censored variables into account.

1.3 Research Scope

The site for this study was Khon-Kaen Province in the northeastern region of Thailand where there is a high degree of agricultural activity and an increasing pattern of agricultural land abandonment. Khon-Kaen is quite dynamic and subject to rapid changes in all aspects, including land use and land markets. Figure 2 presented agricultural land use type in Khon-Kaen where pink color represents abandoned area. The figure showed that the abandoned areas are mostly concentrated in the city. Khon-Kaen also has many different characteristics in terms of soil quality and water

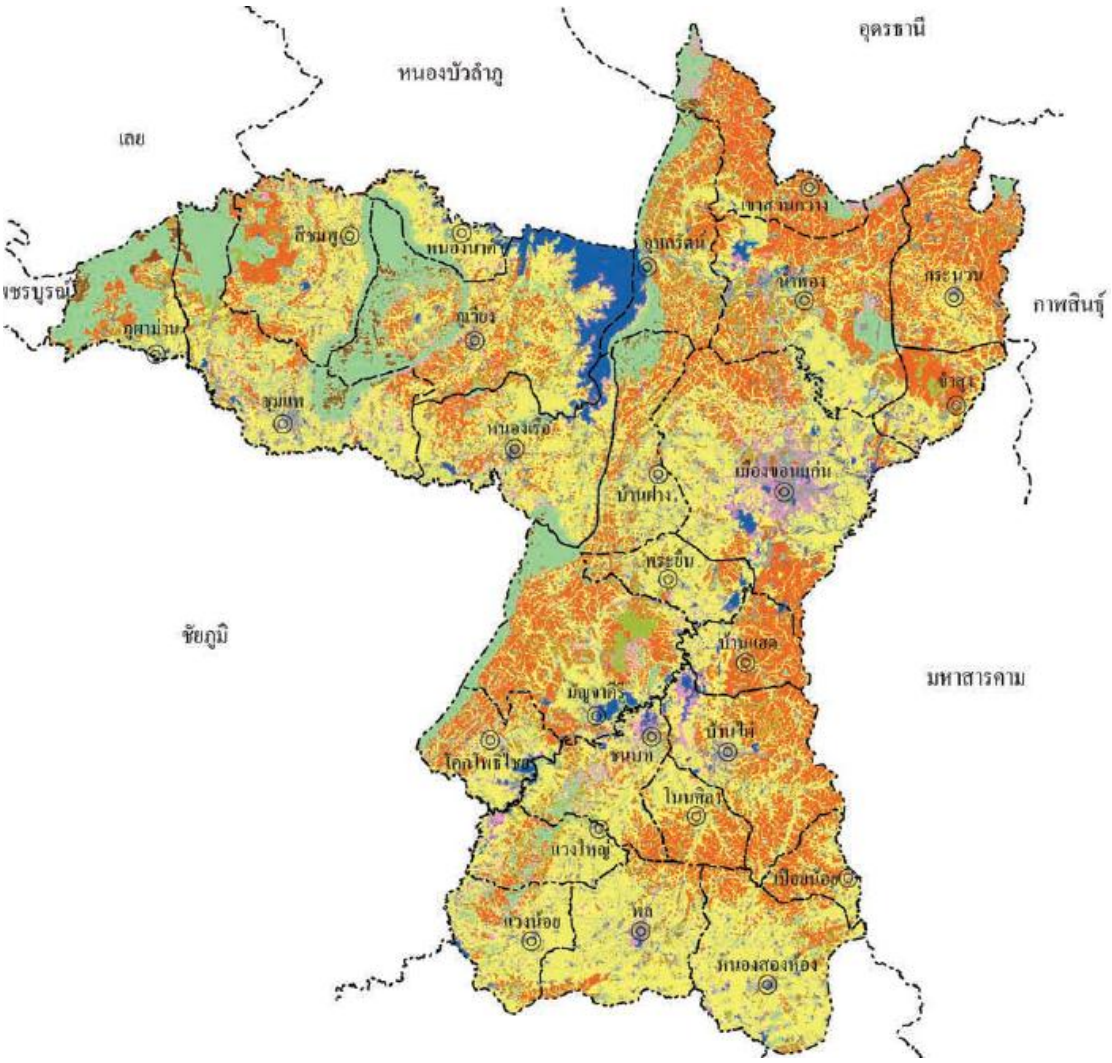

Figure 1.2 Land use type in Khon-Kaen

Source: Office of Agricultural Economics, 2011.

sources for crop production. The primary crops are rain-fed rice, cassava and sugarcane.

The factors affecting agricultural land abandonment to be measured were farm gate prices for the three major crops of Khon-Kaen (cassava, rice, and sugarcane); the price of input used in agricultural production (cash on hand, fertilizer, household labor, machine labor, pesticides, capital or agricultural machinery and loan interest rates). The physical and institutional factors are parcel size, type of property rights, main source of water supply, soil quality, distance to city, farming technology, land tax, perception of land rental and adverse possession laws.

As previously stated in the research problem section, the government introduced the ten key agricultural policies in order to tackle the farmer poverty; Irrigation system and soil development project aims to improve land infrastructure, so that the farmer will be able to cultivate and produce goods for consumption or sales. Therefore, main source of water supply for crop production and soil quality are the factor variables that were tested to examine their impact on land abandonment.

Land allocation and limit of land holding program aim to solve landlessness and land distribution problem as we perceived both problems as the root cause of farmers' poverty. The factors that link to these policies are property right and parcel size. Property right factor is also linked with community land title act. The act do not provide an individual right with an intention to prevent farmer to sell their plot and ensure that they have land for crop production in order to alleviate their poverty. Relative to the Agricultural Land Rental Act of 1981 and Civil and Commercial Code, section 1382 which aim to protect tenant farmers' right, so that they get fair rent for land and eventually their poverty will be relieved. Both policies in turn discourage land owner to lease their land. Therefore the perception of land rental law and adverse possession law is tested in relation to both policies. Distance to city variable is linked with the Agricultural zoning while loan interest rate factor is tested in relation to the debt moratorium program. The agro-zoning aims to prevent low crop price situation with an objective to alleviate farmer poverty which is not different from the debt moratorium program's objective. The crops' farm gate price as well as the input price factor represented the price subsidy program and the land tax is tested in relation to the reform of the land and property tax act policy.

The numbers of years in which agricultural machinery has been used were collected to calculate the present value of each agricultural machine price by the following formula:

$$PV = C_1 / (1 + r)^n$$

where C_1 = cash flow in Period 1,
r = rate of return equal to the inflation rate,
n = number of periods.

1.4 Data

The population consists of a number of agricultural parcels in Khon-Kaen .The total number of agricultural parcels in Khon-Kaen are 729,375, while there are 350,100 agricultural landowners (Official Information Center, Khon-Kaen Governor's Office, 2012). Multi-stage cluster sampling using probability proportional to size (PPS) was employed in this study (Cochran, 1977). The total number of agricultural parcel samples was determined by the following formula:

$$n = \frac{(deff * Z^2 pq)}{d^2}$$

where deff = design effect
Z = The 100[1-(α/2)]
p = proportion
q = (1-proportion)
d = margin of error

The United Nations Children's Fund (UNICEF) recommends design effects equal to two for sub-national estimates. The proportion, p, is 0.48 (350,100 ÷729,375). The margin of error is plus or minus 5 percentage point. With a 95% confidence interval, α = 0.05, Z = 1.96, total sample size is 767 samples. The total number of clusters is determined by the cluster size, which typically ranges from 20-40 households with

15-20 clusters in each province, state or district (UNICEF, 1995). Due to budget constraints, this research used the cluster size of 52 with 15 clusters (767/15 = 52) which is slightly higher than the UNICEF recommendation.

$$\text{Number of clusters} = \frac{\text{Total number of land owner in sample}}{\text{Cluster size}} = \frac{767}{52} = 15 \text{ clusters}$$

In each cluster, the sampling units were selected through PPS of multi-stage sampling. The following 4 stages were used for sampling: district, sub-district, village and parcel. The parcel list was attained from the office of the Sub-district Administrative Organization (Office of the SAO) tax database. Thai law requires a property declaration form every year land taxes are collected. The form called Por.Bor.Tor. 5 provides the following useful land information: landowner name, address, contact number, type of land use, land size, crops grown and location of the parcel. Simple random sampling was used to select the 52 parcels in each village. In total, there were 780 samples from 15 villages[7]. The selected areas from the sampling procedure are presented in Table 1.3.

It should be noted that there were instances where landowners owned multiple agricultural parcels. However, the random sample process selected only one parcel of the multiple parcels for the survey. While conducting the field survey on the selected samples, landowners were also interviewed for data on the other agricultural parcels. Therefore, the total sample obtained from the survey was 808 samples. Of these 808 samples, there are abandoned parcels for 118 samples and the rest 690 samples are used parcels. A depth interview was also conducted on five land owners who abandon the whole parcel of their land in order to get some information for the policy implication.

[7] See Appendix B

Table 1.3 Selected Areas from Multi-stage Cluster Sampling Using Probability Proportional to Size (PPS)

District Name	**Sub-district Name**	**Village No.**	**Number of Parcel sample**
Muang Khon-Kaen	Phra-Lup	2	52
	Don Han	1, 8	104
Phra-Yuen	Phra-Yuen	4, 11	104
Chum-Pae	Nong Pai	4, 9	104
Si-Chompoo	Sri-suk	2, 14	104
Nam Pong	Nam Pong	6, 12	104
	Bao Ngen	8, 17	104
Ubonrat	Na Kum	13	52
Ban Pai	Pa Por	8	52
Total			780 samples

CHAPTER 2

LITERATURE REVIEW

The main objective of identifying factors that cause agricultural land abandonment is to find the appropriate measure to effectively address the problem based on comprehensive quantification study. Therefore the literature review includes three of the following field areas: (1) Determinants of agricultural land abandonment, (2) Agricultural land use model, and (3) Land use management in Thailand

2.1 Determinants of Agricultural Land Abandonment

All land-use decisions are made by the land owners with a broad-scale factor constrained such as location, track size, soil quality, climate, slope and irrigation potential. In particular; agricultural land use is a result of the farmer attempting to maximize long-term profit. A low profit can lead to land abandonment. In contrast a large profit can lead to deforestation and unsuitable land that is converted into agriculture land (Marchant, Audsley, Annetts, Pearn, and Rounsevell, 2003).

Most of studies about the factor effecting agricultural land abandonment usually focus on the relationship between institutional changes on land use and land abandonment during the transition from the state-command to market-driven economies, particularly in post-Soviet Eastern Europe. The empirical technique adopted are Lansat-derived map of cropland use with the spatially explicit logistic regression model, Landsat images with a combination of best-subset linear regression models and hierarchical partitioning, Multi-seasonal Landsat, and GIS data mining techniques. The studies found a strong relationship between policies factor and agricultural land abandonment. Prishchepov, Radeloff, Baumann, Kuemmerle, and Muller (2012) indicated that the strong institution and land use policies can reduce the rate of agricultural land abandonment. Baumann et al. (2011) evaluated the patterns and drivers of post-socialist farmland abandonment in Western Ukraine, they found

that the most important predictors to explain substantial spatial variation in abandonment rates were topography, soil type, population, institutional and economic shock. In the Albania, Muller and Munroe (2008) indicated that most cropland abandonment at the onset of transition period was concentrated in less densely populated area but after the transition period it depend on economic returns. The choice of land use related to the potential profit that the decision maker expect to receive from the land use compare to the set of alternatives. The geographic, economic, demographic, and social contexts influence the return that the farmers expect from land use. Furthermore, these authors also found that the forest clearing in both period were driven by the population density and the policy shift.

Evidence from Romania, (Muller, Kuemmerle, Rusu, and Griffiths, 2009) showed that isolated cropland were more abandoned than more homogenous land, and hilly area were more likely to be abandoned than the plain. Lakes, Muller, and Kruger (2009) found that topography and local market access were the main determinants of farmland abandonment, whereas population parameters did not influence abandonment patterns substantially. Descriptive analyses suggest that topography, population density, migration, ownership regime, and land reform policy also have influenced on post-socialist farmland abandonment (Kuemmerle, Hostert, Radeloff, Vander Linden, Perzanowski and kruhlov, 2008, Sitko and Troll, 2008) Some researchers indicate that the abandonment of agricultural land is mostly driven by socio-economic factor such as immigration into area where new economic opportunities are offered to rural people, ecological factors such as elevation and land mismanagement leading to soil erosion (Benayas, Martin, Nicolau, and Schulz, 2007). However results from Spain, (Zaragozi et al, 2012) showed that only geographic factors were the important driving factor of farmland abandonment. The factors are irrigation, vegetation index, topographic wetness index and climatic index.

Not much research has been done on the agricultural land abandonment outside Europe. In Japan, (Nishihara, 2012) found that agricultural land zoning policy has a great impact on land value increase and discourages the landowner from cultivating the land. A small gap in the anticipation of land policy to convert agricultural zone to residential development zone prevents landowner from selling or leasing the land to a more efficient farmer. Evidence from Thailand, (Gine, 2005)

indicated that the partial rights titles create a distortion of the land rental market by triggering a sense of insecurity to land owner. The land owners are more likely to lease or abandon secured plots and cultivate unsecured plot in order to avoid expropriation risk. A summarize of the feature impact of each factor are shown in Table 2.1.

Table 2.1 Impact Summary of Agricultural Land Abandonment Determinants

Determinant Factors	**Impact**	**Sources**
Distance to city	+	Muller et al. (2009)
	+	Muller and Munroe (2008)
	+	Baumann et al. (2011)
Irrigation	-	Zaragozi et al. (2012)
Soil Fertility	-	Benayas et al. (2007)
	-	Baumann et al. (2011)
Property Right	-	Prishchepov et al. (2012)
	-	Kuemmerle et al (2009)
	+	Gine (2005)
Elevation	+	Benayas et al. (2007)
	+	Muller et al. (2009)
	+	Zaragozi et al. (2012)
Climate	-	Zaragozi et al. (2012)
	+	Baumann et al. (2011)
Agro-zone policy	+	Nishihara (2012)
Agricultural Machine Value	-	Prishchepov et al. (2012)
	-	Muller and Munroe (2008)
Input Output Price Ratio	+	Muller et al. (2009)
Number of Tractor	-	Muller and Munroe (2008)
Population in the city	+	Muller and Munroe (2008)
	+	Zaragozi et al (2012)
Population in farmland area	-	Baumann et al. (2011)
	-	Kuemmerle et al (2009)
Landowner Education	-	Muller and Munroe (2008)

Table 2.1 (Continued)

Determinant Factors	Impact	Sources
Immigration into the city	+	Benayas et al. (2007)
	+	Kuemmerle et al (2009)
Neighbors' cropland concentration	-	Muller et al. (2009)
Roughness	+	Muller et al. (2009)
Opportunity Cost for Labor	+	Muller et al. (2009)
Topography	+	Lake et al.(2009)
	+	Kuemmerle et al (2009)
Land reform policies	-	Sitko and Troll (2008)
Market Access	+	Lake et al. (2009)

In this study, we adopt a concept of "landowners' choice of land use base on long term maximizing profit basis" together with possible determinants of agricultural land abandonment from these literatures. The methodologies that these literatures employed are not suitable for applying with Thailand as the country is and was not a socialist communist regime country. Furthermore, we do not only evaluate the effect of institution and policy scenarios on agricultural land abandonment but also extend the scope of the possible factor to cover quasi-fix input and physical characteristic of parcel as well. Therefore agricultural land use model will be considered. The details are shown in the next topic.

2.2 Agricultural Land Use Model

The theoretical and empirical methodology to analyze land use have several features such as Hedonic Pricing Method (HPM), Computable General Equilibrium (CGE) model, Simultaneous Equation Model (SEM), Dynamic Simulation Model (DSM), model, and a profit optimization method based on duality production theory.

Many researchers have adopted Hedonic Pricing Model (HPM) in their works such as Drozd and Johnson (2004), Plantinga and Miller (2001), and Maddison (2000). The hedonic price method has been used to estimate the impact of various

kinds of parcel characteristics, for instance, land size, soil erosion rate, and distance to metropolitan area, on the agricultural land use. This approach originates from the land rent theory of Von Thunen and that of Ricardo. Any parcel of land, given its attributes and its location, is modeled as being used in the way that earns the highest rent. The models allow investigation of the influence of various policy measures on land allocation choices. However, the Hedonic Pricing Model suffers from other limitations, such as the scopes of physical benefits that can be valued are limited to attributes related to parcel prices. In addition its results depend heavily on model specification.

Some studies have been based on Computable General Equilibrium (CGE) model. Coxhead and Jayasuriya (1994) adopted the CGE model to evaluate the performance of land policy in Mali, Malawi, and Burgina Faso. Bashaasha, Kraybill, and Southgate (2001) study the effect of fuel wood tax and agricultural technology toward the land use between deforestation and agricultural. In Thailand, Panayotou and Sussengkarn (1992) use the CGE model to evaluate the impact of reducing subsidies for agriculture on deforestation. Obviously, the CGE Model is used for evaluating the relationship between the measure and policy performance and the agricultural land use at the national and global scale. Building a CGE model demands economic data such as input-output and social accounting matrices (SAM), which are frequently unavailable in developing countries or of poor quality. Moreover, the models' conclusions are also largely driven by the price and income elasticity, but typically these parameters are copied from models made in other contexts, are based on strong assumptions regarding the functional forms of the production or utility functions, or have simply been set arbitrarily. Therefore, CGE model is best used when no alternative approach can be found to analyze an issue (Kaimowitz and Angelsen, 1998).

Not much study has been done by adopting the Simultaneous Equation Model (SEM). Cho and Wu (2001) adopt this method to evaluate the interactions between residential development, land use regulations, and public financial impacts in California, Idaho, Nevada, Oregon and Washington. The study found that the land use regulation decrease land development, long-run expenditure and property tax at the higher cost of housing prices and property tax while land use regulations, land

development, public expenditure and property tax are affected by population, geographic location, land quality, housing prices, and the risks and costs of development. McMillen and McDonald (1991) adopt the SEM to analyze the relationship between the zoning policy and land use and found a strong effect of the policy on the land utilization. Again, this methodology is suitable for aggregate level analysis which is not the main focus of this study.

The method of Dynamic Simulation Model (DSM) has been used by some researchers such as in the United State, Rashford, Weber, Lewis and Evonuk (2003) analyzed the variables determine the conversion of agricultural land to developed land which includes residential, commercial, and industrial land. The determinants are agricultural expense, neighbor interaction, the number of agricultural input suppliers and output processors. The conversion decision of farmers is based on the return on their investment, profit and the market value of their land. In England, Marchant et al. (2003) used the DSM to predict the impact of future agricultural policies, socio-economic change and climate change on agriculture land use. The model is good at representing land use aggregated at the regional level but it provided contrast result of two regions. The model also indicated that socio-economic change causes larger effects on land use than climate change. Polyakov and Zhang (2008) study the effect of property taxes on changes between agricultural, forestry, Conservation Reserve Program, and developed land uses in Louisiana. The study showed that property tax has no effect on land-use but the current use valuation policy affects rural land uses by slowing down development of rural lands. The dynamic, process based simulation models appears to be better suited to predict change in land use than the SEM methods, however they cannot capture a decision making processes that drive land management.

The most widely used method for investigating the agricultural land use determinants is the “a profit optimization method based on duality production theory” The a profit optimization method based on duality production theory has been used to estimate the impact of various kinds of factors, for instance, input output price, property tax, institutional policy, land physical characteristics, geographic, including environmental and socio-economics factors on agricultural land use. Many researchers have adopted a profit optimization framework based on duality theory

analysis in their works such as Epstein (1981), Taylor and Monson (1985), Lopez (1984), Maligaya and White (1989), Chambers and Just (1989), Coyle (1993), Shumway (2001), Arnade and Kelch (2007), Lubowski, Plantinga, and Stavins (2008), Fezzi and Bateman (2011), and Lacroix and Thomas (2011).

The empirical studies usually employ 2 types of data; the first type is a time Series data at aggregated regional or country which can be obtained from secondary data sources and the second type is a cross-sectional data from field survey. All studies above employed an aggregated time-series data with a suggestion that the model is best used with the micro level, cross-sectional data. Therefore this study will employ the cross sectional data from a field interview survey.

When consider an appearance of a profit optimization technique, several functional forms and econometric issues have been used. The most five common functional forms consist of Cobb-Douglas, Constant elasticity of substitution (CES), generalized Leontief, Translog and Quadratic profit function. Guikey et al. (1983), Perroni and Rutherford (1998), Vardanyan and Noh (2006) and Fare et al (2008) examined the performance of the first four functional form and found that the translog functional form, although not perfect, is acceptable, as it outperforms other parameterization such as the Cobb-Douglas, CES, and Generalized Leontief. Fare, Martins-Filho, and Vardanyan (2010) found that quadratic functional form has better approximation properties than translog parameterization while evidence from Villezca-Becerra and Shumway (1992) indicated that the quadratic functional form outperform all other forms. Based on these authors, we therefore adopt the quadratic functional form for this study. Table 2.2 summarize the impact feature of factors affecting agricultural land use from Hedonic Pricing Method (HPM), Computable General Equilibrium (CGE) model, Simultaneous Equation Model (SEM), Dynamic Simulation Model (DSM), model, and a profit optimization method based on duality production theory.

Table 2.2 Feature Summary of Agricultural Land Use Methodology.

Methodology	Measure on	Determinant Factors	Impact	Sources
DSM	Cropland conversion to development use	Agricultural expense	+	Rashford, Weber, Lewis and Evonuk (2003)
		Population growth rate	+	
		Market value of land	+	
		Input supplier factor	-	
		Output processor factor	-	
		Neighbor interaction factor	+	
		Land use policy	+	
DSM	Agricultural land use	Future agricultural policies	+	Marchant et al. (2003)
		Socio-economic change	+	
		Climate change	+	
DSM	Land conversion to development use	Property tax	no impact	Polyakov and Zhang (2008)
		Current use valuation policy	-	

Table 2.2 (Continued)

Methodology	Measure on	Determinant Factors	Impact	Sources
HPM	Cropland conversion to residential use	Farmability	+	Drozd and Johnson (2004)
		Irrigation potential	+	
		Location	-	
		Parcel size	-	
HPM	Agricultural land value	Interest rate	+	Plantinga and Miller (2001)
		Conversion cost	-	
		Commuting costs	-	
		Distance to metropolitan area	-	
		Change in population in the city	+	
HPM	Agricultural land value	Climate	+	Maddison (2000)
		Soil quality	+	
		Elevation	-	
		Population density	+	
		Distance to Market	-	
SEM	Urban development	Land use regulation	-	Cho and Wu (2001
		Public expenditure	+	
		Property tax	-	
SEM	Land use	Zoning policy	+	McMillen and McDonald (1991)

Table 2.2 (Continued)

Methodology	Measure on	Determinant Factors	Impact	Sources
CGE Model	Agricultural land use	Fuelwood tax	-	Bashaasha, Kraybill, and Southgate (2001)
CGE Model	Upland land degradation	Land policy	-	Coxhead and Jayasuriy (1994)
CGE Model	Deforestation	Subsidies for agriculture	-	Panayotou and Sussengkarn (1992)
Optimization	Agricultural land allocation	Fertilizer tax	-	Fezzi and Bateman (2011)
method		ESA payment scheme	+	
		Cereals price	+	
		Rape price	+	
		Rootcrop price	+	
		Fertilizer price	-	
		Distance to major city	-	
		Average annual rainfall	-/+	
		Machinery working day	-/+	
		Potential evapotranspiration	-/+	
		Median duration of field capacity	-/+	
		Number of degree in growing season	-/+	
		Mean elevation	-/+	
		Land slope	-	

Table 2.2 (Continued)

Methodology	Measure on	Determinant Factors	Impact	Sources
Optimization method	Agricultural land use	Labor	-	Taylor and Monson (1985)
		Materials	+	
		Capital	+	
		Land	-	
Optimization method	Agricultural land use	Crop price	-	Lopez (1984)
		Animal product price	+	
		Hired labor	+	
		Operator and family labor	-	
		Farm capital	+	
Optimization method	Agricultural land use	Crop price	+	Coyle (1993)
		Hired labor	-	
		Machinery and equipment	+	
		Fertilizer	-	
		Capital	+	
		Parcel size	+	

Table 2.2 (Continued)

Methodology	Measure on	Determinant Factors	Impact	Sources
Optimization method	Agricultural land allocation	Hired labor	-	Arnade and Kelch (2007)
		Energy	-	
		Capital	+	
		Family labor	+	
		Intermediate input	-	
Optimization method	Land use with various functional form	Translog: crop prices	+	Chambers and Just (1989)
		Cobb-Douglas: crop prices	+	
Optimization method	Agricultural land allocation	Corn price	+	Lacroix and Thomas (2011)
		Cereals price	+	
		Oilseed price	+	
		Protein price	+	
		Fertilizer price	-	
Optimization method	Land allocation to cropland, forest, pasture, rangeland, and urban land	International trade	no impact	Lubowski et al. (2008)
		Global climate change	no impact	
		Policy change	+	
Optimization method	Agricultural land use	Land rent	+	Maligaya and White (1989)
		Parcel size	+	
		Population	-	
		Disposable per capital income	-	
		Pulpwood price	-	

2.3 Land Use Management in Thailand

Not much study on land use and land management has been done in Thailand The focus of most literatures is on land ownership concentration. Only Land Institute Foundation was found to study the agricultural land abandonment problem. Although it was only one small section of the research on land holdings, land utilization, economic mechanisms and laws for optimizing efficient land use, it provided an overview picture of the country benefit loss from the problem. The research reported that in 1998, it was estimated that an economic value added of 26,355.32 million baht was generated from the additional 3% increase in agricultural land use. Nominal GDP for 1998 was 4,701.6 billion baht; the agricultural sector produced 434.2 billion baht or 9.24% of total GDP. Therefore, the value added from the additional 3% agricultural land use contributes 6.07% of total agricultural GDP.

The issue of land ownership concentration underlies the lack of access to production resources which results in poverty and jeopardization of living conditions of farmers. In Thailand, inequality of land ownership significantly deteriorates between 1930 and 1993. The data from the agricultural censuses and from the interdental surveys of agriculture in 1983 and 1988 do not show any tendency for land ownership to concentrate over time. The Gini coefficients calculated from these sources were 0.46 in 1963 and in 1978, stabilized around 0.36 in 1983 and in 1988, and diminished to 0.30 in 1993 (Phelinas, 2001). However, the study of Land Institute Foundation (2001) indicated that the increase of land ownership concentration was found in 1999. In addition, the problem of land fragmentation in Thailand was very critical as 87% of all parcels in Thailand have their size at 5 rai or lower. Simon (1987) reported that land fragmentation in Thailand increase greater input cost (time to market), greater neighborhood costs (fencing and corner loss), greater risk reduction benefit (land homogeneity) and greater output marketing benefits (number of crops and road infrastructure) In 2012, Laovakul (2012) reported that the Gini coefficient of land ownership was 0.941 which is the highest in the Thai history. The problem of land ownership concentration usually associate with the property right issue, therefore some researchers conduct a research on the land property right together with the land ownership concentration issue.

The study on the relationship between the property right and agricultural land use indicated that land right has substantial impact on agricultural performance of farmer and the main source of greater productivity on land use is the better access to cheaper and longer term institutional credit (Feder, Onchan, Chalamwong, and Hongladarom, 1988). Evidence from Gine (2005) indicated that a partial property right in Thailand triggers a sense of insecurity among land owners, therefore the landowner prefer to abandon the full right parcel and cultivate the unsecured plot to avoid the expropriation risk. (Chankrajang, 2012) also reported that the partial land right in Thailand have 27 per cent impact on labor movement toward the non-agricultural sector. In addition, it increases rice productivity, land use intensity, land related investment and better soil quality.

As previously discussed in Chapter I, the government policies that have been implemented as well as the measures that are being considered at the moment need a rigorous quantification study as a direction to determine whether they are the right policies to be adopted. Onchan (1990) stated that it is not possible for Thai government to formulate a single land policy to tackle all categories of land use problems. The land policies should be divided into four categories for each set of objectives which are the policy for economic benefits, the policy for social benefit, the policy for the purpose of conservation, and the policy for the purpose of national security. He proposed to implement three strategies for these four categories which are improving land classification, establishing a land information system, and restructuring land administration.

CHAPTER 3

CONCEPTUAL FRAMEWORK AND THEORETICAL MODEL

3.1 Overview and Framework Diagram

In the past, there has been no study to find out the factor affecting agricultural land abandonment in Thailand. The land policies in Thailand are usually based on qualitative studies and logical thinking which resulting in a further aggravated in both land use and farmers' poverty problems. The examples and case studies on agricultural land abandonment indicators from other countries were discussed earlier in the first section of the literature review.

The objective of this study is to find factor effecting agricultural land abandonment by applying a profit optimization method based on duality production theory. This is the first attempt to apply the land use model with the land abandonment problem and take the presence of censored variables into account. Without recognizing these censored variables, the parameter estimate will be inconsistency. The profit optimization method is the most widely used method for investigating agricultural land use determinants as it can capture the decision-making processes that drive land management. The method has no limitations in terms of factor type and is not limited to an aggregate level analysis. In addition, it does not require a stack of economic data which is frequently unavailable or of poor quality in developing countries.

Duality theory allows one to obtain output supply and input demand equations by partial differentiation of profit function which is quite useful because it is a more convenient way to obtain supply and demand equation for a price-taking firm than the primal approach. The agricultural land owner makes a decision whether to use or abandon their land by maximizing their long term profit. Through a survey, factors affecting agricultural land abandonment were collected, they were output yield, the

farm gate price of the three major crop of Khon-Kaen: cassava, rice, and sugarcane, the quantity and price of inputs used in agricultural production (cash on hand, fertilizer, household labor, machine labor, pesticide, capital or agricultural machine, and interest rate). The physical and institutional factors are: parcel size, type of property right, main source of water supply, soil quality, distance to city, farming technology, land tax, the perception of land rental law and adverse possession law. Land share for the three major crops, and land share for abandonment were also collected from field survey.

According to the background above, the conceptual framework is mainly based on a profit optimization method and duality production theory, composed of many components, as shown in Figure 3.1.

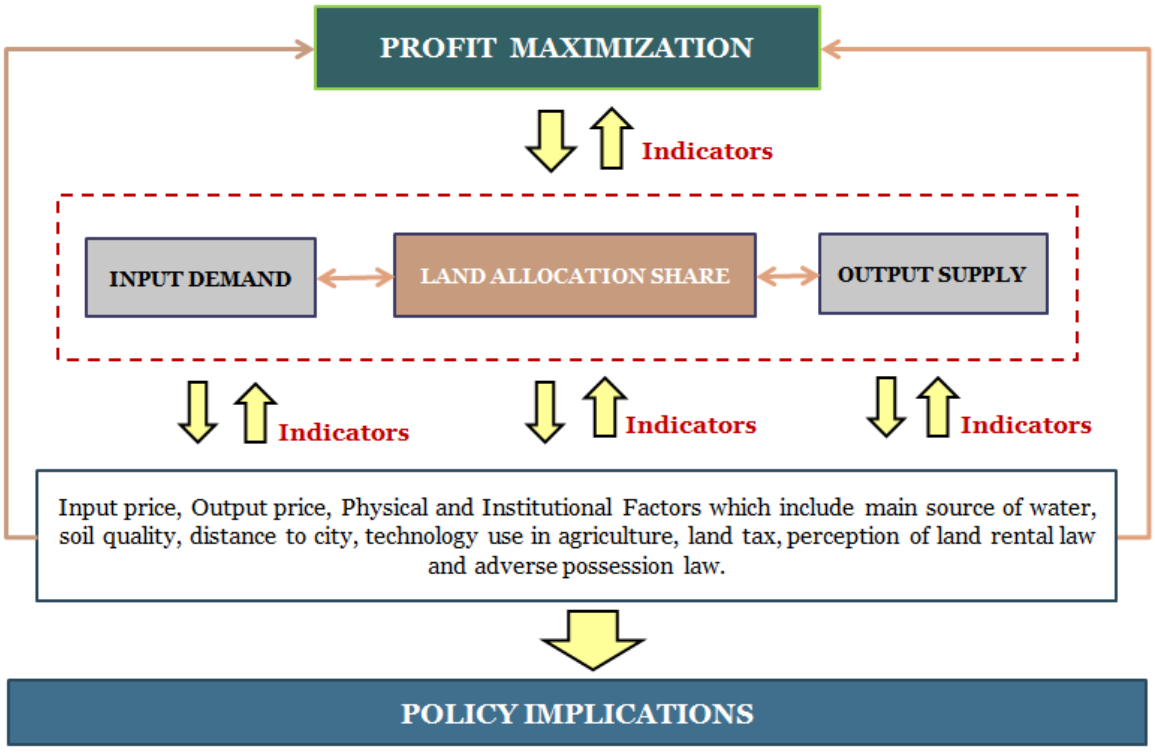

Figure 3.1 Conceptual Framework of the Research

According to Figure 3.1, the objective function to be maximized is profit with a consideration of input demand, output supply and land allocation share. In order to analyze input demand, output supply and land allocation, all possible factors that

affect these three components are required to be identified. Factors selection was based on literature review in Chapter II. They are quantity and price of input and output, and physical and institutional factor such as soil quality and law.

3.2 Characteristic Model

The duality production theory was used to obtain product supply and factor demand equations for a price taking firm by partial differentiation of profit function (Beattie, Taylor &Watts, 1985, p. 258). The agricultural landowner makes a decision whether to use or abandon their land to maximize their long-term profit. The theoretical model adopted for this paper was built upon the Chambers and Just (1989) farm profit maximization problem. The model further developed by Fezzi and Bateman (2011) is specified in the equation (1)

$$\Pi = f(p, w, z, l_1,\ldots,l_h),\ \sum_{i=1}^{h} li = L \qquad (1)$$

Where Π is the maximum profit associated with the vector of competitive output prices p, the vector of competitive input prices w, and the vector of quasi-fix input z which is physical and institutional characteristics with l the vector of h land use allocation and L is the total land available. Assuming the profit function to be positive, linearly homogeneous and convex in the input and output prices, the input demand and output supply equations and the optimal land use share equations can be derived using Hoteling's Lemma. Indicating with s the h land use shares corresponding to the land use allocation, the farm profit function for analysing land use is expressed as follows:

$$\Pi^L(p, w, z, L) = \max_{s1,\ldots,sh} \{\Pi(p, w, z, L, s_1,\ldots,s_h): \sum_{i=1}^{h} Si = 1\} \qquad (2)$$

Where $\Pi^L(.)$ is the profit per unit of land and s is the land use share in which all shares sum to one. According to Hotelling Lemma, the optimal quantity of i^{th} input and the j^{th} output are specified as Equations (3) and (4), respectively.

$$-x_i^L = \partial \Pi^L / \partial w_i \quad (3)$$

$$y_j^L = \partial \Pi^L / \partial p_j \quad (4)$$

Where x_i is the vector of m input and y_j is the vector of n output. The optimal land use equation can be derived recognizing that land is allocated to different uses in order to equalize marginal rent or shadow prices.

$$\frac{\partial \pi^L(p, w, z, L, s_1,\ldots,s_h)}{\partial s_1} = \frac{\partial \pi^L(p, w, z, L, s_1,\ldots,s_h)}{\partial s_i} \text{ for } i = 2,\ldots, h. \quad (5)$$

The quadratic functional form is adopted for this research as it outperforms all other most commonly used functional form for agricultural analysis. These functional forms are Cobb-Douglas, Constant elasticity of substitution (CES), generalized Leontief, Translog and Quadratic profit function. Guikey et al. (1983), Perroni and Rutherford (1998), Vardanyan and Noh (2006) and Fare et al (2008) examined the performance of the first four functional form and found that the translog functional form, although not perfect, is acceptable, as it outperforms other parameterization such as the Cobb-Douglas, CES, and Generalized Leontief. Fare, Martins-Filho, and Vardanyan (2009) found that quadratic functional form has better approximation properties than translog parameterization while evidence from Villezca-Becerra and Shumway (1992) indicated that the quadratic functional form outperform all other form.

3.3 Empirical Specification

The normalized quadratic profit function was applied to multi-input and multi-output production processes and was proof outperforming all other forms used in the study (Villezca-Becerra and Shumway, 1992 and Fare, Martins-Filho and Vardanyan, 2009). The properties of the normalized quadratic profit function are that it is locally flexible and self-dual with a globally convex Hessian matrix. Defining x_1 as the numeraire good and vector of normalized net put prices represent with $p' = (p/p_1, w/p_1)$. The normalized quadratic profit function can be expressed as follows:

$$\Pi^{*\prime} = \alpha_0 + \sum_{i=2}^{m+n} \alpha_i p_i' + \sum_{i=1}^{h-1} \beta_i s_i + \sum_{k=1}^{n} \gamma_k z_k + \sum_{i=2}^{m+n} \sum_{j=1}^{h-1} \delta_{ij} p_i' s_j + \sum_{i=2}^{m+n} \sum_{l=1}^{n} \phi_{ij} p_i' z_l + \sum_{i=1}^{h-1} \sum_{l=1}^{n} \varphi_{ij} s_i z_l + \frac{1}{2}\left(\sum_{i=2}^{m+n} \sum_{j=2}^{m+n} \alpha_{ij} p_i' p_j' + \sum_{i=1}^{h-1} \sum_{j=1}^{h-1} \beta_{ij} s_i s_j + \sum_{k=1}^{n} \sum_{l=1}^{n} \gamma_{kl} z_k z_l\right) \quad (6)$$

Where $\Pi^{*\prime}$ is the profit divided by the price of net put 1, p_i is net put price, p_i' is the normalized price (p_i/p_1, i = 2,…m+n), z_k is a vector of n quasi-fix input which includes physical and institutional characteristic variables and α_i, β_i, γ_k, δ_{ij}, ϕ_{ij}, φ_{ij}, α_{ij}, β_{ij}, and γ_{kl} are the parameters to be estimated. Linear homogeneity was imposed on the quadratic production function by normalization. Conditions for symmetry are imposed on the models with the constraints $\alpha_{ij} = \alpha_{ji}$, $\beta_{ij} = \beta_{ji}$ and $\gamma_{ij} = \gamma_{ji}$.

This paper uses output price; cassava price as numeraire. The output price was, on average, a better predictor of output than the models based on input prices (Paudel & Mcintosh, 2005). Even previous work by Shumway, Saez and Gottret (1998), Shumway and Alexander (1998), and Shumway and Gottret (1991) reported that numeraire was arbitrarily chosen to be the material input. By Hoteling Lemma, input demand and output function is specified as (7) where qi is net put with positive output quantity and negative input quantities.

$$q_i = \alpha_i + \sum_{i=2}^{m+n} \alpha_{ij} p_j' + \sum_{j=1}^{h-1} \delta_{ij} s_j + \sum_{l=1}^{n} \phi_{ij} z_l \quad (7)$$

Optimal land use share was derived from solving the system of h-1 equations in (5) with $\sum_{j=1}^{h} s_j = 1$.

$$\frac{\partial \pi^L}{\partial s_1} = \beta_1 + \sum_{j=1}^{m+n} \delta_{1j} x_j + \sum_{j=1}^{h} \beta_{1j} s_j + \sum_{j=1}^{n} \varphi_{1j} z_j =$$

$$\beta_i + \sum_{j=1}^{m+n} \delta_{1j} x_j + \sum_{j=1}^{h} \beta_{ij} s_j + \sum_{j=1}^{n} \varphi_{ij} z_j = \frac{\partial \pi^L}{\partial s_i}$$

At the end, there will be h reduced form equations as in (8)

$$s_i = \theta_i + \sum_{j=1}^{m+n} \Theta_{ij}\, p_j' + \sum_{l=1}^{n} \eta_{ij}\, z_j \quad \text{for i = 1,...,h} \tag{8}$$

where θ and η are the vector of the parameters to be estimated. The optimal land allocations depend on all the net put prices and all quasi-fix input, which includes physical and institutional characteristics.

A farmer may not plant certain crops in a particular year, thereby resulting in a zero value for the corresponding land shares and output observation. Some landowners leave their land totally abandoned which leads to a zero value in both input and output yields. By applying a traditional three-stage least square to the system of equation consisting of these censored variables leads to inconsistent parameter estimates (Amemiya, 1973). Therefore, the Tobit regression (Tobin, 1958) was used to estimate the system of equation (7) and (8) to find factors causing agricultural land abandonment, crop supply and input use. Because of censoring, the dependent variable y is the incompletely observed value of the latent dependent variable y*. The structural equation in the Tobit model is

$$y_i^* = X_i^{'}\beta + e \tag{9}$$

When dependent variable is censored from below at zero, we have

$$y_i = \begin{cases} y^* \text{ if } y^* > 0 \\ 0 \text{ if } y^* \leq 0 \end{cases} \tag{10}$$

After the system of equations has been estimated, the marginal effects of each factor will be calculated to find the effect size of each factor on the dependent variable. The following three possible marginal effects are possible: the marginal effect on the latent dependent variable; y*, the marginal effect on the expected value for y: E[y] for uncensored observations and the marginal effect on the E[y] for censored and uncensored observations. Wooldridge (2002, p. 520) and Greene (2003, p. 764) side with E [y] as the most useful component. Therefore, for this paper, the

marginal effect on the E[y] for censored and uncensored observations will be determined by:

$$\frac{\partial E[y]}{\partial x_k} = \phi\left(\frac{x_i\beta}{\sigma}\right)\beta_k \qquad (11)$$

This paper estimates one system of nine equations: the two output supply equations for rice and sugarcane (note: the price for cassava was set as numeraire because its farm gate price was the most stable among the study crop), six input demand equations (cash on hand, fertilizer, household labor, machine labor, pesticides and capital), and one land share equation for abandonment. Based on the theoretical model proposed by Fezzi and Bateman (2011), the land share for each output must be jointly estimated with the system of supply and demand equations. However, the above authors did not estimate the full model; instead, they estimated the land share equations separately because of the convergence and parameter instability problem. In contrast, the present study estimates the full model by using Seemingly Unrelated Regression analysis. According to the findings, however, all types of land shares cannot be incorporated into the system due to the identification problem. Therefore, the researcher followed the suggestion of Arnade and Kelch (2007) in constructing the simplest model possible by including only land shares of interest which is the land share for abandonment.

Gujarati and Porter (2009, p. 281) stated that if a qualitative variable has m categories, for each qualitative regressor, the number of dummy variables introduced must be one less than the categories of that variables. Otherwise, there will be the dummy variable trap problem, that is, the situation of perfect collinearity or perfect multicollinearity. There are three qualitative variables in this research; they are property right, main source of water supply and soil quality. The category for which no dummy variable is assigned is known as the base, benchmark, control, comparison, reference, or omitted category. All comparisons are made in relation to these benchmark categories. The benchmark or omitted category for property right, main source of water supply, and soil quality variables are no property right, rain, and medium of soil quality. The choice of benchmark is determined by the fact that the

omitted variables are the variables that are not of interest for example for the water variable, we have the least interested on the effect of water source supply from rain on land abandonment. The category that most interest us is irrigation, underground water, and river respectively. Therefore we set the rain category as a benchmark or omitted category.

CHAPTER 4

EMPIRICAL STUDY

4.1 Overview

In this chapter, a system of nine equations will be estimated with two main purposes: (1) to find factors effecting agricultural land abandonment, and (2) to make a scenario test based on the estimation result. The system of equation consists of two output supply equations, one abandonment land share equation, and six of input demand equations. The structural estimation will not only provide factors effecting land abandonment but also provide factors affecting the quantity supply of crop and the factors affecting demand of input for crop production.

Descriptive statistics are presented in table 4.1. As expected, this table shows that all farm gate prices of crops are low while all farm input prices are high. All crop yields were extremely low compared to the average yield from the 2012 report of the OAE. On average, cassava, rice, and sugarcane crop yields in the study area were 157.23 kg/rai, 275.66 kg/rai, and 1,716.31 kg/rai, respectively, while the average yields from the OAE report were 3,419 kg/rai, 415 kg./rai, and 12,280 kg/rai, respectively. On average, household labor used in the production process was 27 days/rai/season while the machine labor was only 7.15 hour/rai/season. This figure shows that crop production in the study area was based on labor intensive farming.

An average parcel size is around 11 rai and the standard deviation is 9.5, which indicates a wide gap between large and small parcel sizes. The minimum parcel size is 0.38 rai or 152 square-wa, and the maximum is 100 rai. Cash on hand, or the agricultural landowners' average savings 13,163.77 baht with a minimum of 3,200 baht, which is quite low. Understandably, Thai farmers are always in poverty.

Table 4.1 Descriptive Statistics of Model Variables

Variable Code	Definition	Mean	Standard deviation	Minimum	Maximum
Y_CASSAVA	Cassava yield (Kg./rai/crop)	157.23	756.87	0.00	8,570.00
Y_RICE	Rice yield (Kg./rai/crop)	275.66	360.49	0.00	2,666.67
Y_SUGARCANE	Sugarcane yield (Kg./rai/crop)	1,716.31	4,552.24	0.00	27,500.00
CASH	Cash on hand or Saving (baht)	13,163.77	8,081.99	3,200.00	61,666.67
FERT	Fertilizer (Kg./rai/crop)	41.14	32.37	0.00	250.00
LABOR	Household labor (day/rai/season)	27.00	39.50	0.00	336.00
MACHINE	Machine labor (hour/rai/season)	7.15	8.38	0.00	120.00
PEST	Pesticide (Kg./rai/crop)	0.25	0.93	0.00	16.25
CAPITAL	Capital (number of capital)	1.68	1.38	0.00	6.00
P_CASSAVA	Cassava price (baht/kg)	19.01	4.35	10.00	30.00
P_RICE	Rice price (Baht/kg.)	12.66	2.52	4.00	22.50
P_SUGARCANE	Sugarcane price (Baht/kg.)	0.98	0.17	0.60	2.00
P_CASH	Interest rate (percent)	7.82	1.93	1.00	14.00
P_FERT	Fertilizer price (Baht/rai)	165.59	26.55	60.00	320.00
P_LABOR	Household labor price (Baht/rai)	295.03	44.76	100.00	750.00
P_MACHINE	Machine labor price (Baht/rai)	407.66	257.77	100.00	1,800.00
P_PEST	Pesticide price (Baht/rai)	407.92	224.19	31.25	1,500.00
P_CAPITAL	Land owners' machine price (baht)	80,165.47	17,0447.40	0.00	1,046,249.00
SIZE	Parcel size (rai)	10.95	9.50	0.38	100.00
FULL_RIGHT	Full property right (full right = 1, otherwise = 0)	0.91	0.29	0.00	1.00
SEMI_RIGHT	Partial property right (partial right = 1, otherwise = 0)	0.09	0.28	0.00	1.00
NO_RIGHT	No property right (no right = 1, otherwise = 0)	0.00	0.04	0.00	1.00
UNDERGROUND	Water supply from underground (underground = 1, otherwise = 0)	0.05	0.21	0.00	1.00
RAIN	Main water supply from rain (rain =1, otherwise = 0)	0.82	0.39	0.00	1.00
RIVER	Main water supply from river (river = 1, otherwise = 0)	0.05	0.23	0.00	1.00
IRRIGATION	Main water supply from irrigation (irrigation = 1, otherwise = 0)	0.08	0.28	0.00	1.00
SOIL_LOW	Low quality of soil (low = 1, otherwise = 0)	0.18	0.38	0.00	1.00
SOIL_MED	Medium quality of soil (medium=1,otherwise =0)	0.57	0.50	0.00	1.00
SOIL_HIGH	High quality of soil (high = 1, otherwise = 0)	0.25	0.43	0.00	1.00

Table 4.1 (Continued)

Variable Code	Definition	Mean	Standard deviation	Minimum	Maximum
DIST	Distance to city (kms.)	54.77	35.52	0.40	144.00
TECH	Farming technology (technology usage; yes = 1, no = 0)	0.73	0.44	0.00	1.00
RENT	Land rental law perception (yes = 1, no = 0)	0.26	0.44	0.00	1.00
POSSESSION	Adverse possession law perception (yes = 1, no = 0)	0.25	0.43	0.00	1.00
TAX	Land tax paid (yes = 1, no = 0)	0.98	0.16	0.00	1.00
S_CASSAVA	Land share for Cassava (percent)	0.05	0.20	0.00	1.00
S_RICE	Land share for Rice (percent)	0.67	0.46	0.00	1.00
S_SUGARCANE	Land share for Sugarcane (percent)	0.17	0.37	0.00	1.00
S_ABANDON	Land share for Abandoned land (percent)	0.11	0.29	0.00	1.00
PP_RICE	Rice price/Cassava price (price ratio)	7.20	2.85	2.00	20.00
PP_SUGARCANE	Sugarcane price/Cassava price (price ratio)	0.56	0.25	0.30	1.50
PP_INTEREST	Interest rate/Cassava price (price ratio)	4.38	1.67	0.50	14.00
PP_FERT	Fertilizer price/Cassava price (price ratio)	9.40	3.51	3.00	20.80
PP_LABOR	Household labor price/Cassava price (price ratio)	1.67	0.60	0.50	4.50
PP_MACHINE	Machine labor price/Cassava price (price ratio)	2.45	2.34	0.50	18.00
PP_PEST	Pesticide price/Cassava price (price ratio)	2.33	1.60	0.16	10.00
PP_CAPITAL	Capital price/Cassava price (price ratio)	4.46	10.13	0.00	104.62

In addition, the average loan interest rate was 7.82%, while the maximum rate was as high as 14%. The landowners possessed an average of two agricultural machines in which the maximum was six while the minimum was zero. The frequency analysis in Table 4.2 showed average soil quality to be moderate at 56.93% and high at 25.25%, which indicated that 80% of the parcel samples had medium to high soil quality. The main water source was from rain at 81.56 percent, followed by irrigation at only 8.29%, which indicated that most of the farmers relied on nature.

Table 4.2 Soil Quality Details

Variable	Categories	Frequency	(%)
Soil			
	Low	144.00	17.82
	Medium	460.00	56.93
	High	204.00	25.25
Total		808.00	100.00
Water			
	Underground water	38.00	4.70
	Rain	659.00	81.56
	River	44.00	5.45
	Irrigation	67.00	8.29
Total		808.00	100.00

Table 4.3 reports the correlation coefficient matrix of endogenous and exogenous variables. The land rental law and adverse possession law are significantly correlated to each other as both laws support each other. Most of exogenous variables in each equation are correlated to the dependent variables in the respective equation, for example the parcel size, soil quality, distance to city, farming technology, rental law, rice yield, sugarcane yield, interest rate and household labor are significantly correlated to land share of abandonment. There are no strong high pair-wise correlations between variables which indicated that there is no outlier and collinearity problem.

Table 4.3 Correlation Coefficient Matrix of Model Variables

Variable	S_CASSAVA	S_RICE	S_SUGARCANE	S_ABANDON	Y_CASSAVA	P_CASSAVA	Y_RICE	P_RICE	Y_SUGAR	P_SUGAR CANE	CASH	P_CASH	FERT	P_FERT
S_CASSAVA	1.000													
S_RICE	-0.324***	1.000												
S_SUGARCANE	-0.090**	-0.676***	1.000											
S_ABANDON	-0.054	-0.488***	-0.155***	1.000										
Y_CASSAVA	0.801***	-0.288***	-0.057	-0.020	1.000									
P_CASSAVA	0.070**	0.032	-0.112***	0.045	0.041	1.000								
Y_RICE	-0.161***	0.462***	-0.342***	-0.178***	-0.139***	-0.018	1.000							
P_RICE	0.044	-0.085**	0.090**	-0.011	0.035	-0.056	-0.011	1.000						
Y_SUGARCANE	-0.062*	-0.547***	0.775***	-0.089**	-0.049	-0.161***	-0.281***	0.112***	1.000					
P_SUGARCANE	0.133***	-0.104***	0.070**	-0.017	0.061*	-0.221***	-0.043	0.017	0.061*	1.000				
CASH	-0.011	0.138***	-0.099***	-0.083**	-0.029	-0.095***	-0.044	-0.040	-0.124***	-0.001	1.000			
P_CASH	0.125***	-0.046	-0.076**	0.084**	0.088**	0.214***	-0.006	-0.057	-0.039	-0.020	-0.047	1.000		
FERT	-0.024	0.002	-0.235***	0.312***	-0.021	0.136***	-0.313***	-0.116***	-0.253***	-0.026	0.084**	0.038	1.000	
P_FERT	-0.025	-0.002	0.010	0.006	-0.013	0.008	0.013	0.009	0.018	0.045	-0.141***	0.045	0.029	1.000
LABOR	-0.083**	0.016	-0.091***	0.147***	-0.117***	0.000	-0.007	-0.051	-0.090**	0.023	-0.082**	-0.013	0.200***	0.036
P_LABOR	-0.188***	0.054	-0.028	0.080**	-0.193***	0.014	0.054	0.012	0.043	-0.050	-0.048	0.026	0.003	0.057
MACHINE	0.003	-0.113***	-0.022	0.204***	0.004	0.046	-0.077**	0.040	-0.040	-0.016	0.023	-0.023	0.096***	-0.106
P_MACHINE	-0.132***	0.045	-0.013	0.036	-0.124***	-0.271***	0.080**	-0.060*	0.078**	-0.007	0.026	-0.056	-0.002	0.060***
PEST	-0.075**	0.035	-0.018	0.018	-0.057	-0.056	0.022	0.028	-0.046	0.005	0.088**	-0.064*	0.086**	-0.056*
P_PEST	-0.065*	0.084**	-0.061*	-0.010	-0.073**	0.019	-0.012	-0.054	-0.072**	-0.035	0.061*	-0.016	0.088**	-0.002
CAPITAL	-0.041	0.083**	-0.098***	0.023	-0.024	0.067*	-0.063*	-0.081**	-0.131***	-0.057	0.187***	0.022	0.235***	-0.041
P_CAPITAL	0.061*	-0.082**	0.070**	-0.001	0.069**	0.005	-0.053	-0.036	0.090**	-0.021	-0.132***	0.024	-0.025	-0.053

Table 4.3 (Continued)

Variable	S_CASSAVA	S_RICE	S_SUGAR CANE	S_ABANDON	Y_CASSAVA	P_CASSAVA	Y_RICE	P_RICE	Y_SUGAR CANE	P_SUGAR CANE	CASH	P_CASH	FERT	P_FERT
SIZE	-0.024	-0.036	0.187***	-0.166***	-0.045	-0.023	-0.189***	0.001	0.099***	0.009	-0.089**	0.001	0.122***	-0.028
FULL_RIGHT	-0.299***	0.241***	-0.172***	0.044	-0.249***	-0.112***	0.141***	-0.019	-0.005	-0.118***	0.052	-0.128***	0.016	0.024
SEMI_RIGHT	0.289***	-0.240***	0.175***	-0.043	0.221***	0.112***	-0.146***	0.018	0.006	0.121***	-0.052	0.131***	-0.012	-0.020
NO_RIGHT	0.099***	-0.021***	-0.017***	-0.013	0.241***	0.008	0.032	0.005	-0.013	-0.016	0.004	-0.015	-0.037	-0.034
DIST	-0.009	0.055	0.199***	-0.333***	-0.013	-0.547***	0.015	0.124***	0.220***	0.322***	0.068*	-0.229***	-0.218***	-0.044
TECH	0.013	-0.047	0.104***	-0.068*	0.019	-0.076**	-0.013	-0.014	0.124***	0.058	-0.101**	-0.008	-0.151***	0.047
RENT	-0.015	0.130***	-0.072**	-0.102**	0.016	0.031	-0.015	-0.130***	-0.013	-0.009	0.030	0.062*	0.088**	-0.119
POSSESSION	-0.013	-0.068*	0.074**	0.021	-0.020	0.038	-0.088**	-0.057	0.065*	-0.078**	-0.108***	0.016	0.087**	-0.019
TAX	0.036	-0.045	0.053	-0.022	0.033	0.011	-0.018	-0.030	0.025	0.054	-0.062*	0.081**	-0.014	0.103***
LAND RENT	-0.074**	0.001	-0.132***	0.217***	-0.068*	0.063*	0.023	0.019	-0.103***	-0.090**	-0.020	-0.060*	0.104***	-0.022
PP_SUGARCANE	-0.006	-0.075**	0.105***	-0.013	-0.015	-0.859***	-0.008	0.045	0.165	0.615***	0.064*	-0.136***	-0.116***	0.040
PP_INTEREST	0.017	-0.062*	0.037	0.039	0.013	-0.679***	0.019	0.011	0.128***	0.205***	0.037	0.517***	-0.088**	0.051
PP_FERT	-0.071**	-0.052	0.108***	-0.007	-0.050	-0.856***	0.008	0.053	0.174***	0.256***	0.023	-0.124***	-0.099***	0.432***
PP_LABOR	-0.128***	-0.029	0.091***	0.016	-0.114***	-0.876***	0.024	0.046	0.185***	0.222***	0.055	-0.137***	-0.111***	0.029
PP_MACHINE	-0.099***	-0.039	0.085**	0.021	-0.091***	-0.572***	0.025	-0.002	0.177***	0.108***	0.053	-0.120***	-0.060*	0.047
PP_PEST	-0.075**	0.057	-0.011	-0.024	-0.075**	-0.491***	-0.007	-0.024	0.003	0.107***	0.100***	-0.103***	0.031	-0.012
PP_CAPITAL	0.040	-0.074**	0.075**	-0.007	0.049	-0.105***	-0.044	-0.018	0.111***	0.002	-0.099***	0.013	-0.032	-0.035
PP_RICE	-0.033	-0.081**	0.127***	-0.013	-0.024	-0.837***	0.005	0.520***	0.193***	0.214***	0.049	-0.171***	-0.157***	0.014
UNDERGROUND	-0.001	-0.118***	0.138***	0.010	-0.008	0.035	-0.049	0.081**	0.101***	-0.027	-0.034	-0.040	-0.035	-0.027
RAIN	0.033	0.003	-0.047	0.032	0.006	0.029	-0.104***	0.068*	-0.038	0.080**	0.052	-0.034	0.051	0.022
RIVER	0.029	-0.072**	0.090**	-0.023	0.073**	-0.167***	-0.014	0.026	0.094***	0.016	-0.004	0.008	-0.074**	-0.002
IRRIGATION	-0.069**	0.145***	-0.115***	-0.034	-0.063*	0.069*	0.196***	-0.179***	-0.102***	-0.105***	-0.044	0.072**	0.017	-0.009
SOIL_LOW	0.050	-0.145***	0.100***	0.067*	-0.004	0.037	-0.128***	0.024	0.056	-0.096***	-0.063*	0.024	0.065**	-0.014
SOIL_MED	-0.039	-0.038	0.052	0.021	-0.019	-0.129***	-0.046	0.076**	0.067*	0.134***	0.038	-0.124***	-0.045	0.064*
SOIL_HIGH	0.000	0.171***	-0.146***	-0.083**	0.025	0.115***	0.165***	-0.108***	-0.125***	-0.068*	0.012	0.120***	-0.006	-0.061*

Table 4.3 (Continued)

Variable	LABOR	P_LABOR	MACHINE	P_MACHINE	PEST	P_PEST	CAPITAL	P_CAPITAL	SIZE	FULL_ RIGHT	SEMI_ RIGHT	NO_ RIGHT	DIST	TECH
LABOR	1.000													
P_LABOR	0.006	1.000												
MACHINE	0.025	-0.013	1.000											
P_MACHINE	0.081**	0.047	-0.058	1.000										
PEST	0.013	0.021	-0.017	-0.009	1.000									
P_PEST	0.053	0.043	-0.022	-0.019	0.015	1.000								
CAPITAL	-0.008	-0.020	0.038	0.001	0.051	0.046	1.000							
P_CAPITAL	-0.030	0.008	0.067*	-0.059*	0.020	-0.017	-0.440***	1.000						
SIZE	0.208***	-0.044	-0.067**	-0.080**	0.045	0.056	-0.119***	0.213***	1.000					
FULL_RIGHT	0.021	0.224***	-0.011	0.179***	0.064*	0.041	0.078**	-0.112***	-0.121***	1.000				
SEMI_RIGHT	-0.003	-0.217***	0.011	-0.177***	-0.059*	-0.038	-0.084**	0.115***	0.125***	-0.992***	1.000			
NO_RIGHT	-0.147***	-0.075**	-0.004	-0.026	-0.047	-0.025	0.043	-0.017	-0.033	-0.113***	-0.011	1.000		
DIST	0.002	-0.103***	-0.039	0.099***	-0.043**	-0.088**	-0.074**	-0.044	0.075**	0.037	-0.037***	0.001	1.000	
TECH	0.011	0.007	-0.059*	0.087**	-0.076	-0.053	-0.739***	0.286***	0.154***	-0.053	0.061*	-0.058*	0.082**	1.000
RENT	0.000	0.052	-0.002	0.003	-0.010	0.059*	0.076**	0.146***	0.123***	0.105***	-0.103***	-0.021	0.046	-0.044
POSSESSION	0.042	0.032	0.031	0.073**	-0.022	0.092***	-0.122***	0.104***	0.114***	0.021	-0.019	-0.020	-0.094***	0.089**
TAX	-0.023	0.035	-0.071**	0.047	-0.007	-0.029	-0.118***	0.035	0.062*	-0.050	0.050	0.006	-0.039	0.118***
PP_SUGARCANE	0.008	-0.012	-0.045	0.229***	0.002	0.014	-0.060	-0.035	0.006	0.063*	-0.061*	-0.016	0.605***	0.091***
PP_INTEREST	-0.003	0.024	-0.058	0.183***	-0.018	0.007	-0.036	0.003	0.010	0.038	-0.036	-0.019	0.340***	0.057
PP_FERT	0.019	0.014	-0.086**	0.283***	-0.018	0.015	-0.075**	-0.041	0.004	0.119***	-0.117***	-0.024	0.515***	0.103***
PP_LABOR	0.013	0.392***	-0.049	0.275***	0.013	0.040	-0.052	-0.020	-0.001	0.196***	-0.193***	-0.039	0.504***	0.075**
PP_MACHINE	0.056	0.016	-0.045	0.889***	-0.010	-0.024	-0.019	-0.050	-0.030	0.151***	-0.149***	-0.020	0.348***	0.097***
PP_PEST	0.042	0.025	-0.045	0.095***	0.025	0.815***	0.019	-0.028	0.069*	0.091***	-0.088**	-0.024	0.234***	-0.008
PP_CAPITAL	-0.017	0.009	0.051	-0.019	0.016	-0.014	-0.411***	0.948***	0.201***	-0.077**	0.079**	-0.016	0.037	0.268***
PP_RICE	-0.020	-0.011	-0.017	0.222***	0.018	-0.009	-0.085**	-0.037	0.013	0.097***	-0.097***	-0.009	0.556***	0.057

Table 4.3 (Continued)

Variable	LABOR	P_LABOR	MACHINE	P_MACHINE	PEST	P_PEST	CAPITAL	P_CAPITAL	SIZE	FULL_RIGHT	SEMI_RIGHT	NO_RIGHT	DIST	TECH
UNDERGROUND	0.006	-0.039	0.040	-0.043	-0.066*	-0.052	-0.091***	0.017	0.065*	-0.156***	0.158***	-0.008	0.050	0.056
RAIN	0.008	-0.004	-0.018	-0.125***	0.038	-0.001	0.100***	0.012	0.034	0.086**	-0.089**	0.017	0.089**	-0.067*
RIVER	-0.043	-0.052	0.053	0.067*	-0.027	0.003	-0.041	-0.027	-0.019	-0.078**	0.080**	-0.009	0.158***	0.048
IRRIGATION	0.020	0.079**	-0.049	0.154***	0.020	0.037	-0.036	-0.008	-0.082**	0.063*	-0.062*	-0.011	-0.294***	0.011
SOIL_LOW	0.021	0.044	-0.003	-0.109***	0.039	0.053	-0.007	0.061*	0.081**	-0.105***	0.108***	-0.016	-0.096***	-0.032
SOIL_MED	-0.037	-0.025	0.052	0.063*	-0.004	-0.086**	-0.071*	-0.053	0.021	0.062*	-0.066*	0.031	0.161***	0.114***
SOIL_HIGH	0.024	-0.010	-0.057	0.025	-0.030	0.051	0.087**	0.006	-0.095*	0.022	-0.020	-0.021	-0.098***	-0.102***

Variable	RENT	POSSESSION	TAX	PP_SUGARCANE	PP_INTEREST	PP_FERT	PP_LABOR	PP_MACHINE	PP_PEST	PP_CAPITL	PP_RICE	UNDERGROUND
RENT	1.000											
POSSESSION	0.226***	1.000										
TAX	0.003	0.001	1.000									
PP_SUGARCANE	-0.019	-0.056	0.019	1.000								
PP_INTEREST	0.046	-0.013	0.037	0.673***	1.000							
PP_FERT	-0.074**	-0.031	0.042	0.833***	0.677***	1.000						
PP_LABOR	-0.001	-0.010	0.001	0.831***	0.681***	0.823***	1.000					
PP_MACHINE	-0.011	0.041	0.033	0.535***	0.409***	0.569***	0.560***	1.000				
PP_PEST	0.038	0.061*	-0.017	0.482***	0.379***	0.464***	0.500***	0.253***	1.000			
PP_CAPITAL	0.149***	0.113***	0.041	0.068*	0.099***	0.075**	0.090**	0.026	0.034	1.000		
PP_RICE	-0.093***	-0.048	-0.032	0.782***	0.613***	0.782***	0.783***	0.523***	0.434***	0.075***	1.000	
UNDERGROUND	-0.091***	-0.035	0.035	-0.041	-0.062*	-0.038	-0.047	-0.025	-0.069*	0.006	0.008	1.000
RAIN	0.054	-0.041	-0.014	0.017	-0.028	-0.010	-0.010	-0.082**	-0.002	0.029	0.021	-0.467***
RIVER	-0.029	0.075**	0.003	0.164***	0.157***	0.173***	0.146***	0.125***	0.101***	-0.031	0.165***	-0.053
IRRIGATION	0.018	0.022	-0.010	-0.128***	-0.042***	-0.100***	-0.070**	0.032	-0.028	-0.020	-0.172***	-0.067*
SOIL_LOW	-0.051	0.157***	0.032	-0.088***	-0.033***	-0.053	-0.034	-0.109***	0.023	0.050	-0.034	-0.027
SOIL_MED	-0.055	-0.045	-0.026	0.153***	0.021***	0.141***	0.107***	0.118***	-0.005	-0.025	0.145***	0.016
SOIL_HIGH	0.107***	-0.088**	0.001	-0.096***	0.005***	-0.114***	-0.092***	-0.039	-0.015	-0.016	-0.135***	0.005

Table 4.3 (Continued)

Variable	RAIN	RIVER	IRRIGATION	SOIL_LOW	SOIL_MED	SOIL_HIGH
RAIN	1.000					
RIVER	-0.505***	1.000				
IRRIGATION	-0.632***	-0.072**	1.000			
SOIL_LOW	0.070**	0.017	-0.093***	1.000		
SOIL_MED	0.129***	-0.045	-0.156***	-0.534***	1.000	
SOIL_HIGH	-0.208***	0.036	0.259***	-0.270***	-0.670***	1.000

Note: ***, **, * statistically significant at level 0.01, 0.05 and 0.10

4.2 Empirical System Estimation

An estimation of the output supply equations in Table 4.4 shows that different factors affected each crop supply. All significant factors and signs were as expected. The higher rice supply came from a reduction in other types of land allocation, an increase in the water supply from irrigation system, a larger parcel size and a decrease in the property right. The coefficient of the FULL_RIGHT and SEMI_RIGHT variable suggests that those land owners who have full and semi right of property right on average tend to supply less of rice than those land owners who have no property right. This is agrees with Gine (2005) in a study indicating that a partial property right in Thailand triggers a sense of insecurity among landowners. So, they prefer to abandon the secured parcel and cultivate the unsecured plots to avoid expropriation risks. The higher sugarcane supply came from increases in agricultural machine prices that belong to the land owner, land allocation for cassava and sugarcane and decreases in property rights and loan interest rates. The more capital resources the landowner possessed, the greater the likelihood advanced agricultural machinery was utilized in sugarcane production, which resulted in higher yields. Land shares for cassava also affected the supply of sugarcane, but not land shares for abandonment. It showed that landowners still did not consider allocating abandoned land for sugarcane production, even if there was available land, which indicates that the abandoned plots must have an infrastructure problem that is too difficult to correct with the resources on hand. In contrast, greater land shares for cassava resulted in additional supplies of sugarcane because both crops grow well in poor soil quality with low rainfall and they share the same input such as agricultural machinery, production technology, fertilizer and pesticides.

An estimation result of the input demand equations shows that pesticide price affects the quantity of fertilizer used; while the fertilizer price also affects the quantity of pesticide use, which indicates that farmers traded-off between these two types of input. As expected, the higher the price for rice, the more the landowners would invest in fertilizer, household labor and agricultural machine. Technology affects all input use with negative effects, except household labor, which indicates that better

Table 4.4 Tobit Estimation of Input Demand, Output Supply, and Abandoned Land Share Equations

Variable	Output Supply Equations		Input Demand Equations						S_ABANDON
	Y_RICE	Y_SUGARCANE	CASH	FERT	LABOR	MACHINE	PEST	CAPITAL	
Intercept	1.194***	-39.544	-1.011	-62.322*	-176.908***	-0.941	-0.635	7.040	-10.167
	(0.407)	-	(0.813)	(32.364)	(41.317)	(10.260)	(1.775)	(669.793)	-
PP_RICE	0.009	0.071	-0.001	-2.203***	-2.005**	0.357	0.050	-0.103***	0.010
	(0.009)	(0.414)	(0.018)	(0.741)	(0.948)	(0.242)	(0.047)	(0.027)	(0.040)
PP_SUGARCANE	-0.043	1.987	0.151	-1.577	-7.879	-0.161	0.538	0.327	-1.457***
	(0.144)	(4.193)	(0.264)	(10.628)	(13.561)	(3.383)	(0.654)	(0.375)	(0.559)
PP_INTEREST	0.015	-0.712*	0.007	-1.84*	-1.097	-0.305	-0.033	0.022	0.069
	(0.013)	(0.410)	(0.025)	(1.001)	(1.284)	(0.323)	(0.063)	(0.036)	(0.051)
PP_FERT	-0.038	-0.926	-0.310*	13.530**	11.242	-5.140**	-0.810*	0.120	-0.212
	(0.009)	(0.288)	(0.017)	(0.689)	(0.882)	(0.224)	(0.045)	(0.026)	(0.035)
PP_LABOR	0.868	-23.990	2.412	-295.857	-77.426	-58.764	18.625	3.367	9.652
	(0.062)	(1.291)	(0.103)	(4.146)	(5.322)	(1.362)	(0.266)	(0.150)	(0.227)
PP_MACHINE	0.141	15.973	2.175	56.289	150.873*	-8.093	2.144	6.175***	2.496
	(0.009)	(0.184)	(0.015)	(0.614)	(0.785)	(0.196)	(0.038)	(0.020)	(0.034)
PP_PEST	-1.720	-50.670	5.393***	191.861**	82.900	-2.942	-5.017	2.050	11.088**
	(0.011)	(0.315)	(0.021)	(0.839)	(1.072)	(0.269)	(0.052)	(0.030)	(0.047)
PP_CAPITAL	19.724	1140.013***	-49.884*	-1496.134	-2637.352*	1516.601***	122.864	-340.594***	128.762**
	(0.002)	(0.038)	(0.003)	(0.119)	(0.152)	(0.042)	(0.008)	(0.004)	(0.006)
S_CASSAVA	-1.202***	10.076***	-0.060	-2.997	-10.949	-0.347	-0.394	-0.229	-
	(0.214)	(2.849)	(0.152)	(5.960)	(7.767)	(1.935)	(0.379)	(0.218)	
S_SUGARCANE	-1.104***	28.582***	-0.186**	-17.045***	-12.433***	-0.012	-0.047	0.033	-
	(0.087)	(2.256)	(0.082)	(3.212)	(4.159)	(1.051)	(0.206)	(0.113)	
S_ABANDON	-0.903***	1.953	-0.026	90.431***	81.978***	20.102***	1.640***	0.417	-
	(0.103)	(3.569)	(0.197)	(7.848)	(9.735)	(2.293)	(0.483)	(0.280)	
SIZE	0.009***	-0.073	-0.005	0.872***	1.294***	-0.006	0.011	0.008*	-0.026***
	(0.002)	0.049	(0.003)	(0.130)	(0.167)	(0.042)	(0.008)	(0.004)	(0.008)

Table 4.4 (Continued)

Variable	Output Supply Equations		Input Demand Equations						S_ABANDON
	Y_RICE	Y_SUGARCANE	CASH	FERT	LABOR	MACHINE	PEST	CAPITAL	
FULL_RIGHT	-0.860**	-22.149***	0.062	26.056	143.720***	2.989	2.464	-0.097	9.859***
	(0.396)	(5.304)	(0.791)	(31.408)	(40.080)	(9.900)	(1.696)	(0.153)	(0.431)
SEMI_RIGHT	-0.892**	-17.761***	0.062	30.850	149.338***	2.928	2.166	-0.113	9.643***
	(0.396)	(5.378)	(0.794)	(31.529)	(40.231)	(9.941)	(1.704)	-	(0.479)
UNDERGOUND	0.056	0.895	-0.046	-4.111	-3.250	1.324	-0.203	-0.364**	0.538**
	(0.082)	(1.612)	(0.136)	(5.477)	(7.026)	(1.790)	(0.351)	(0.184)	(0.263)
RIVER	0.073	-0.957	-0.016	-6.129	-9.078	4.578***	-0.116	-0.159	0.415
	(0.072)	(1.875)	(0.127)	(5.078)	(6.503)	(1.702)	(0.311)	(0.176)	(0.274)
IRRIGATION	0.187***	-3.226	-0.148	0.606	5.361	0.423	-0.161	-0.394**	-0.418**
	(0.056)	(3.595)	(0.115)	(4.585)	(5.858)	(1.454)	(0.284)	(0.165)	(0.204)
SOIL_LOW	-0.037	0.094	-0.072	3.908	4.511	-0.673	0.154	-0.005	0.109
	(0.045)	(1.165)	(0.078)	(3.240)	(4.138)	(1.050)	(0.211)	(0.115)	(0.153)
SOIL_HIGH	0.033	-0.820	-0.044	0.967	6.675*	-1.767**	-0.201	0.031	-0.287*
	(0.037)	(1.467)	(0.071)	(2.863)	(3.662)	(0.912)	(0.178)	(0.106)	(0.153)
DIST	0.001	-0.006	0.001	0.033	0.189***	0.034**	-0.006**	-0.001	-0.026***
	(0.001)	(0.028)	(0.001)	(0.053)	(0.067)	(0.016)	(0.003)	(0.002)	(0.003)
TECH	0.051	2.140	-0.100	-11.516***	-2.933	-1.980**	-0.639***	-8.309	-0.098
	(0.036)	(1.395)	(0.067)	(2.764)	(3.526)	(0.887)	(0.183)	(669.793)	(0.144)
RENT	-0.037	0.404	0.079	5.190*	-4.559	-0.482	-0.281)	0.381***	0.461***
	(0.036)	(1.351)	(0.070)	(2.807)	(3.583)	(0.901)	(0.178)	(0.104)	(0.174)
POSSESSION	-0.040	-1.332	-0.178***	4.478	3.964	0.931	-0.043	-0.316***	-0.050
	(0.038)	(1.143)	(0.068)	(2.808)	(3.589)	(0.905)	(0.180)	(0.099)	(0.143)
TAX	0.058	-3.358	-0.212	-2.646	-10.871	-5.541**	-0.328	-0.698**	-0.104
	(0.094)	(4.546)	(0.181)	(7.611)	(9.804)	(2.635)	(0.522)	(0.347)	(0.385)

Note: ***, **, * statistically significant at level 0.01, 0.05 and 0.10, 808 observations, LR chi2(210) = 2741.86, Log likelihood = -13269.424 , Prob > chi2 = 0.0000, standard error are in parentheses.

technology helps to decrease all input use in crop production. The perception of land rental law has a positive effect on fertilizer and capital use which implies that the parcel that being used is encouraged by the law for both short and long-term investments. Landowners are inclined to cultivate the land rather than lease it to others for production.

The estimation result from the land abandonment share equation shows the factors with the greatest effect on land abandonment to be agricultural machinery prices, followed by semi-right of property right, pesticide price, full right of property right, sugarcane prices, land rental laws, water, soil quality, parcel size, and distance to city. The degree of effect from the marginal effect calculation presented in Table 4.5 indicates that if the capital price of the landowner is increased by one baht, there will be an additional 9.151 or 9 rai 151 square-wa[8] in land abandonment. This indicates that the richer landowners tend to abandon their land more quickly than the poorer landowners. During the field interview survey, these landowners were found to have the equipment necessary to accomplish all of the tasks for their enterprises, but to prefer providing a custom hiring service for others instead of cultivating the land. The services range from custom planting, harvesting or hauling. The custom hiring business not only made better use of their equipment, labor, and management resources throughout the year but it also increased their income and profits for the year and, in most cases, made the aforementioned considerably higher than crop production. The coefficient of the SEMI_RIGHT and FULL_RIGHT variable suggests that those land owners who have full and semi right of property right on average tend to abandon more of their plot than those land owners who have no property right for 0.163 and 0.997 or 398.8 and 65.2 square wa respectively. This is also agrees with Gine (2005) that a partial property right in Thailand led to the abandonment of secured parcel. If the price of pesticides increases by one baht, there will be an additional 0.788 or 315.2 square-wa in land abandonment, while a reduction in sugarcane price by one baht will result in an additional 0.104 or 41.6

[8] 1 rai = 4 ngan = 400 square-wa = 1,600 square meters = 0.16 hectare = 1,914 square yards = 0.4 acre

Table 4.5 Marginal Effect of Input Demand, Output Supply, and Abandoned Land Share Equations

Variable	Output Supply Equations		Input Demand Equations						S_ABANDON
	Y_RICE	Y_SUGARCANE	CASH	FERT	LABOR	MACHINE	PEST	CAPITAL	
PP_RICE	0.009	0.071	-0.001	-2.203***	-2.005**	0.357	0.050	-0.103***	0.001
	(0.009)	(0.414)	(0.018)	(0.741)	(0.948)	(0.242)	(0.047)	(0.027)	(0.003)
PP_SUGARCANE	-0.043	1.987	0.151	-1.577	-7.879	-0.161	0.538	0.327	-0.104**
	(0.144)	(4.193)	(0.264)	(10.628)	(13.561)	(3.383)	(0.654)	(0.375)	(0.044)
PP_INTEREST	0.015	0.712*	0.007	-1.84*	-1.097	-0.305	-0.033	0.022	0.005
	(0.013)	(0.410)	(0.025)	(1.001)	(1.284)	(0.323)	(0.063)	(0.036)	(0.004)
PP_FERT	-0.038	-0.926	-0.310*	13.530**	11.242	-5.140**	-0.810*	0.120	-0.015
	(0.009)	(0.288)	(0.017)	(0.689)	(0.882)	(0.224)	(0.045)	(0.026)	(0.003)
PP_LABOR	0.868	-23.990	2.412	-295.857	-77.426	-58.764	18.625	3.367	0.686
	(0.062)	(1.291)	(0.103)	(4.146)	(5.322)	(1.362)	(0.266)	(0.150)	(0.016)
PP_MACHINE	0.141	15.973	2.175	56.289	150.873*	-8.093	2.144	6.175***	0.177
	(0.009)	(0.184)	(0.015)	(0.614)	(0.785)	(0.196)	(0.038)	(0.020)	(0.002)
PP_PEST	-1.720	-50.670	5.393***	191.861**	82.900	-2.942	-5.017	2.050	0.788**
	(0.011)	(0.315)	(0.021)	(0.839)	(1.072)	(0.269)	(0.052)	(0.030)	(0.004)
PP_CAPITAL	19.724	1140.013***	-49.884*	-1496.134	-2637.352*	1516.601***	122.864	-340.594***	9.151*
	(0.002)	(0.038)	(0.003)	(0.119)	(0.152)	(0.042)	(0.008)	(0.004)	(0.001)
S_CASSAVA	-1.202***	10.076***	-0.060	-2.997	-10.949	-0.347	-0.394	-0.229	-
	(0.214)	(2.849)	(0.152)	(5.960)	(7.767)	(1.935)	(0.379)	(0.218)	
S_SUGARCANE	-1.104***	28.582***	-0.186**	-17.045***	-12.433***	-0.012	-0.047	0.033	-
	(0.087)	(2.256)	(0.082)	(3.212)	(4.159)	(1.051)	(0.206)	(0.113)	
S_ABANDON	-0.903***	1.953	-0.026	90.431***	81.978***	20.102***	1.640***	0.417	-
	(0.103)	(3.569)	(0.197)	(7.848)	(9.735)	(2.293)	(0.483)	(0.280)	
SIZE	-0.009***	-0.073	-0.005	0.872***	1.294***	-0.006	0.011	0.008*	-0.002***
	(0.002)	0.049	(0.003)	(0.130)	(0.167)	(0.042)	(0.008)	(0.004)	(0.001)

Table 4.5 (Continued)

Variable	Output Supply Equations		Input Demand Equations						S_ABANDON
	Y_RICE	Y_SUGARCANE	CASH	FERT	LABOR	MACHINE	PEST	CAPITAL	
FULL_RIGHT	-0.860**	22.149***	0.062	26.056	143.720***	2.989	2.464	-0.097	0.163***
	(0.396)	(5.304)	(0.791)	(31.408)	(40.080)	(9.900)	(1.696)	(0.153)	(0.038)
SEMI_RIGHT	-0.892**	17.761***	0.062	30.850	149.338***	2.928	2.166	-0.113	0.997***
	(0.396)	(5.378)	(0.794)	(31.529)	(40.231)	(9.941)	(1.704)	(0.153)	(0.001)
UNDERGOUND	0.056	0.895	-0.046	-4.111	-3.250	1.324	-0.203	-0.364**	0.059
	(0.082)	(1.612)	(0.136)	(5.477)	(7.026)	(1.790)	(0.351)	(0.184)	(0.041)
RIVER	0.073	-0.957	-0.016	-6.129	-9.078	4.578***	-0.116	-0.159	0.041
	(0.072)	(1.875)	(0.127)	(5.078)	(6.503)	(1.702)	(0.311)	(0.176)	(0.036)
IRRIGATION	0.187***	-3.226	-0.148	0.606	5.361	0.423	-0.161	-0.394**	-0.022**
	(0.056)	(3.595)	(0.115)	(4.585)	(5.858)	(1.454)	(0.284)	(0.165)	(0.009)
SOIL_LOW	-0.037	0.094	-0.072	3.908	4.511	-0.673	0.154	-0.005	0.008
	(0.045)	(1.165)	(0.078)	(3.240)	(4.138)	(1.050)	(0.211)	(0.115)	(0.012)
SOIL_HIGH	0.033	-0.820	-0.044	0.967	6.675*	-1.767**	-0.201	0.031	-0.018*
	(0.037)	(1.467)	(0.071)	(2.863)	(3.662)	(0.912)	(0.178)	(0.106)	(0.009)
DIST	0.001	-0.006	0.001	0.033	0.189***	0.034**	-0.006**	-0.001	-0.002***
	(0.001)	(0.028)	(0.001)	(0.053)	(0.067)	(0.016)	(0.003)	(0.002)	(0.001)
TECH	0.051	2.140	-0.100	-11.516***	-2.933	-1.980**	-0.639***	-8.309	-0.007
	(0.036)	(1.395)	(0.067)	(2.764)	(3.526)	(0.887)	(0.183)	(669.793)	(0.011)
RENT	-0.037	0.404	0.079	5.190*	-4.559	-0.482	-0.281)	0.381***	0.027***
	(0.036)	(1.351)	(0.070)	(2.807)	(3.583)	(0.901)	(0.178)	(0.104)	(0.010)
POSSESSION	-0.040	-1.332	-0.178***	4.478	3.964	0.931	-0.043	-0.316***	-0.003
	(0.038)	(1.143)	(0.068)	(2.808)	(3.589)	(0.905)	(0.180)	(0.099)	(0.010)
TAX	0.058	-3.358	-0.212	-2.646	-10.871	-5.541**	-0.328	-0.698**	-0.008
	(0.094)	(4.546)	(0.181)	(7.611)	(9.804)	(2.635)	(0.522)	(0.347)	(0.033)

Note: ***, **, * statistically significant at level 0.01, 0.05 and 0.10, standard errors are in parentheses

square-wa in land abandonment. All of these price factors are consistent with economic theory. Relative to landowner perception of land rental laws, there will be an additional 0.027 or 10.8 square-wa in land abandonment if the laws are perceived. Relative to parcel size, if the parcel size is smaller by one rai, there will be an additional 0.002 or 3.2 square-meters in land abandonment. This is due to the production inefficiency of small parcels as reported by Simon (1987) and McClosekey (1975). The coefficient of the IRRIGATION variable suggests that those land owners who have the main water source supply from irrigation system on average tend to abandon less of their plot than those land owners whose main source of water supply are rain for 0.022 or 8.8 square-wa while those land owners who have the high quality of soil on average tend to abandon less of their plot than those land owners whose soil quality are medium for 0.018 or 7.2 square-wa. Closer distance to a city by one kilometer will generate an additional 0.002 or 3.2 square meters in land abandonment. This occurs because the economic rent and productivity of the parcels near urban areas is higher for non-agricultural activities. The summary of sign and size effect of significant variables on land abandonment share are reported in Table 4.6.

Table 4.6 Sign and Size Effect of Significant Variables on Land Abandonment Share.

Variables	**Sign affect**	**Size affect**
Agricultural Machine price	+	9 rai 151 square-wa
Semi right of property right	+	398.8 square-wa
Pesticide price	+	315.2 square-wa
Full right of property right	+	65.2 square-wa
Sugarcane price	-	41.6 square-wa
Land rental law perception	+	10.8 square-wa
Irrigation system	-	8.8 square-wa
High quality of soil	-	7.2 square-wa
Land size	-	3.2 square-meters
Distance to city	-	3.2 square-meters

4.3 Marginal Effect Scenario Test

The marginal effect scenario testing on the structural model provides an expected value for the dependent variable which is land share for abandonment for different values of significant variables. The purpose of this test was to find a turning point of land shares for abandonment, or a zero value of land shares for abandonment. The present study tested the following two variables: distance to city and land size. The scenario values for land size are set based on the proposed measure to limit the holding size of agricultural land at 50 rai. The scenario values for the distance to city variable were set based on the maximum distance of the parcel sample from the Khon-Kaen municipality, which is 144 km. Therefore, the scenario values for both variables were set as:

Land size: 0, 25, 50, 75, 100, 125

Distance to city: 0, 25, 50, 75, 100, 125, 150

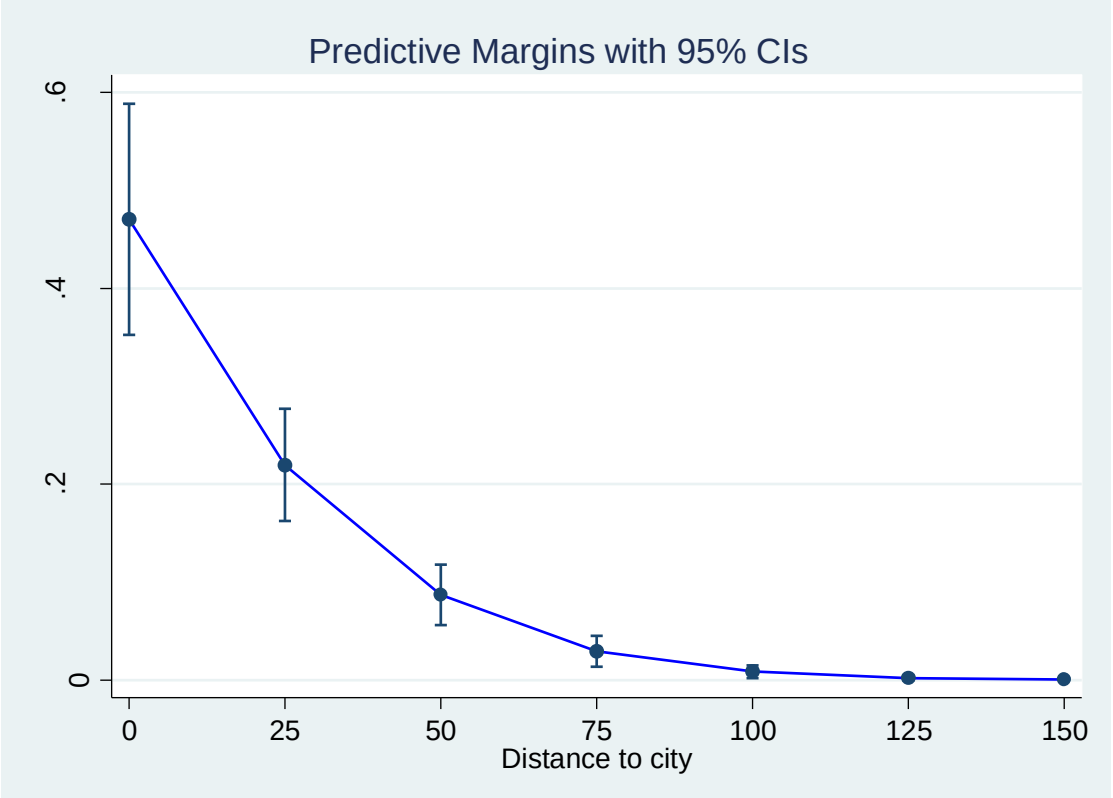

Figure 4.1 Marginal Effect Scenario Test on Distance to City

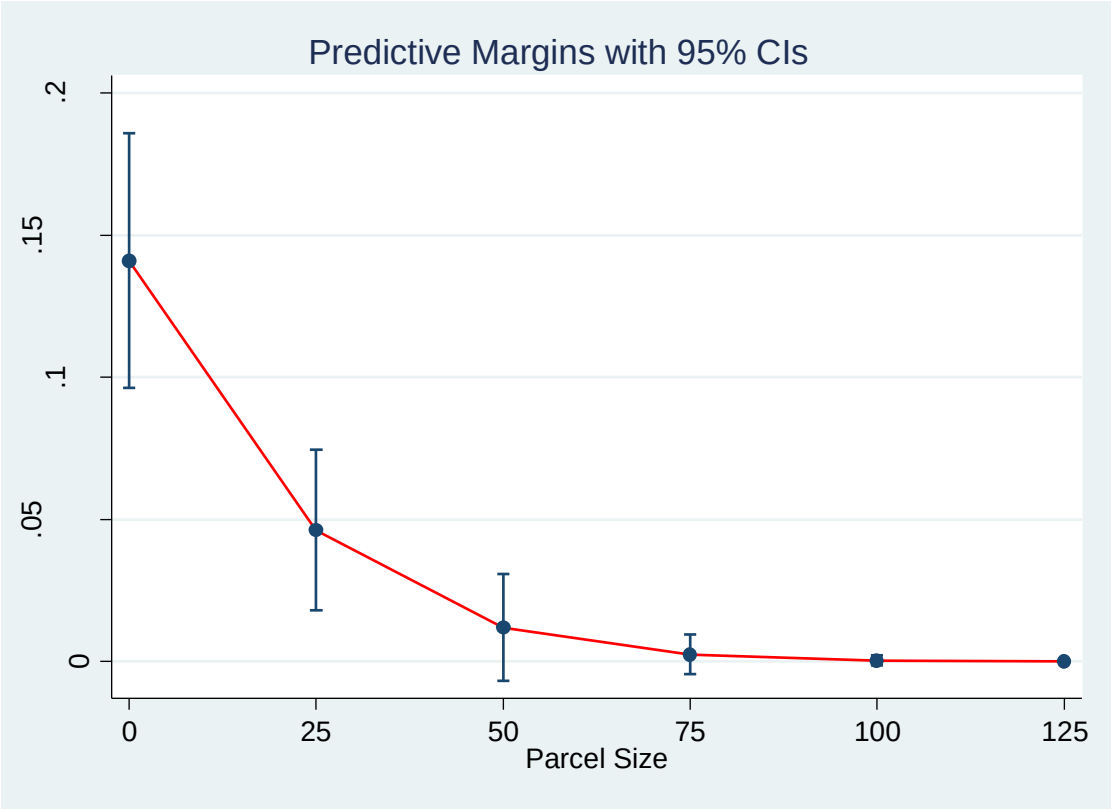

Figure 4.2 Marginal Effect Scenario Test on Parcel Size

The marginal effect scenario testing on distance to city and parcel size is presented in Figure 4.1 and 4.2 respectively. The test shows that agricultural land will be fully utilized at approximately 125 kilometers from municipality and the most effective land size for agricultural production at approximately 100 rai at which point there will be no agricultural land abandonment.

4.4 Model Validity Test

The problem of heteroscedasticity and nonnormality which lead to inefficiency and unbiased parameter estimate are critical in Tobit setting. This study uses the Breusch-Pagan LM Test for testing the heterosceasticity problem under the hypothesis: Ho: No system heteroscedasticy

Ha: There is a system heteroscedasticity

Table 4.7 Breusch-Pagan LM Test

Statistic Description	Chi-square	P-Value
Breusch-Pagan LM Test	-1.71	1.000

Table 4.7 showed that we accept the null of no system heteroscedasticy, therefore there is no inefficiency problem in Tobit setting.

Relative to non-normality problem, the Doornik-Hansen is used under the hypothesis:

Ho: Multivariate non-normality

Ha: Multivariate normality

Table 4.8 Doornik-Hansen Test

Statistic Description	Chi-square	P-Value
Doornik-Hansen	1.33	0.000

Table 4.8 showed that we failed to accept the null of non-normality indicating that the Tobit setting is unbiased.

4.5 Factor Effecting Land Abandonment and Parcel Leasing Anxiety from Direct Interview Question

In addition to the estimation approach, a direct question on why the land owners decide to abandon their parcel along with the opinion on the parcel leasing anxiety was asked directly. There are 118 samples for the abandon parcel and 21 samples for the lease parcel. The landowner will be able to choose more than one answer for each question, therefore the frequency analysis was used to find the factor that highly affect the landowner ‘s decision to abandon their land together with their concern on the lease parcel.

Table 4.9 Opinion on Factor Effecting Land Owners' Decision to Abandon Their Land and on Parcel Leasing.

1. Why you abandon your land?	Frequency	(%)
1.1 Lack of water supply	93	20.58
1.2 Short of labor	62	13.72
1.3 Lack of agricultural machine	84	18.58
1.4 Inappropriate soil quality	45	9.96
1.5 I have other job	88	19.47
1.6 No road access to my parcel	2	0.44
1.7 No cash for investment	17	3.76
1.8 Intend to keep my parcel for speculation	58	12.83
1.9 There is news on a mega project construction nearby	0	0.00
1.10 If I let it lease, there will be a problem on a tenant eviction	0	0.00
1.11 If I let it lease, there will be a problem on adverse possession	0	0.00
1.12 Other: please specify	3	0.66
Total	452	100.00
2. Do you worry about these leasing problems?	Number of owner	(%)
2.1 No, I do not worry about these problems	12	44.44
2.2 Yes, and the problem that concern me are:		
2.2.1 Tenant does not pay for the lease	5	18.52
2.2.2 Tenant does not leave when the contract is over	3	11.11
2.2.3 Tenant over utilize my parcel	7	25.93
2.2.4 Tenant claim for the right over my parcel through adverse possession law	0	0
Total	27	100

Table 4.9 showed that water, soil quality, and agricultural machine are among the highest frequency which is complying with the result from our structural estimation. Labor shortage is also one of the important factors for agricultural land owner to abandon their parcel for 13.72%. Interestingly, 12.83% percent of the samples intend to keep the parcel for speculation, therefore they cease the crop production while waiting for its price to rise. We found that 0.66% have other reasons to abandon their land that is not listed in our choices. They specify that the parcel belong them are saturated all year; therefore they are unable to cultivate their land. This is another problem related to physical and infrastructure of parcel.

Most people who lease their parcel for 44.44% do not worry about all possible problems related to the lease as most tenants are their relatives. 25.93% were concern about the parcel over utilization of the tenant and 18.52% worry about the rental fee collection problem. There are 11.11% worries about the eviction of the tenant problem when the leasing contract is over.

These direct questions support our estimation result from the structural model for the factor effecting land abandonment as well as provide additional information on the lease problem.

CHAPTER 5

CONCLUSION AND POLICY IMPLICATIONS

Thai government introduced ten key agricultural policies with an intention to tackle the farmer poverty but they have guarded results. These policies are land infrastructure development, limited land holding, land allocation program, land rental law, adverse possession law, agricultural-zoning, debt moratorium program, price subsidy program, community land title act and reform of the land and property tax act. The policies led to agricultural land abandonment due to the fact that the factors that cause farmers' poverty are the causal factors behind agricultural land abandonment. Therefore, by solving the core issue of agricultural land abandonment is the way to solve the farmers' poverty problem.

This research aims to find the factors that affect the land owners' decision to abandon their agricultural land. Each factor tested is link with the key government polies. The crops' farm gate price as well as the input price factor represents the price subsidy program. Loan interest rate factor represented the debt moratorium program. Parcel size represents the limited land holding measure while the property right factor represents land allocation program and community land title act. Main source of water supply in agricultural production and soil quality factor represents the land infrastructure development policies. Distance factor represents the agricultural zoning program. Perception of land rental law represents the land rental law while the perception of adverse possession law represents the adverse possession law, and the land tax variable represents the reform of the land and property tax act policy.

The agricultural landowner makes a decision whether to use or abandon their land to maximize their long-term profit. Land is allocated to different uses including to be abandoned in order to equalize marginal rent. The outcome showed that the factors with the greatest effect on land abandonment are agricultural machinery prices, followed by semi-right of property right, pesticide price, full right of property

right, sugarcane prices, land rental laws, water, soil quality, parcel size, and distance to city. In light of the aforementioned results, this study makes the following policy implications:

First, Relative to land infrastructure development policies such as irrigation system and soil improvement programs, both policies are the right measure for the Thai government to adopt. Although, financial limitations have hindered the widespread construction of irrigation systems throughout Thailand, the shortage can be solved by introducing a value capture tax. Landowners who enjoy and benefit from a government-built irrigation system should return a portion of their increased profits to the government to maintain the system and build additional irrigation systems. Relative to the soil improvement program: The government has done a good job by establishing and developing volunteer soil doctors with learning centers at the sub-district level, which can be accomplished in a cost-effective manner. However, they need to be promoted more because many of the agricultural areas continue to face soil quality issues.

Second, Limited land holdings at 50 rai measure need to be revised. The results suggested that the minimum efficient parcel size for agricultural production is approximately 100 rai. Therefore, the plan of 50 rai should be reconsidered. It should be stressed that small parcel size reduces production efficiency.

Third, With the land allocation program, the full and semi right of property right factor is positively significant, which suggests that those land owners who have full and semi right of property right on average tend to abandon more of their plot than those land owners who have no property right. The result implied that the effectiveness of the land allocation program is inconclusive.

Fourth, With the land rental law, the result suggested reformation of the Agricultural Land Rental Act of 1981. The aforementioned law favors the tenants and thereby encourages land abandonment. It was effective in the past under a different social context, but is currently out-of-date and should be revised. Revising the law will not only reduce the land abandonment problem, but also encourage land use at its maximum capacity through the leasing process.

Fifth, With the adverse possession law, the perception of the law is insignificant, which suggests that the law is an inconclusive policy.

Sixth, Agricultural-zoning is the right policy for the government to adopt, but should be based upon a use-based, not crop-based format. A radius of 125 kilometers from municipality is proposed for the province of Khon-Kaen. The parcels near the city should be converted to other uses more suitable for their economic rent. This is due to uncontrollable urban development and sprawl. Therefore, legislative action should be used to manage the development and utilization of land to maximize economic return.

Seventh, Concerning the debt moratorium program, the insignificance of loan interest rates suggested that the program is an inconclusive policy.

Eighth, With the price subsidy program, although the significant factors related to this policy are pesticide and sugarcane prices. Only the input price subsidy; pesticide prices can be implemented, but with caution because government intervention on output price destroys the market price mechanism and it has been proven in other parts of the world that intervening output price exacerbates the situation. Therefore, the output price subsidy should be cancelled.

Ninth, The Community Land Title Act is the right policy due to the positive significant of full and semi right of property right variables. The act should be implemented with the communal land size of 100 rai, which is the most efficient size for agricultural production based on the marginal scenario test analysis.

Tenth With the Reformation of Land and Property Tax Act, the insignificance of land tax suggest that the Reformation of Land and Property Tax Act is an inconclusive policy.

An implication for farmers based on this study is to recognize that the factor behind their poverty do not come from the lack of property right over the land as the partial and full property right encourage more of poverty or land abandonment than to have no right at all. When farmers recognize this fact, they will try to isolate the sense of their resource shortage and start to put their full effort into the crop production. In addition, they should consider putting more concern in the water supply and soil quality management as well as finding most appropriate crop for small plot production instead of being anxious about the plummeting crop price as well as the skyrocketing input price as it is the government duty to retain the price stability in the economy. By changing their focus, they will not only increase their resource

quality from water and soil quality management but also help the government on the price stability through new kind of crop grow on their small plot. Although the Agricultural Land Rental Act of 1981 is out of date and encourages land abandonment, it obviously benefits tenant farmers who do not have enough space for doing mass plantation. They should take the advantage of the act while it is still in affective for their agricultural production trough leasing process.

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APPENDICES

APPENDIX A

PROVINCE LIST OF EACH LAND ABANDONMENT TREND

Provinces with a Constant in Land Abandonment Trend

1. Bangkok

Provinces with a Decreasing in Land Abandonment Trend

1. Sra-kaew
2. Ubolrachathani
3. Chumporn
4. Lumpang
5. Sukhothai
6. Uthaithani
7. Petchaboon
8. Nakornsawan
9. Pichit
10. Nakornpanom
11. Roied
12. Srisaket
13. Phuket
14. Pattani

Provinces with an Increasing in Land Abandonment Trend

1. Chiangrai
2. Nongkai
3. Narathiwas
4. Yasotorn
5. Songkha
6. Ayuthaya
7. Surajthani
8. Nakornsritammarat
9. Chacheongsao
10. Pathumthani
11. Ranong
12. Prachinburi
13. Chaiyaphom
14. Maehongsorn
15. Samutsakorn
16. Kumpangpetch
17. Lumpoon
18. Amnajcharoen
19. Sakolnakorn
20. Mukdahan
21. Rajburi
22. Prajuabkirikun
23. Pitsanulok
24. Singburi
25. Trad
26. Lobburi
27. Kalasin
28. Burirum
29. Saraburi
30. Chainaj
31. Angthong
32. Chonburi
33. Nonthaburi
34. Samutsongkram
44. Udonthani
54. Nakornnayok

35. Supanburi
36. Janthaburi
37. Rayong
38. Panggha
39. Khon-khen
40. Yala
41. Lei
42. Trung
43. Satul
45. Chiangmai
46. Udtaradit
47. Nakornpathom
48. Kanchanaburi
49. Pattalung
50. Krabi
51. Payao
52. Prae
53. Surin
55. Petchburi
56. Samutprakarn
57. Mahasarakam
58. Nongbualampoo
59. Nakornsatchasima
60. Tark
61. Nan

APPENDIX B

MULTI-STAGE CLUSTER SAMPLING USING PROBABILITY PROPORTION TO SIZE (PPS)

The advantage of the multi-stage cluster sampling using PPS is that each unit in the sample will have an equal chance of being selected or it is self-weighting which will simplify the analysis.

The sampling process of multi-stage cluster sampling are as follow; (1) List all communities in Khon-Kean province to be surveyed in 4 stages which are District, Sub-district, Village, and the agricultural parcel, (2) List the population of each stage which are 26 District, 199 Sub-district, 2,297 Villages, and 729,375 agricultural parcels, (3) List the cumulative population of each stage, (4) calculate the sampling interval using the formula: Sampling interval = cumulated total population ÷ number of clusters required, (5) Select a random number which is equal to or less than the sampling interval, this number will be a random start (RS). The first cluster to be sampled contains this cumulative population, (6) Add the sampling interval to the random start: RS; RS+SI: RS+2SI;…RS+(d-1)*SI., (7) Identify the location of each subsequent cluster from the cumulative population that contains one of the serial numbers calculated from adding the sampling interval to the random start, and (8) When the location is identified which will be the village in the 3^{rd} stage sampling, the agricultural parcel list will be attained from the office of Subdistrict Administrative Organization (Office of the SAO) tax database. The simple random sampling will be used to select 52 parcels in each village in the 4^{th} stage sampling. Totally, there will be 780 samples from 15 villages. The parcel sample list of the 4^{th} stage sampling is available upon request due to the redundant data on file and document from the Office of SAO.

Table 1 Population List of the First 3 Stage of the Sampling Process

District Number	District Name	Sub-district No.	Sub-district Name	Number of Village
1	Muang Khon-Kaen	1	Nai-Muang	1
		2	Sam-ran	13
		3	Kok-Sri	14
		4	Ta-pra	20
		5	Ban-toom	18
		6	Muang-Kao	17
		7	Phra-Lup	19
		8	Savatee	23
		9	Ban Wa	13
		10	Ban kor	19
		11	Daeng Yai	11
		12	Don Chang	8
		13	Don Han	15
		14	Sila	28
		15	Ban Ped	23
		16	Nong Tum	11
		17	Beung Nium	12
		18	NonTon	10
2	Ban-Fang	1	Nong Bao	11
		2	PaWaiNang	9
		3	Non Kong	10
		4	Ban Lao	13
		5	PaManao	9
		6	Ban Fang	12
		7	Kok-Ngam	10
3	Phra-Yuen	1	Phra-Yuen	15
		2	Phra-Bu	8
		3	Ban Ton	6
		4	Nong Wang	8
		5	Kham Pom	9
4	Nong Ruea	1	Nong Ruea	13
		2	Ban Meng	18
		3	Ban Kong	10
		4	Yang Kam	14
		5	Jorakae	13
		6	Nong-Thong	21
		7	Kud-Kwang	21
		8	Non-Tun	14
		9	Non-Sa-at	15
		10	Ban-Pue	10

District Number	District Name	Sub-district No.	Sub-district Name	Number of Village
5	Chum-Pae	1	Chum-Pae	18
		2	Non-Hun	10
		3	Na-Nong-Tum	13
		4	Non-Udom	11
		5	Khua riang	12
		6	Nong Pai	19
		7	Chai-Sor	10
		8	Wang Hin Lard	12
		9	Na-Pieng	14
		10	Nong-Khiat	10
		11	Nong-SaoLao	10
		12	Non-Sa-at	9
6	Si-Chompoo	1	Si-Chompoo	11
		2	Sri-suk	15
		3	Najan	14
		4	Wang Perm	13
		5	Sam-Yang	6
		6	Nong Daeng	11
		7	Dong-Lan	11
		8	Boriboon	12
		9	Ban Mai	10
		10	Poo Han	7
7	Nam Pong	1	Nam Pong	17
		2	Wang Chai	16
		3	Nong Kung	11
		4	Bao Yai	17
		5	Sa at	14
		6	Muang Whan	14
		7	Ban Kham	16
		8	Bao Ngen	17
		9	Sai Mul	13
		10	Ta Kra Serm	10
		11	Pang Tui	13
		12	Kud Namsai	10
8	Ubonrat	1	Kok Soong	13
		2	Ban Dong	14
		3	Kuen Ubonrat	10
		4	Na Kum	13
		5	Sri Suk Samran	9
		6	Tung Pong	9
9	Kra nuan	1	Nong Ko	19
		2	Nong KungYai	13

District Number	District Name	Sub-district No.	Sub-district Name	Number of Village
		3	Huay Jode	11
		4	Huay Yang	8
		5	Ban Fang	11
		6	Doon Sard	11
		7	Nong No	7
		8	Nam Oam	8
		9	Hua Na Kam	10
10	Ban Pai	1	Ban Pai	13
		2	Nai Muang	9
		3	Muang Fia	13
		4	Ban Lan	15
		5	Khaen Neua	9
		6	Poo Lek	8
		7	Pa Por	9
		8	Sin Tang	11
		9	Nong Namsai	11
		10	Hao Nong	6
11	Pueai Noi	1	Pueai Noi	7
		2	Wang Muang	8
		3	Kham Pom	10
		4	Sra Kaew	7
12	Pon	1	Muang Pon	11
		2	Jod Nong Kae	14
		3	Kao Kgew	11
		4	Nong Makhuea	9
		5	Nong Wang Sok Phra	14
		6	Peck Yai	10
		7	Kok Sanga	10
		8	Nong Weng Nang Pao	13
		9	Lom Kom	11
		10	Non Kha	9
		11	Sok Nok Ten	11
		12	Hao Tung	8
13	Waeng Yai	1	Korn Chim	9
		2	Mai Napiang	14
		3	Non Thong	11
		4	Waeng yai	7
		5	Non Saat	11
14	Waeng Noi	1	Waeng Noi	13
		2	Kanluaeng	14
		3	Tanagmaew	10
		4	Lahanna	16

District Number	District Name	Sub-district No.	Sub-district Name	Number of Village
		5	Tawat	10
		6	Tangkwang	11
15	Nong Song Hong	1	Nong Song Hong	17
		2	Khuem Chat	9
		3	Non That	11
		4	Ta kua pa	11
		5	Samrong	9
		6	Nongmag	15
		7	Dondu	11
		8	Dongkeng	13
		9	Hanjode	12
		10	Dondung	10
		11	Wang Hin Lard	8
		12	Nong Pai Lom	9
16	Poo Wieng	1	Ban rua	9
		2	Wa Thong	8
		3	KudKhonKaen	15
		4	Nachumsaeng	12
		5	Na wah	11
		6	Nongkungthanasarn	16
		7	Nongkungsle	9
		8	Songpuay	11
		9	Tumchompoo	8
		10	Dindum	7
		11	Poo wieng	8
17	Munjakiri	1	Kudkao	17
		2	Suanmon	14
		3	Nongpean	16
		4	Ponpeg	14
		5	Kamkan	13
		6	Nakha	17
		7	Nagnam	14
		8	Tasala	11
18	Chonnabot	1	Chonnabot	13
		2	Kutpiengyom	7
		3	Wangsaeng	11
		4	Huaykae	9
		5	Bantaen	8
		6	Sriboonruang	12
		7	Nonpayom	10
		8	Po daeng	10

District Number	District Name	Sub-district No.	Sub-district Name	Number of Village
19	Kaosuankwang	1	Kaosuankwang	11
		2	Dongmuangann	15
		3	Nangew	7
		4	Nonsomboon	10
		5	Kammuang	13
20	Phu pha man	1	Nonkom	8
		2	Nafai	6
		3	Phuphaman	9
		4	Wangsawap	10
		5	Huaymuang	8
21	Sam Soong	1	Kranuan	6
		2	Kammat	5
		3	Bannon	9
		4	KuKam	8
		5	Huaytei	7
22	Kokpochai	1	Bankok	11
		2	Pochai	10
		3	Supsomboon	11
		4	Napaeng	8
23	Nongnakam	1	Kutthat	16
		2	Bankok	8
		3	Kanuan	11
24	Banhad	1	Banhad	11
		2	Koksamran	16
		3	Nonsomboon	11
		4	Nongsaeng	7
25	Nonsila	1	Nonsila	7
		2	Nongplamor	8
		3	Banhun	16
		4	Puayyai	8
		5	Nondaeng	7
26	Wieng Kao	1	Naimuang	15
		2	Muangkaopattana	10
		3	Kaonoi	11
Total				2,297

Stage I District Sampling

Sampling interval = 199/15 = 13, random start = 2. Serial numbers are as follow:

2	15	28	41	54	67	80	93	106	119	132	145	158	171	184

District Number	Number of Sub-district	Number of Sub-district Accumulation	Accumulate Interval	Selection
1	18	18	1-18	√√
2	7	25	19-25	
3	5	30	26-30	√
4	10	40	31-40	
5	12	52	41-52	√
6	10	62	53-62	√
7	12	74	63-74	√
8	6	80	75-80	√
9	9	89	81-89	
10	10	99	90-99	√
11	4	103	100-103	
12	12	115	104-115	√
13	5	120	116-120	√
14	6	126	121-126	
15	12	138	127-138	√
16	11	149	139-149	√
17	8	157	150-157	
18	8	165	158-165	√
19	5	170	166-170	
20	5	175	171-175	√
21	5	180	176-180	
22	4	184	181-184	√
23	3	187	185-187	
24	4	191	188-191	
25	5	196	192-196	
26	3	199	197-199	
Total	199			

Stage II Sub-district Sampling

Sampling interval = 1,513/15 = 101, random start = 84. Serial numbers are as follow:

84	185	286	387	488	589	690	791	892	993	1,094	1,195	1,296	1,397	1,498

District Number	Sub-district Number	Number of Village	Number of Village Accumulation	Accumulate Interval	Selection
1	1	1	1	1	
	2	13	14	2-14	
	3	14	28	15-28	
	4	20	48	29-48	
	5	18	66	49-66	
	6	17	83	67-83	
	7	19	102	84-102	√
	8	23	125	103-125	
	9	13	138	126-138	
	10	19	157	139-157	
	11	11	168	158-168	
	12	8	176	169-176	
	13	15	191	177-191	√
	14	28	219	192-219	
	15	23	242	220-242	
	16	11	253	243-253	
	17	12	265	254-265	
	18	10	275	266-275	
3	1	15	290	276-290	√
	2	8	298	291-298	
	3	6	304	299-304	
	4	8	312	305-312	
	5	9	321	313-321	
5	1	18	339	322-339	
	2	10	349	340-349	
	3	13	362	350-362	
	4	11	373	363-373	
	5	12	385	374-385	
	6	19	404	386-404	√
	7	10	414	405-414	
	8	12	426	415-426	
	9	14	440	427-440	
	10	10	450	441-450	
	11	10	460	451-460	
	12	9	469	461-469	
6	1	11	480	470-480	

District Number	Sub-district Number	Number of Village	Number of Village Accumulation	Accumulate Interval	Selection
	2	15	495	481-495	√
	3	14	509	496-509	
	4	13	522	510-522	
	5	6	528	523-528	
	6	11	539	529-539	
	7	11	550	540-550	
	8	12	562	551-562	
	9	10	572	563-572	
	10	7	579	573-579	
7	1	17	596	580-596	√
	2	16	612	597-612	
	3	11	623	613-623	
	4	17	640	624-640	
	5	14	654	641-654	
	6	14	668	655-668	
	7	16	684	669-684	
	8	17	701	685-701	√
	9	13	714	702-714	
	10	10	724	715-724	
	11	13	737	725-737	
	12	10	747	738-747	
8	1	13	760	748-760	
	2	15	775	761-775	
	3	10	785	776-785	
	4	13	798	786-798	√
	5	9	807	799-807	
	6	9	816	808-816	
10	1	13	829	817-829	
	2	9	838	830-838	
	3	13	851	839-851	
	4	15	866	852-866	
	5	9	875	867-875	
10	6	8	883	876-883	
	7	9	892	884-892	√
	8	11	903	893-903	
	9	11	914	904-914	
	10	6	920	915-920	
12	1	11	931	921-931	

District Number	Sub-district Number	Number of Village	Number of Village Accumulation	Accumulate Interval	Selection
	2	14	945	932-945	
	3	11	956	946-956	
	4	9	965	957-965	
	5	14	979	966-979	
	6	10	989	980-989	
	7	10	999	990-999	√
	8	13	1012	1000-1012	
	9	11	1023	1013-1023	
	10	9	1032	1024-1032	
	11	11	1043	1033-1043	
	12	8	1051	1044-1051	
13	1	9	1060	1052-1060	
	2	14	1074	1061-1074	
	3	11	1085	1075-1085	
	4	7	1092	1086-1092	
	5	11	1103	1093-1103	√
15	1	17	1120	1104-1120	
	2	9	1129	1121-1129	
	3	11	1140	1130-1140	
	4	11	1151	1141-1151	
	5	9	1160	1152-1160	
15	6	15	1175	1161-1175	
	7	11	1186	1176-1186	
	8	13	1199	1187-1199	√
	9	12	1211	1200-1211	
	10	10	1221	1212-1221	
	11	8	1229	1222-1229	
	12	9	1238	1230-1238	
16	1	9	1247	1239-1247	
	2	8	1255	1248-1255	
	3	15	1270	1256-1270	
	4	12	1282	1271-1282	
	5	11	1293	1283-1293	
	6	16	1309	1294-1309	√
	7	9	1318	1310-1318	
	8	11	1329	1319-1329	
	9	8	1337	1330-1337	
	10	7	1344	1338-1344	

District Number	Sub-district Number	Number of Village	Number of Village Accumulation	Accumulate Interval	Selection
	11	8	1352	1345-1352	
18	1	13	1365	1353-1365	
	2	7	1372	1366-1372	
	3	11	1383	1373-1383	
	4	9	1392	1384-1392	
	5	8	1400	1393-1400	√
	6	12	1412	1401-1412	
	7	10	1422	1413-1422	
	8	10	1432	1423-1432	
20	1	8	1440	1433-1440	
	2	6	1446	1441-1446	
	3	9	1455	1447-1455	
	4	10	1465	1456-1465	
	5	8	1473	1466-1473	
22	1	11	1484	1474-1484	
	2	10	1494	1485-1494	
	3	11	1505	1495-1505	√
	4	8	1513	1506-1513	

Stage III Village Sampling

Sampling interval = 22,768/15 = 1,518, random start = 302. Serial numbers are as follow:

302	1,820	2,978	4,136	5,294	6,452	7,610	8,768	9,926

11,084	12,242	13,400	14,558	15,716	16,874	18,032

District Number	Sub-district Number	Village Number	Number of Agricultural parcel	Parcel Accumulation	Accumulate Interval	Selection
1	7	1	132	132	1-132	
		2	180	312	133-312	√
		3	42	354	313-354	
		4	116	470	355-470	
		5	60	530	471-530	
		6	32	562	531-562	

District Number	Sub-district Number	Village Number	Number of Agricultural parcel	Parcel Accumulation	Accumulate Interval	Selection
		7	51	613	563-613	
		8	192	805	614-805	
		9	60	865	806-865	
		10	67	932	866-932	
		11	29	961	933-961	
		12	141	1102	962-1102	
		13	97	1199	1103-1199	
		14	107	1306	1200-1306	
		15	46	1352	1307-1352	
		16	127	1479	1353-1479	
		17	93	1572	1480-1572	
		18	51	1623	1573-1623	
		19	122	1745	1624-1745	
	13	1	186	1931	1746-1931	√
		2	132	2063	1932-2063	
		3	302	2365	2064-2365	
		4	129	2494	2366-2494	
		5	81	2575	2495-2575	
		6	164	2739	2576-2739	
		7	185	2924	2740-2924	
		8	82	3006	2925-3006	√
		9	158	3164	3007-3164	
		10	92	3256	3165-3256	
1	13	11	48	3304	3257-3304	
		12	138	3442	3305-3442	
		13	80	3522	3443-3522	
		14	160	3682	3523-3682	
		15	103	3785	3683-3785	
3	1	1	117	3902	3786-3902	
		2	82	3984	3903-3984	
		3	146	4130	3985-4130	
		4	162	4292	4131-4292	√
		5	318	4610	4293-4610	
		6	196	4806	4611-4806	
		7	84	4890	4807-4890	
		8	92	4982	4891-4982	
		9	121	5103	4983-5103	
		10	172	5275	5104-5275	
		11	143	5418	5276-5418	√
		12	125	5543	5419-5543	
		13	160	5703	5544-5703	
		14	91	5794	5704-5794	

District Number	Sub-district Number	Village Number	Number of Agricultural parcel	Parcel Accumulation	Accumulate Interval	Selection
		15	89	5883	5795-5883	
5	6	1	143	6026	5884-6026	
		2	225	6251	6027-6251	
		3	147	6398	6252-6398	
		4	313	6711	6399-6711	√
		5	92	6803	6712-6803	
		6	166	6969	6804-6969	
		7	204	7173	6970-7173	
		8	247	7420	7174-7420	
		9	344	7764	7421-7764	√
		10	135	7899	7765-7899	
		11	91	7990	7900-7990	
		12	127	8117	7991-8117	
		13	207	8324	8118-8324	
		14	147	8471	8325-8471	
		15	43	8514	8472-8514	
		16	97	8611	8515-8611	
6	2	1	131	8742	8612-8742	
		2	161	8903	8743-8903	√
		3	127	9030	8904-9030	
		4	139	9169	9031-9169	
		5	111	9280	9170-9280	
6	2	6	47	9327	9281-9327	
		7	30	9357	9328-9357	
		8	76	9433	9358-9433	
		9	79	9512	9434-9512	
		10	53	9565	9513-9565	
		11	127	9692	9566-9692	
		12	113	9805	9693-9805	
		13	108	9913	9806-9913	
		14	95	10008	9914-10008	√
		15	81	10089	10009-10089	
7	1	1	244	10333	10090-10333	
		3	492	10825	10334-10825	
		5	111	10936	10826-10936	
		6	155	11091	10937-11091	√
		7	187	11278	11092-11278	
		8	382	11660	11279-11660	
		9	93	11753	11661-11753	
		10	64	11817	11754-11817	
		11	320	12137	11818-12137	
		12	121	12258	12138-12258	√

District Number	Sub-district Number	Village Number	Number of Agricultural parcel	Parcel Accumulation	Accumulate Interval	Selection
		14	57	12315	12259-12315	
		16	139	12454	12316-12454	
		17	106	12560	12455-12560	
	8	1	113	12673	12561-12673	
		2	117	12790	12674-12790	
		3	127	12917	12791-12917	
		4	125	13042	12918-13042	
		5	120	13162	13043-13162	
		6	84	13246	13163-13246	
		7	44	13290	13247-13290	
		8	167	13457	13291-13457	√
		9	219	13676	13458-13676	
		10	181	13857	13677-13857	
		11	176	14033	13858-14033	
		12	25	14058	14034-14058	
		13	235	14293	14059-14293	
		14	69	14362	14294-14362	
		15	96	14458	14363-14458	
		16	78	14536	14459-14536	
		17	99	14635	14537-14635	√
8	4	1	131	14766	14636-14766	
		2	108	14874	14767-14874	
		3	79	14953	14875-14953	
		4	44	14997	14954-14997	
		5	15	15012	14998-15012	
		6	25	15037	15013-15037	
		7	97	15134	15038-15134	
		8	82	15216	15135-15216	
		9	171	15387	15217-15387	
		10	163	15550	15388-15550	
		11	49	15599	15551-15599	
		12	87	15686	15600-15686	
		13	92	15778	15687-15778	√
10	7	1	152	15930	15779-15930	
		2	222	16152	15931-16152	
		3	206	16358	16153-16358	
		4	47	16405	16359-16405	
		5	90	16495	16406-16495	
		6	81	16576	16496-16576	
		7	157	16733	16577-16733	
		8	155	16888	16734-16888	√

District Number	Sub-district Number	Village Number	Number of Agricultural parcel	Parcel Accumulation	Accumulate Interval	Selection
		9	61	16949	16889-16949	
		10	111	17060	16950-17060	
		11	142	17202	17061-17202	
12	7	1	80	17282	17203-17282	
		2	102	17384	17283-17384	
		3	178	17562	17385-17562	
		4	220	17782	17563-17782	
		5	95	17877	17783-17877	
		6	207	18084	17878-18084	
		7	108	18192	18085-18192	
		8	58	18250	18193-18250	
		9	47	18297	18251-18297	
		10	30	18327	18298-18327	
13	5	1	186	18513	18328-18513	
		2	70	18583	18514-18583	
		3	221	18804	18584-18804	
		4	128	18932	18805-18932	
		5	59	18991	18933-18991	
		6	93	19084	18992-19084	
		7	90	19174	19085-19174	
		8	175	19349	19175-19349	
		9	109	19458	19350-19458	
		10	45	19503	19459-19503	
		11	90	19593	19504-19593	
15	8	1	57	19650	19594-19650	
		2	59	19709	19651-19709	
		3	74	19783	19710-19783	
		4	23	19806	19784-19806	
		5	61	19867	19807-19867	
		6	53	19920	19868-19920	
		7	60	19980	19921-19980	
		8	58	20038	19981-20038	
		9	94	20132	20039-20132	
		10	121	20253	20133-20253	
		11	139	20392	20254-20392	
		12	20	20412	20393-20412	
		13	77	20489	20413-20489	
16	6	1	13	20502	20490-20502	
		2	10	20512	20503-20512	
		3	12	20524	20513-20524	
		4	25	20549	20525-20549	
		5	3	20552	20550-20552	

District Number	Sub-district Number	Village Number	Number of Agricultural parcel	Parcel Accumulation	Accumulate Interval	Selection
		6	5	20557	20553-20557	
		7	6	20563	20558-20563	
		8	17	20580	20564-20580	
		9	7	20587	20581-20587	
		10	11	20598	20588-20598	
		11	20	20618	20599-20618	
		12	14	20632	20619-20632	
		13	4	20636	20633-20636	
		14	5	20641	20637-20641	
		15	8	20649	20642-20649	
		16	11	20660	20650-20660	
18	5	1	61	20721	20661-20721	
		2	89	20810	20722-20810	
		3	140	20950	20811-20950	
		4	138	21088	20951-21088	
18	5	5	152	21240	21089-21240	
		6	59	21299	21241-21299	
		7	113	21412	21300-21412	
		8	45	21457	21413-21457	
22	3	1	121	21578	21458-21578	
		2	175	21753	21579-21753	
		3	129	21882	21754-21882	
		4	168	22050	21883-22050	
		5	195	22245	22051-22245	
		6	107	22352	22246-22352	
		7	106	22458	22353-22458	
		8	67	22525	22459-22525	
		9	152	22677	22526-22677	
		10	91	22768	22678-22768	

Selected areas from the 1st – 3rd stage of multi-stage cluster sampling using probability proportional to size are as in table below.

District No.	District Name	Sub-district No.	Sub-district Name	Village number
1	Muang Khon-Kaen	7	Phra-Lup	2
		13	Don Han	1, 8
3	Phra-Yuen	1	Phra-Yuen	4, 11
5	Chum-Pae	6	Nong Pai	4, 9
6	Si-Chompoo	2	Sri-suk	2, 14
7	Nam Pong	1	Nam Pong	6, 12
		8	Bao Ngen	8, 17
8	Ubonrat	4	Na Kum	13
10	Ban Pai	7	Pa Por	8
Total	7 Districts		9 Sub-district	15 Villages

The 4th stage of parcel selection was conducted by simple random sampling method. There are 52 parcels for each village. Total sample selected are 780 from 15 villages.

APPENDIX C

DEPTH INTERVIEW

There are four questions for the depth interview and the time spent on each land owner is 30 minutes and more. Some land owners do not aware of the adverse possession law and some details of the land rental act, therefore explanations and policies' background must be discussed prior to get to the questions. The questions are as follow.

1) The government is considering to issue a progressive tax rate for the abandoned land. The abandoned land will have a higher tax rate than the used land. What do you think about this? And do you think that the new tax rate will be a burden for you?

2) If the government collect the tax for the people who own the land more than 50 rai higher than the people who own less than 50 rai, what do you think about it?

3) The objective of the adverse possession law is to discourage the land abandonment, do you think that the land acquisition through adverse possession law is fair to the land owner?

4) What do you think about the Agricultural land rental act of 1981 which favor tenant farmer?

(1) Leasing period enforced by this law is 6 year. Although, the land owner and tenant farmer agreed for a yearly contract, the law protects the tenant farmer up to 6 years.

(2) The termination of the contract can be done only if the owner would like to do agriculture by themselves and it require the land rental sub-district committee to terminate the contract not the land owners them self.

(3) The leasing rate is set by the land rental sub-district committee every 3 years.

(4) If the land owner would like to sell their land, it required to provide the existing tenants with the first opportunity to purchase the land.

Land Owner 1

Questions	Answers
1	It is not good that we need to pay higher tax if we abandon our land. I think the current rate is the appropriated rate. I can take the current rate but If we need to pay higher tax, we will be in trouble.
2	If the tax rate is higher for the people who own more than 50 rai, it will create a double standard in our society. People will be divided into two groups; the rich and the poor. Rich people will think that the government supports only the poor and think that we are their burden. I think it should be collected equally because everyone has equal freedom. We should accept that they are rich because of their former merit and fortune.
3	It is certainly unfair to the land owner. I hate this law. The fact is the people who use or possess other people's land should be punished but we do the opposite which is so bad.
4.1	I agree with it as the tenant farmer who invest their labor on the land should get enough period to cultivate the land especially for the former abandoned parcel which the tenant must invest a lot to make it good enough for crop production. If the leasing period is too short, it is not good for the tenant.
4.2	I do not agree with this. The land owner and the tenant should have a freedom to make leasing agreement by their own. When the land rental sub-district committee get involve, it will only create more difficulty. The land owner should have a full right on their own land as they would certainly want to lease their land if the tenant is really good. We should leave some choice for the land owner.

Questions	Answers
4.3	The land owner and the tenant farmer should be able to make a decision on the leasing fee. In case the fee must be adjusted immediately but the land owner have to wait until the end of three year to be able to raise the rental rate, the land owner will have an opportunity cost.
4.4	I do not agree with this. The land owner should have a right to decide who they would sell their land to especially for those who offer a higher price. Think about this, it is bad enough if the tenant farmer is not good, we need to wait up to 6 years according to this law in order to change a new tenant. Now you said that we must sell our own land to the bad tenant farmer who would definitely offer a low price and we can sell to other people only if this bad tenant farmer does not want to buy it. So when we will be able to sell our own land? At least 6 years, right? This is unacceptable for me.

Land Owner 2

Questions	Answers
1	I agree with it. If the land owners do not use their land, the tax rate should be higher than those who actually cultivate the land. I think this is the right way to solve the land abandonment problem.
2	I agree with it. People who has big parcel should pay more than those who has small parcel.
3	I do not agree with the adverse possession law. I saw one case in my village. The one who took the land is the tenant farmer. They took the land that belongs to the land owner by this law. I think this is too much. They took advantage of that kind land owner to get that parcel. The right way is to proceed with an eviction not to give them the plot

Questions	Answers
	like this. I think we are encouraging people to be a thief by this law not discouraging land abandonment.
4.1	I agree with it because tenant farmers typically do different kind of crop production for example a perennial plant which takes 5-6 years to cultivate. If the contract is too short, they will not be able to cultivate what they have invested.
4.2	I agree with it. It will be very good if the land rental sub-district committee get involve with the leasing process. I am not only own a parcel but I am a tenant as well. I lease some parcel for 20 years now but the land rental sub-district committee never recognized or get involved in the leasing process.
4.3	I agree with it as the land owner always changes the rental rate based on the rice price. If the rice price is rising, they would ask for a higher rate. I think the rate is changed too often. The big plot land owners mostly are the money sucker. I own only a small plot. If I have a big plot like them, I will not behave like that. There is a case that the land owner deceive tenant farmer to make a registration that their paddy field was flood to get a subsidy from the government but when they get the money, they do not share it with the tenant. The land owner took all the money even they are very rich already.
4.4	I agree with it because the tenant farmers typically grow more than one crop on the parcel. They do not only grow rice. Land owner should let the tenant cultivate what they have invested before selling the parcel to someone else. There is a case in my village that the tenant farmer does paddy farming as usual but a new land owner claim that the tenant intrudes his paddy field. He brought that parcel and wanted the tenant

Questions	Answers
	to leave the plot immediately. From that incident, the tenant farmer did not only lose their rental fee to the former land owner but also the expense for hiring a tractor for plowing the paddy field.

Land Owner 3

Questions	Answers
1	I agree with it as the capitalist who buy a lot of parcel for speculation have a lot of money to pay for it for sure.
2	This is so good, so that we can use the money to develop the local community and the country.
3	It is not fair for the land owner. It will discourage the land owner to lease their land and encourage the land abandonment. They will be afraid that the tenant farmer will take their land through adverse possession law.
4.1	I agree with it as it helps to prevent the land owner to cheat the tenant farmer. Assume that there is a big flood this year, tenant farmer would not be able to make any production. There will be no output but they have to pay for the rental fee. If land owner terminate the contract that year, tenant farmer would be in a big trouble. The six year contract helps a lot in this case as in the second or third year that there is no flood, there will be some output to compensate for the rental fee this year.
4.2	I agree with it as the tenant farmer would like to have the output from their leasing plot as they have already paid for the rental fee.

Questions	Answers
4.3	I agree with it as the land owners typically raise the rental fee every year. If there is a third party to help to set up the rental rate, I think we will be able to get a fair price for both parties.
4.4	As a land owner and a tenant farmer myself. I agree with this as the tenant farmer is the one who clear the forest and develop the plot, therefore they should have an opportunity before someone else to purchase the land. Clearing and developing the abandoned plot is a hard job, we should recognize those people who did the job.

Land Owner 4

Questions	Answers
1	As a land owner who has other job in the city, I do not agree with it. I do not own a big plot, so the current tax rate is good for me but I have planned to purchase more land in the future and honestly I don't have enough time to take care of them as I have a full time job in town. If I have to take care of the high tax until I will be able to cultivate my parcel in the future, it would be a real burden for me. I think in 15-20 years, I will be back and cultivate the land as I hate being in town but I own only a parcel of 3 rai, what can I do from it. The plot is too small to do anything except a small production of vegetable. I have to save some money to buy more space. I think the best size is about 15-20 rai which is sufficient for a single family like mine; I, my wife and a son.
2	I do not agree with it as we have been working hard in order to save some money and to be able to own something. This means that you should not be trying to get out of poverty, right? When you try you will have to pay more for your endeavor. This is not right for me.

Questions	Answers
	Poor people, they are poor because they are lazy. There are a lot of jobs out there for everyone. It is very easy to find a job or to have something to do but the poor people chose to sleep instead of working. I have seen people in my village since I was a little boy, they were so available all day. Sit here and there and talk about their poverty without doing anything. Just to complain and make a request from the government. The attitude has to be changed around here. They think they don't have resources on hand for crop production but once they have it like Sor.Por.Kor parcel from the government, they will just sell it and sleep at home as usual. It is not about what they don't have, it is the way they think about it.
3	It is extremely not fair to the land owner. Think about it. Suppose that you are working so hard in the city with an objective to own a 20 rai parcel. You have been saving money for 10 years to get that land with a hope that you will retire from the company and the life in a busy city in the next 10 years. When the time come, you found someone who has not done anything at all live on your parcel for 10 year and claim for the right over your 20 year of hard work. How do you feel? This kind of law should be cancelled. Actually, it should not be implemented in the first place.
4.1	The law is out of date already. Six year should be set for perennial plant not rice paddy field. We are not living in aristocratic era anymore that there is no opportunity for the poor. We are living in a capitalism era. Everyone has an equal freedom to make their own decision. Land owner and tenant should be able to make their own decision that how long the leasing contract should be.

Questions	Answers
4.2	I do not agree with it. The land owner should have the full right over their own parcel. What they are going to do with their own land is their own freewill. What if your parcel is located near a university and it is a good location to do an apartment or a commercial building, will you continue the rice production? If leasing the land limits the right of land owner, they would prefer to abandon their land. If I were the land owner, I will never give it a lease.
4.3	I do not agree with it. As I said the land owner should have the full right over their own land. Why the land rental sub-district committee has to get involved in the leasing process? Is there any additional expense for the committee? It will only create a corruption in a leasing process. Whenever the government officer is involved, there will always be a corruption. I don't really see the point of a third party in this process. If the tenant farmer do not agree or satisfy with the agreement, they would be able to refuse to lease the plot. It is easy like that. No one can compel them to lease the land.
4.4	This is ridiculous. If the tenant farmer can afford, they do not lease for it in the first place. Beside, when they can manage to save some money, they will have to go for the lower quality of parcel. Normally, the leasing plot is the fertile parcel for crop production and its rent is very high. I think the whole set of this law should be revised. It does not actually help the farmer. Have you ever heard of this saying "Give a man a fish and you feed him for a day; teach a man to fish and you feed him for a life time" Our government has been giving the poor a fish for decades, they should stop doing that and start to teach the poor to fish now.

Land Owner 5

Questions	Answers
1	I agree with it. The land owners who abandon their land will certainly cultivate their land by this new regulation. I have own only 6 rai parcel and currently, I pay very low tax each year that I don't even think about it. As an owner of small parcel, a new tax rate should not be any burden for me but for my relative who own 70 rai is different. I am indifferent with the new tax rate but I think you should ask the rich people who own big plot bout this.
2	It has to be separated into two cases here. First, the land owner who own over 50 rai but cultivate the land and second those who own over 50 rai but abandon their land. I think it is the right thing to collect the higher tax rate for the land owner who own over 50 rai as the people who own a bigger plot, they should have a larger income from crop production than those who own smaller plot. Therefore they have to pay a higher tax rate but they have to pay a lot higher rate if they abandon their land.
3	It is wrong to issue this regulation from the start. This law violate an individual right. The land owner should have the right over their own land whether to use or to abandon. You can collect higher tax for the abandon land but not give it to someone else. In case the abandon parcel belong to the government such as Sor.Por.Kor., adverse possession should be applied. We should give it to someone else if the people who get the usufruct right do not actually use it.
4.1	I think it is fair for the tenant farmer as 3-5 years is enough to get what they have invested in the plot. If it is only 1 year, it is too short to get all output back.

Questions	Answers
4.2	It is good to have a third party to get involved in the leasing process as when there is any argument later there will be a witness to end the debate.
4.3	I think the rental rate should be changed every 3 years as it is the appropriate period to get all we have invested in crop production. I totally agree with it.
4.4	It is o.k. for me but if the tenant farmer cannot afford we should be able to sell it to someone else. We should not have to wait until they can afford just because they wish to buy. In case they have to spend 1,000 years to save the money for our parcel, we will definitely die before the sale happen and no one will get anything.

APPENDIX D

QUESTIONNAIRE FOR FIELD INTERVIEW SURVEY

Questionnaire on Agricultural Parcel

Agricultural Land Abandonment in Thailand:

A case of Khon-Kaen Province

Parcel Number.....

Introductory Statement

Agricultural Land Abandonment in Thailand causes substantial losses each year. The information provided by you in this interview about your agricultural parcel and activities will contribute to understanding the likely impacts of factors on agricultural land abandonment. Your responses to these questions are anonymous. The content of this questionnaire consists of two parts:

Part I: General Information of land owner

Part II: Land use activities

Interviewer.....

Contact number.....Date of interview.....

Time of interview.....Place of interview….....

Part I: General Information of Land Owner

1. Name……
   Number of Mooban…..Tambon name……..…….
2. Sex ( ) Male ( ) Female
3. Age…….……years old
4. Household size (of owner of the farm): ……..……
5. How long have you been farmers or hold the agricultural land?.....Years
6. Have you ever study or attend a seminar in agricultural field?
   ( ) Yes please specify the level of the study
   ……Seminar with the government institution
   ……..Primary level
   ……..Secondary level
   ……..High school level
   ……..Diploma level
   ……..Bachelor level
   ……..Above Bachelor level
   ( ) Never
7. Income from selling the agricultural output
   ( ) approximately……..Baht/year
   ( ) No income

8. The source of other income apart from your major income

( ) Salary: approximately……..Baht/year

( ) Relatives providing support: approximately……Baht/year

( ) Lease the land: approximately……...……...Baht/year

( ) Other, please specify…….

Approximately……Baht/year

( ) No other income

- Total of (7) + (8) divided by 12.....Baht/month

9. Expenses and Saving of the Owner ‘s Household

Description	Amount (Bath/month)
<u>Expense</u>	
- Food	……
- Medical care	……
- water supply bill	……
- electricity bill	……
- Kids’ tuition fee (in a year)	……
- Gasoline expenses	……
- Loan interest expense (interest rate.....) from.....	……
- Lottery	……
- Other, please specify……..	……
	……
• **Total Expenses**	
<u>Saving</u>	

Part II: Land Use Activities

Parcel no.	Land size	Type of property right 1. Title deed (NS-4) 2. Land right investigation (NS-5) 3. Certificate of use (NS-3, SPK.) 4. Preemptive certificate (NS-2) 5. Land possession notice (SK-1) 5. No right (PBT-5)	Season no.	Crop grow 1. rice 2. sugarcane 3. cassava	Annual crop yield (kgs/bucket/ton/sack) per rai	Farm gate price (baht/kg, baht/bucket, baht/ton, baht/sack)
1			1.(…….m.)			
			2.(…….m.)			
			3.(…….m.)			
2			1.(…….m.)			
			2.(…….m.)			
			3.(…….m.)			
3			1.(…….m.)			
			2.(…….m.)			
			3.(…….m.)			
4			1.(…….m.)			
			2.(…….m.)			
			3.(…….m.)			
5			1.(…….m.)			
			2.(…….m.)			
			3.(…….m.)			

- **Note: 1 bucket = …….kg, 1 sack = ……kg**

Parcel no.	Pesticide use/rai/season (kg/litre/cc.)	Pesticide expense (Baht/kg, baht/liter, baht/cc.)	Fertilizer use/rai/season (kg/sack/ton)	Fertilizer expense (Bath/kg, baht/sack, baht/ton)
1				
2				
3				
4				
5				

- **Note: 1 sack = …….kg**

Parcel no.	Household labor			Hired labor			Machine labor	
	Number of labor/ season (man)	Avg.Working Hours/Day (hours)	Number of working day/season (days)	Number of labor/ season (man)	Avg.Working hours/ Day (hours)	Number of working day/season (days)	Number of hour work/ season (hours)	Total wage/season (baht)
1								
2								
3								
4								
5								

Parcel no.	Main source of water 1. underground water 2. rain 3. river 4. irrigation	Soil Fertility level (High/Medium/Low)	Distance from city (Kms.)	Approximate Land Rent (Baht/Rai)
1				
2				
3				
4				
5				

10. Do you have machine to do agriculture?

( ) No

( ) Yes, please specify in below table

Machinery Type	Number	Average price per unit (Baht)	Years of utilization (Years)
1.Cutlass, machete			
2. Tractor			
3. Plough			
4. Trolley/Trailers			
5.Thresher			
6.Fodder cutting machine			
7. Generator/Diesel Pumps (including groundwater pumps)			
8. Spraying machines (chem./fertilizer)			
9.Harvester machine			
10.Other heavy machine. Please specify…….			

11. Why you abandon your land? (Be able to choose more than 1 answer)

( ) Lack of water supply

( ) Short of labor

( ) Lack of agricultural machine

( ) Inappropriate soil quality

( ) I have other job

( ) No road access to my parcel

( ) No cash for investment

( ) Intend to keep my parcel for speculation

( ) There is news on a mega project construction nearby

( ) If I let it lease, there will be a problem on a tenant eviction

( ) If I let it lease, there will be a problem on adverse possession

( ) Others, please specify……

12. Do you worry about these leasing problems? (Be able to choose more than 1 answer)
    ( ) No, I do not worry about these problems.
    ( ) Yes, and the problem that concern me are:
        ( ) Tenant does not pay for the lease
        ( ) Tenant does not leave when the contract is over
        ( ) Tenant over utilize my parcel
        ( ) Tenant claim for the right over my parcel through adverse possession law.

13. Do you aware of the Land Rental Act 1981 article 53-54 and the Civil and Commercial Code Section 537-571 Title IV Hire of Property which enforce a minimum 6 years lease period and in case the landowner desired to sell their land, they were require to provide the existing tenant with the first opportunity to purchase the land. In addition, the law prohibits a landowner from evicting a tenant before the lease agreement has expired.
    ( ) Yes ( ) No

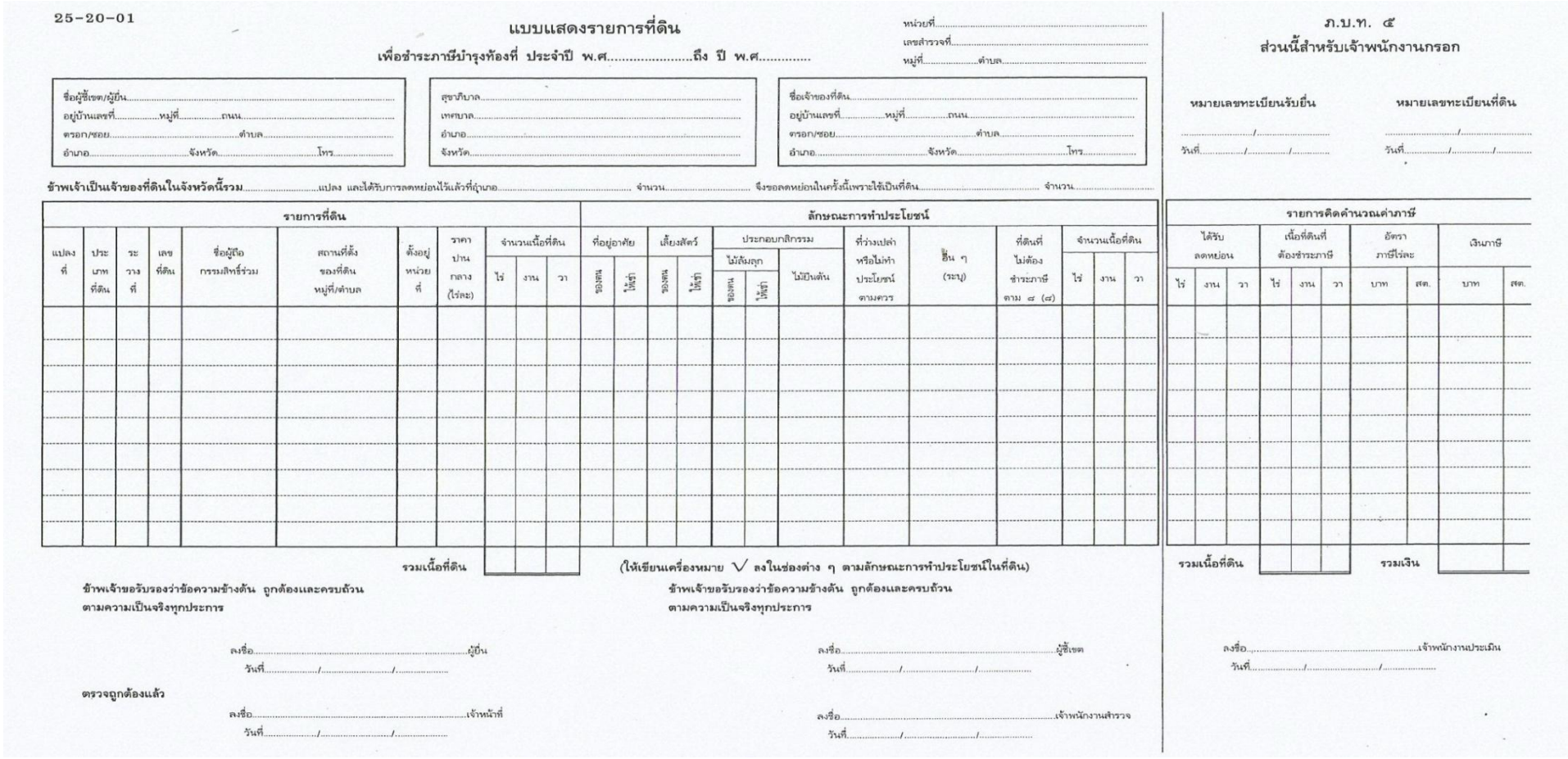
14. Do you aware of the adverse possession law which refers to a person in possession of land owned by someone else may acquire valid title to it, by cultivating and showing possession to public for 10 years?
    ( ) Yes ( ) No

15. Did you pay the land tax to the office of Subdistrict Administrative Organization last year?
    ( ) Yes ( ) No

----------Thank you for your kind cooperation----------

APPENDIX E

POR. BOR. TOR.5 FORM



25-20-01

แบบแสดงรายการที่ดิน

เพื่อชำระภาษีบำรุงท้องที่ ประจำปี พ.ศ.....ถึง ปี พ.ศ.....

หน่วยที่.....
เลขสำรวจที่.....
หมู่ที่.....ตำบล.....

ชื่อผู้ชี้เขต/ผู้ยื่น.....
อยู่บ้านเลขที่.....หมู่ที่.....ถนน.....
ตรอก/ซอย.....ตำบล.....
อำเภอ.....จังหวัด.....โทร.....

สุขาภิบาล.....
เทศบาล.....
อำเภอ.....
จังหวัด.....

ชื่อเจ้าของที่ดิน.....
อยู่บ้านเลขที่.....หมู่ที่.....ถนน.....
ตรอก/ซอย.....ตำบล.....
อำเภอ.....จังหวัด.....โทร.....

ข้าพเจ้าเป็นเจ้าของที่ดินในจังหวัดนี้รวม.....แปลง และได้รับการลดหย่อนไว้แล้วที่กำนัน/ผู้ใหญ่บ้าน..... จำนวน..... จึงขอลดหย่อนในครั้งนี้เพราะใช้เป็นที่ดิน..... จำนวน.....

รายการที่ดิน

แปลงที่	ประมาทที่ดิน	ระวางที่	เลขที่ดิน	ชื่อผู้ถือกรรมสิทธิ์ร่วม	สถานที่ตั้งของที่ดิน หมู่ที่/ตำบล	ตั้งอยู่หน่วยที่	ราคาปานกลาง (ไร่ละ)	จำนวนเนื้อที่ดิน ไร่	งาน	วา
							รวมเนื้อที่ดิน			

ลักษณะการทำประโยชน์

ที่อยู่อาศัย ของตน	ที่อยู่อาศัย ให้ผู้อื่น	เลี้ยงสัตว์ ของตน	เลี้ยงสัตว์ ให้ผู้อื่น	ประกอบกสิกรรม ไม้ล้มลุก ของตน	ประกอบกสิกรรม ไม้ล้มลุก ให้ผู้อื่น	ประกอบกสิกรรม ไม้ยืนต้น	ที่ว่างเปล่าหรือไม่ทำประโยชน์ตามควร	อื่น ๆ (ระบุ)	ที่ดินที่ไม่ต้องชำระภาษีตาม ๘ (๙)	จำนวนเนื้อที่ดิน ไร่	งาน	วา

(ให้เขียนเครื่องหมาย ✓ ลงในช่องต่าง ๆ ตามลักษณะการทำประโยชน์ในที่ดิน)

รายการคิดคำนวณค่าภาษี

ได้รับลดหย่อน ไร่	งาน	วา	เนื้อที่ดินที่ต้องชำระภาษี ไร่	งาน	วา	อัตราภาษีไร่ละ บาท	สต.	เงินภาษี บาท	สต.
รวมเนื้อที่ดิน						รวมเงิน			

ข้าพเจ้าขอรับรองว่าข้อความข้างต้น ถูกต้องและครบถ้วน ตามความเป็นจริงทุกประการ

ลงชื่อ.....ผู้ยื่น
วันที่...../...../.....

ตรวจถูกต้องแล้ว

ลงชื่อ.....เจ้าหน้าที่
วันที่...../...../.....

ข้าพเจ้าขอรับรองว่าข้อความข้างต้น ถูกต้องและครบถ้วน ตามความเป็นจริงทุกประการ

ลงชื่อ.....ผู้ชี้เขต
วันที่...../...../.....

ลงชื่อ.....เจ้าพนักงานสำรวจ
วันที่...../...../.....

ภ.บ.ท. ๕

ส่วนนี้สำหรับเจ้าพนักงานกรอก

หมายเลขทะเบียนรับยื่น
...../.....
วันที่...../...../.....

หมายเลขทะเบียนที่ดิน
...../.....
วันที่...../...../.....

ลงชื่อ.....เจ้าพนักงานประเมิน
วันที่...../...../.....

BIOGRAPHY

NAME	Nararuk Boonyanam
ACADEMIC BACKGROUND	Bachelor's Degree in Business Administration from Burapha University, Chonburi, Thailand in 1998, Bachelor's Degree in Education from SukhothaiThammathiraj Open University, Bangkok, Thailand in 2008, and Master's Degree in Business Economics from Kasetsart University, Chonburi, Thailand in 2010
PRESENT POSITION	Lecturer, Faculty of Economics at Sri-racha, Kasetsart University
EXPERIENCES	2000-2002: Sales Representatives, Tycoons Worldwide Group (Thailand) Public Co., Ltd. 2002-2003: Sales Executive, Steel Processing (Thailand) Co., Ltd. 2003-2010: Senior Customer Service Representative, Ampacet (Thailand) Co., Ltd.