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Organic Smallholder Farming in Northwest Vietnam: A Case Study from Tan Lac District, Hoa Binh Province

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ORGANIC SMALLHOLDER FARMING IN NORTHWEST VIETNAM: A CASE STUDY FROM TAN LAC DISTRICT, HOA BINH PROVINCE

by

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ABSTRACT

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This study asks whether organic vegetable production is a suitable alternative farming practice for conventional vegetable farmers in Tan Lac, a mountainous area in the North of Vietnam. The study is motivated by three questions: (1) who among the vegetable farmers in Tan Lac tended to switch to organic vegetable production? (2) is organic vegetable production profitable, compared with conventional production? And (3), what could be done to make organic vegetable production a more sustainable source of income and to help farmers switching to organic farming be more successful?

These questions are answered using quantitative and qualitative data collected from a household survey conducted in 2017 that included 95 smallholder farmers. Focus group discussions and key-informant interviews were also used to learn about farming practices and challenges in the area. A series of regressions are used to examine whether organic vegetable production is more or less profitable than conventional vegetable production, and what characteristics are common among farmers who tend to be organic adopters. The results show that organic vegetable production in the study site is less profitable than conventional production. One hectare of organic vegetables is 42 million dong (1840 USD) less profitable than one hectare of conventional vegetables. To help organic farmers in the study site become more successful, (i) farmers need to be aware not only of the benefits but also the challenges when going organic before making the switch; (ii) production sites must be carefully chosen; (iii) a marketing plan should be

established when production plans are developed; and (iv) smallholder farmers need to cooperate when producing and selling organic vegetables.

CHAPTER 1. INTRODUCTION

Although many smallholder farmers in developing areas of the world are interested in growing vegetables organically, whether to lessen the effects of pesticides on their health or to reach new markets, many are concerned that they may not be able to earn sufficient income to make the switch. Some who make the switch later revert to conventional farming. This thesis studies organic vegetable production in Vietnam, asking whether organic vegetable production is profitable and, if not, what changes might make organic farming a sustainable source of income for farmers. Data collected in 2017 from 95 farms in Tan Lac, a district in the North of Vietnam, are used to study the transition from conventional to organic vegetable production. The ultimate goal is to understand what factors can help organic farmers in Tan Lac to succeed.

1.1 Organic Agriculture

1.1.1 Definition of Organic Agriculture

In the *era of pesticides,* the term organic was first brought to the world by Lord Northbourne (Walter James; 1896-1982), an Oxford University lecturer in agriculture, in his book *Look to the Land,* which was published in 1940 (Paull). The term *organic farming,* which was formerly used only by researchers, is now widely used by farmers, traders, consumers and policy makers worldwide. There is no unique definition for *organic farming*. The definition varies depending on the individual or organization using the term. However, the common idea of organic agriculture places an emphasis on a system based on ecosystem management instead of using external agricultural inputs (FAO, *Organic Agriculture: What Is Organic Agriculture?*). The Food and Agriculture Organization of the United Nations (FAO) defines organic agriculture as:

> [A] holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity. It emphasizes the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adapted systems. This is accomplished by using, where possible, agronomic, biological, and mechanical methods, as opposed to using synthetic materials, to fulfil any specific function within the system (FAO, *Organic Agriculture: What Is Organic Agriculture?*).

The International Federation of Organic Agriculture Movement (IFOAM), which calls itself the umbrella organization of the organic world, with the participation from more than 100 countries, defines organic agriculture as:

> [A] production system that sustains the health of soils, ecosystems and people; relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects; and combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved (IFOAM, *Definition of Organic Agriculture | IFOAM*).

In Vietnam, the definition of organic farming, which is actually the IFOAM's definition translated into Vietnamese, is indicated in The Vietnamese National Standard 11041 on the General Requirements for Organic Production and Labels of Organic Products.

In order to grow and sell organic products, a farm in the US needs to be certified by an accredited certifying agent after 3 years of transitioning from conventional to organic. A final organic product is also certified and labeled with an organic seal (USDA). While farmers in the

Vietnamese study site grew and sold vegetables following organic practices, both their farms and their products have not been certified. This study refers to the IFOAM definition of organic farming when mentioning organic farming or organic production, and refers to organic products as the products produced by farmers following organic practices, not products that have been certified as organic.

1.1.2 Organic Agriculture Movement

The modern organic movement developed as an environment-friendly alternative means of farming in an attempt to avoid the negative effects of conventional agriculture (soil fertility decreases, biodiversity loss, environmental degradation, water contamination, and the risks from toxic agrochemicals) (IFOAM, *Organic Agriculture and Food Security*). Total area planted with organic crops worldwide in 2015 was 50.9 million hectares, which accounted for just 1.1% of the total agricultural land. However, the area devoted to organic production has been increasing over time. Australia, Argentina and the United States had the largest organic agricultural land area. Asia was the area with the most organic producers (35% of the world's organic producers), followed by Africa (30%) and Latin America (19%) (Figure 1.1). In 2015, 90% of organic product sales were reported to have occurred in North America and Europe (Figure 1.2). The share of organic sales was decreasing in these markets, as sales increased in Asia, Latin America and Africa. As of 2015, out of 179 countries with organic production, 87 had organic regulations (FiBL&IFOAM). Organic development was expected to continue in the upcoming years (FiBL&IFOAM).

DISTRIBUTION OF RETAIL SALES VALUE BY REGION 2015

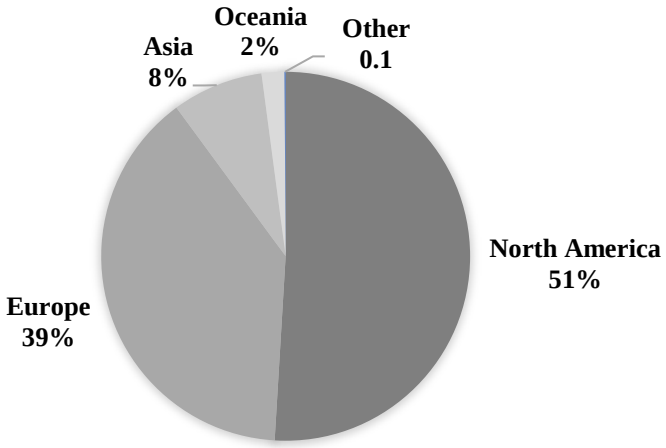

Figure 1.1 Distribution of retail sales value by region 2015

Source: FiBL & IFOAM (2017)

DISTRIBUTION OF ORGANIC PRODUCERS BY REGION 2015

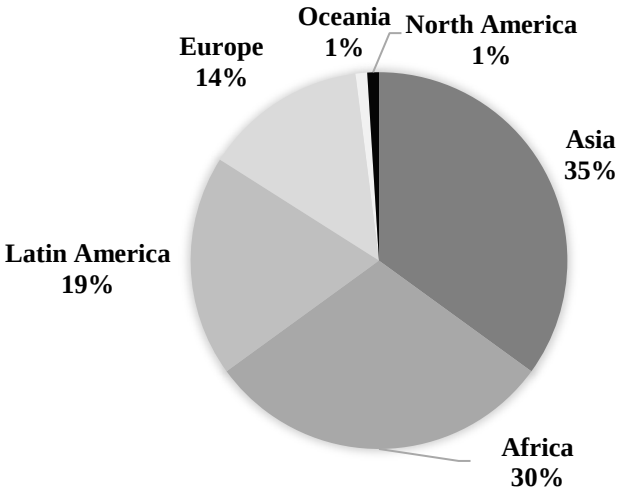

Figure 1.2 Distribution of organic producers by region 2015

Source: FiBL & IFOAM (2017)

Of 50.9 million organic hectares, 4 million were in Asia. The share of Asian organic food sales was continuously increasing. In Asia, India was the leading country in number of organic producers (0.5 million people). China was the biggest organic market. Nineteen Asian countries already had organic agriculture regulations and 5 of them were in the process of drafting regulations as of 2015 (FiBL&IFOAM). Vietnam was among the 10 countries with the largest organic area in Asia and was among 9 countries in the Asia and Pacific Region that has a national standard but does not have national legislation.

The main driver of organic food sales in Asia has been consumer concerns regarding food safety. China has had numerous food scandals relating to adulteration and contamination of meat, the use of waste oil in food products, and the use of industrial melamine in infant formula (FiBL&IFOAM). These episodes have partly driven sales of organic products in China. Food safety issues have also been a widely discussed topic in Vietnam for more than a decade.

Organic farming is considered an environment-friendly method of farming that helps build sustainability in the ecosystem in the long term, improves quality and structure of soil, reduces groundwater pollution, decreases agrochemical needs, thereby contributing to reducing climate change and improving biodiversity (FAO, *Organic Agriculture: What Are the Environmental Benefits of Organic Agriculture?*). Organic farming is perceived by many as bringing safer products to consumers and higher incomes to farmers (IFOAM, *Organic Agriculture and Food Security*). Furthermore, organic farming is considered as bringing more opportunities to the rural labor force. Another potential benefit of organic farming is that it may help reduce health expenditures (IFAD). However, in spite of these perceived benefits, organic farming is seen as having low yields and costly certification. In addition, smallholders, especially those in developing

countries, have difficulties accessing organic markets, and it is not always easy for them to meet the requirements of supermarkets (Jouzi et al.).

1.1.3 Adopting Organic Practices

Why do some farmers practice organic farming? Who converts to organic farming and why do they convert? Research suggests that in developing countries, farmers with more resources are more risk-tolerant and probably better understand potential returns from switching, therefore they tend to be more likely to adopt organic practices or to convert a large proportion of their crop area to organic (IFAD). The same study found that most farmers tended to take an incremental step, switching only one crop or one field first. Moreover, the early converters were more educated, had better skills and more resources. Sometimes they were the community leaders.

Studies found that farmers adopting organic farming practices base on both economic and non-economic reasons (Läpple and Rensburg; Mzoughi; Veldstra et al.). Crowder and Reganold pointed out that whether organic farming can be expanded depends on how economically efficient it is compared with conventional farming. Bruckmeier et al. reported that East German farmers followed economic incentives instead of ethical-based motivations when deciding to convert to organic farming (Fairweather). Some studies captured non-economic factors, for example environment concern, that drive the adoption of organic farming practice (Läpple and Rensburg; Mzoughi; Veldstra et al.). Hong (1994) reported that farmers in Korea converted to organic farming because they did not have pleasant experiences with agricultural chemicals (Fairweather).

IFAD pointed out that there were at least five key reasons explaining why that happened: (1) higher income from production; (2) lower input costs; (3) elimination of agrochemicals; (4) soil quality improvements; and (5) local natural resources and biodiversity maintenance (IFAD).

As regards to characteristics of organic farmers, researchers have found that organic farms tend to be smaller than conventional farms (Veldstra et al.) and organic farmers tend to be younger (Burton et al.; Genius et al.; Veldstra et al.; Souza et al.). Some found that organic farmers were more educated (Souza et al.; Genius et al.), some found insignificant correlation between education of farmers and the adoption of organic (Burton et al.)

1.1.4 Comparative Profitability of Conventional and Organic Farming

Crowder and Reganold (2015) conducted a meta-analysis involving 44 studies of the financial performance of organic and conventional agriculture in both developed and developing countries. They concluded that organic farming had significantly higher labor costs, but that these were offset by lower input costs. Also, organic agriculture, with a price premium, was significantly more profitable than conventional agriculture (Crowder and Reganold; Delbridge et al.; Klonsky and Greene). Similar results were found by Nieberg and Offermann, who studied several farms in different EU countries. A review of research on comparative profitability of organic and conventional agriculture found mixed results, with some evidence that organic farming was as profitable as conventional farming due to a price premium, and other evidence suggesting that organic production did not always require a price premium to be as profitable as conventional production (Greer et al.).

1.2 Organic Vegetables Movement in the Study Site

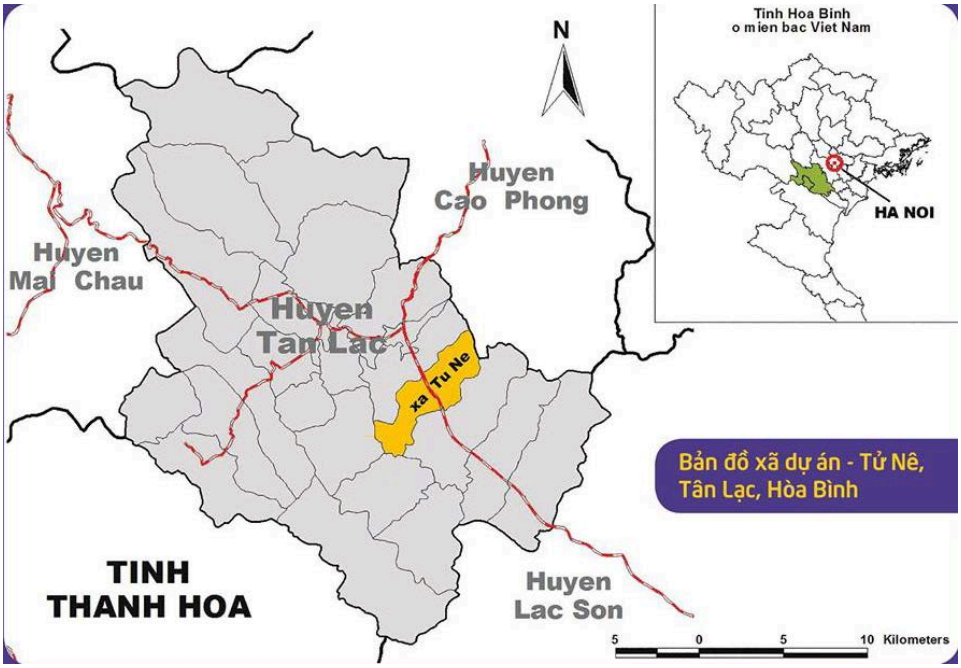

Figure 1.3 Map of Study Site: Tan Lac District, Hoa Binh Province, Vietnam

Source: The Centre for Environment and Community Assets Development

Tu Ne and Thanh Hoi are communes of Tan Lac, a district in the North mountainous area of Vietnam, 110 kilometers (68 miles) from Hanoi. In Tan Lac, 80% of the population are Muong ethnic minority people. Most of the local farmers are small farmers with a farm size less than one hectare. The main sources of income and livelihood in the study site are rice and other annual crops, fruit trees, vegetables, acacia for the paper making industry, and animal husbandry. As a poor mountainous area inhabited primarily with Muong ethnic minority communities, this district has been supported by some non-governmental organizations (NGOs) working on environmental protection, cultural identity preservation, and household's economic development projects. In 2007, the first organic project in the area was brought into Sung village, in Thanh Hoi commune, one of the villages surveyed for this study. One farmer in the village was sent to an organic training

program provided by the Agricultural Development Denmark Asia (ADDA). That was the first time farmers in these villages had been exposed to the idea of organic farming. After the project, only some of the farmers in Sung village started growing organic vegetables. However, most of those in this village and the nearby villages in the commune still did not know about this new method of farming. The idea of organic farming did not spread in the local area at that time.

Like farmers in other areas in Vietnam, Tan Lac farmers have used agricultural chemicals for decades. The Centre for Environment and Community Assets Development (CECAD), an NGO working in Tan Lac for over 10 years, realized that using pesticides had become a daily habit and not many farmers were aware of how harmful it could be to the environment and to their health. In 2010, the district announced a policy that encouraged farmers to make use of their rice-growing land between the two rice crops (September to January) to grow winter vegetables to increase their incomes. CECAD considered this as an opportunity to raise farmers' awareness about pesticides before they started using a lot of pesticides on their vegetable gardens, as was common among vegetables farmers near Hanoi. CECAD developed a program to educate farmers, teachers and middle-school students about the proper usage of pesticides. It was believed that the students would be future farmers and policy makers, thus it was important to equip them with this knowledge at a young age. These efforts started with Tu Ne and Thanh Hoi. In 2014, CECAD continued to spread their awareness campaign to more communes within the district. The initiative was successful in that more and more local farmers learnt about the harm of pesticides through the campaign. Prior to the project, reports showed that farmers were over-applying pesticides on rice and vegetables. Nearly 100% of farmers involved in the project had been exposed to pesticides, and up to 70% had experienced chronic and acute symptoms that could be potentially attributed to pesticide exposure, including cancer, miscarriage and birth defects (CECAD).

During this time, there were also many scandals about food safety, especially the safety of vegetables, in Hanoi. Vegetable farmers near Hanoi used an excessive amount of pesticides, dirty water and stimulating chemicals for their vegetable gardens. Images of farmers using pesticides were displayed all over the big newspapers. Consumers started worrying about their health and created demand for what they called *safe vegetables*. *Safe vegetables* is a term used to refer to the vegetables that were grown with pesticides being correctly used to avoid pesticide residues in them. When demand increased, a trend began toward growing *safe vegetables* in Vietnam. Middle and upper income people started buying *safe vegetables* from convenience stores and supermarkets in Hanoi. After this time, another scandal was revealed on the newspapers that even *safe vegetables* were not safe because the government agents responsible for monitoring food safety detected that small stores and even big supermarkets in Hanoi sold conventional vegetables but labeled them as *safe vegetables* (Dân Trí; Báo Mới; Vietnamnet). Consumers, concerned about their health, lost trust in these sellers and were very worried about how they could buy vegetables without pesticide residues. *Safe vegetables* suddenly had a bad reputation.

In Tan Lac, local authorities started encouraging farmers to grow safe and organic vegetables, and to develop a *safe vegetable area* within the district. This goal was stipulated in the district's annual socio-economic development plan. CECAD supported the first farmers that wanted to grow safe vegetables in 2014. In 2015, this organization carried out training programs on organic farming as one of the alternative sustainable farming practices that helped reduce the amount of pesticides used, thus decrease the harm to farmers' health. CECAD also hoped that the organic vegetables could be more easily sold in the market, as vegetables labeled as *safe vegetables* were not trusted any more.

Between farmer trainings, CECAD organized workshops for local government and farmers and invited guest speakers including private companies that buy and sell organic vegetables to talk about the potential market for organic produce. These representatives also talked about the high price of organic vegetables and the high demand in big cities. Some of the farmers attending the trainings started their own organic gardens, creating a trend of growing organic vegetables in the local area. On recognizing that awareness-raising and training programs were not enough to help the farmers succeed as organic farmers, CECAD developed a channel to distribute the farmers' organic products in Hanoi with the hope that if the farmers could earn profit from organic vegetables, they would have a more sustainable income source and would no longer need to use pesticides. This channel included online ordering and door-to-door delivery. However, this distribution channel was not as successful as CECAD expected. Consumers were doubtful about the origin of the products. Farmers could not always satisfy the consumers' requirements of products' quantity, quality and variety. CECAD was not a trading agent and therefore lacked business knowledge and practices, from advertising to finding more consumers and delivering the product. In the local market, a major drawback was that organic vegetables often could not be distinguished from conventional vegetables. Furthermore, organic vegetables were sometimes not appreciated by consumers in Tan Lac because of their blemished appearance. According to farmers, growing organic vegetables is more complicated, requires more labor and takes more time; however, organic prices are often no different than the prices of conventional vegetables. All of these above-mentioned reasons led to the disappointment of organic farmers in Tan Lac. The case of Tan Lac demonstrates that although farmers had a desire to grow organic vegetables to lessen the effects of pesticides on their health, they thought they could not earn sufficient income from selling these products in the market while spending more labor on production. Some farmers

stopped growing organically. Some now have to contend with switching back to growing vegetables using agricultural chemicals even though they do not want to, as it is easier for them and is thought to bring a similar amount of income. Local authorities have not provided solutions that help the farmers sell their organic products. Tan Lac is just one of many areas in Vietnam where farmers face a choice between risking their health and risking their family's income.

1.3 Motivating Questions

To better understand whether organic vegetable production can be an effective alternative source of income for conventional vegetable farmers in Tan Lac, this research has the following motivating questions:

In Tan Lac,

(1) Who among vegetable farmers is more likely to switch to organic vegetable production?

(2) Is organic vegetable production profitable, compared with conventional production?

(3) What could be done to make organic vegetable farming a more sustainable source of income and to help farmers switching to organic farming to be more successful?

1.4 Research Objectives

The main objectives of this research are as follows:

(1) Identify characteristics of organic farmers and farmers who tend to switch to organic farming. Compare organic and conventional farmers;

(2) Identify the comparative profitability of organic and conventional vegetable production and factors that influence profitability under the two production systems;

(3) Identify changes that could be made to help organic adopters to be more successful

1.5 Hypotheses to be Tested

H1: Farm characteristics are correlated with the choice of a farmer to go organic

H2: Organic farming is less profitable than conventional farming in the study site

To collect data to test these hypotheses, a household survey was designed. In addition, questions for focus group discussions and key informant interviews were designed to collect additional information about farming in the study areas, including characteristics of households in the sample, their production practices and the perspectives of important stakeholders on the development of organic vegetables in the local area. The data collection process and a description of the survey data are presented in Chapter 2. Chapter 3 presents the theoretical and empirical models used to analyze the data. Chapter 4 reports the research results. Chapter 5 contains conclusions and recommendations. Appendices contain household survey, questions for focus group discussion and key-informant interviews.

CHAPTER 2. DATA

2.1 Data Collection

Data for this study were collected from three different sources: household surveys, focus group discussions and key-informant interviews. All of the surveys and questions for the focus groups and the key informants were developed based on previous experience in the study site and the objectives of this research. The data were collected during June and July 2017 and describe conditions and outcomes for the growing seasons of 2015 and 2016. This chapter describes the process of data collecting and some descriptive data.

2.1.1 Household Survey

The objective of the study is to learn whether organic vegetable production can bring farmers benefits comparable to those of conventional farming. Accordingly, a survey of both organic and conventional farmers was designed. This survey captured the household characteristics and farming practices of 95 households growing vegetables, both organic and conventional in 5 villages (Buc, Chua, Sung, Tan Huong 2, Tam), in Tu Ne and Thanh Hoi commune, Tan Lac District, Hoa Binh Province, Vietnam in the year 2015 and 2016. The villages were chosen because they were the leading villages in producing and selling vegetables in the local market. Lists of households were provided by heads of villages and local NGO officers. A random sample of households in each village was then selected from these lists. The organic growers were all included in the data set because of their relatively small number and because the main objective of this research is to understand more about local organic growers, including their backgrounds, their reasons for adopting organic techniques, their production and marketing channels, the challenges they face, and the reasons why they want or do not want to continue growing organically. Because

there were not many organic growers in the local area (in comparison with conventional growers) it was decided that studying all of these farmers would be necessary to provide a sample that could provide a diverse set of characteristics for these local organic farmers. Of the 95 households, 77 only grew using conventional practices and 18 grew organic vegetables. The sample is unbalanced; however, it reflects the low ratio of organic farmers to conventional farmers in the area. These 18 organic farmers are actually all the organic farmers in these surveyed villages.

The survey included household demographic information, their sources of income, vegetable production indicators including cash revenue, input costs, family and hired labor costs; marketing channels and opinions regarding advantages of organic farming and challenges faced by organic farmers. These data help answer questions about who the organic farmers are, the relative profitability of organic and conventional farming, and whether organic vegetable production is profitable for farmers in the area.

Questions were developed with simple wording after consulting with the staff of an NGO working in the local area for 10 years. Surveys were also tested with farmers from different villages and then adjusted to make them friendlier to all of the farmers before the actual interviews with sample farmers were conducted. One of the enumerators on the research team was a Muong woman, thus she could understand the local dialect and helped when there were any communications difficulty during the interviews. The interviews were, on average, one hour in length. Data collected from this household survey is retrospective recall data.

2.1.2 Group Discussion

For group discussion, I organized four groups in 4 villages (10 representatives each). They were drawn from different civic organizations, namely the Women's Union, the Youth's Union, the Farmer Association and the Veteran's Association. Discussion sessions focused on the reasons

why farmers in their village wanted to switch to growing organic vegetables, the advantages and challenges of growing organically, the impact of organic farming on their lives, and their suggestions to the local government on developing organic farming in the area. As the people in these groups represent all the local civic organizations, they are the bridges between the local government and the farmers. They help bring desires of the villagers to the local government and bring guidance of the local government to the villagers. Their opinions tend to represent the community's wish. As these people are elected by the villagers, their opinions on different issues are important to the village. Learning about their opinions could help understand the direction the villagers might take. The discussions were, on average, one hour in length.

2.1.3 Key-informant Interviews

Key informants included some of the organic vegetables traders, governmental officials and NGO staff members supporting the local farmers in organic vegetable production. The key informant interviews were designed to discover perspectives of important stakeholders on organic vegetables production in the local area. This information might be useful for the farmers when considering growing organic vegetables. Interviews with the buyers focused on the requirements as well as the challenges faced when buying from organic farmers, especially organic farmers in Tan Lac. The local officials from the District Division of Agriculture and Rural Development, Communal People's Committee, Plant Protection Division and Agricultural Extension Division were asked about the governmental programs and policies that supported organic farmers and their perspectives on the potential of organic farming becoming a main income source in the local area. The interviews with the NGOs' staffs provided information about their experiences working with organic farmers, their views on how the farmers could be helped to increase their income from

growing vegetables and whether organic farming can become a good source of income for farmers in the local area.

2.2 Descriptive Statistics

2.2.1 Demographic Information

Characteristics of average organic and conventional farmers in the sample are discussed in a series of tables, based on the survey data. The sample includes 95 households from five villages, namely Buc, Chua, Tam, Sung, Tan Huong 2, in two communes Tu Ne and Thanh Hoi, Tan Lac district. Among them, 77 households grow only conventional vegetables and 18 grow organic (10 only grow organic and 8 grow both).

Table 2.1 compares demographic characteristics among two types of households. The table indicates that household heads tend to be older for organic farms. The average age of household's head is 50.2 for conventional and 56.6 for organic farms ($p < 0.05$). Farmers that grew organic seemed to be older, aged 45 to 73. Age of conventional households' heads was more spread out than organic households', from 27 to 76 (Figure 2.1). Both organic and conventional households' heads have quite similar average education level of secondary school. However, ttest shows that average education of conventional farms' household heads is higher than that of organic farms' household heads ($p < 0.1$). Family sizes of organic and conventional households are not very different, 4.7 and 5.3, respectively. Ttest also shows insignificant difference between family size of these two groups.

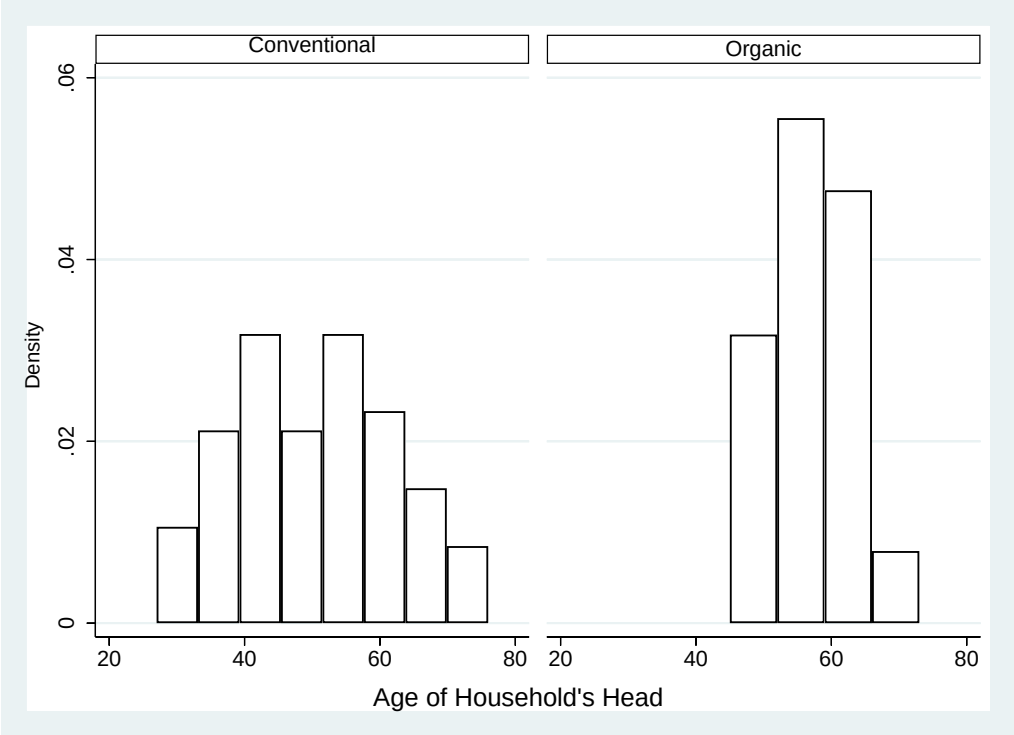

Figure 2.1 Distribution of Age of Household's Head

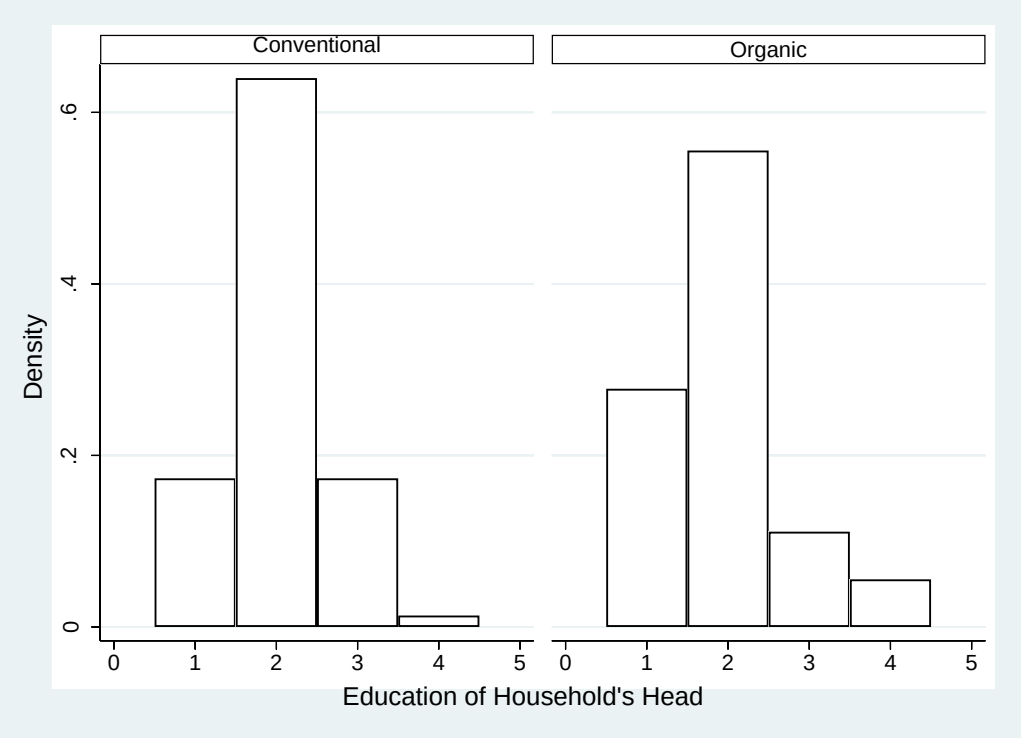

Figure 2.2 Distribution of Education of Household's Head

Main local family income sources are animal husbandry, forest, rice, vegetables, fruit trees and working off farm. Rice is considered the main source of food security for all of the villagers, thus rice growing is prioritized in the local area (79/95 households grow rice). However, to 89% of households, rice was not the income source that generated the most income. To organic farmers, income sources that bring them the most income are animal husbandry and working off farm. Rice and vegetables contribute a very similar income amount to the total income of the family, about 16% in 2015 and 15% in 2016.

All farmers in the sample grow vegetables for sale and/or for family consumption; some of them grow vegetables all year round as their main income (Tan Huong and Sung village) while some only grew vegetables between two crops of rice (from September to January) when they had available land. Organic farms had higher total annual and per capita income, on average, in both 2015 and 2016.

Table 2.1 Demographic Data from Household Survey, 2017

Variables		Conventional				Organic			
		Mean	SD.	Min	Max	Mean	SD.	Min	Max
Age of Household's Head (years)		50.2	11.7	27	76	56.6	7.5	45	73
Education of Household's Head (education level)		2.0	0.6	1	4	1.9	0.8	1	4
Family size (people)		4.7	1.4	1	9	5.3	2	2	8
Annual Household Income (million dong)	2015	75.4	46.1	3.9	207	81.4	47.9	25.2	174
	2016	70.5	44.6	3.9	194	88.9	62.1	12.8	210
Annual Household Income per Capita (million dong)	2015	16.4	9.6	1.3	49.5	16.5	11.1	3.4	41.5
	2016	15.1	8.6	1.1	39.1	17.8	11.8	2.1	44.7
N Obs		**77**				**18**			

(Table 2.1 continues)

(Table 2.1 Continued)

Variables		Conventional				Organic			
		Mean	SD.	Min	Max	Mean	SD.	Min	Max
Income Share 2015 (%)	Animal husbandry	37.7	25.4	0	92.3	28.2	20.1	0.12	67
	Forest	2.4	10.6	0	85.2	8.2	18.1	0	72
	Rice	10.1	10.5	0	57.6	16.2	13	0	48.2
	Vegetables	18.1	21.2	0	100	16.4	15.7	0	58.5
	Fruit trees	1.9	5.62	0	34.2	1.1	2.6	0	9.5
	Working off farm	24.3	24.6	0	79.7	25.8	27.2	0	84.8
	Others	9	15.3	0	84.8	3.8	7.6	0	29.5
Income Share 2016 (%)	Animal husbandry	29.3	24.5	0	96.5	29.5	22.5	0	72.2
	Forest	4.1	13.8	0	71.2	4.6	10.1	0	37.2
	Rice	11.6	13	0	54.8	15.4	14.3	0	63
	Vegetables	18	22.6	0	100	15.1	16.2	0	58.7
	Fruit trees	3.4	9.3	0	58.7	1.6	2.9	0	9.8
	Working off farm	24.7	26	0	84.5	28.5	27.9	0	89
	Others	11.2	19.4	0	85.9	5	10.5	0	39.9
N		**77**				**18**			

2.2.2 Vegetable Production

There were 44 types of vegetables grown in the study site. Organic farmers grew fewer types of vegetables (33) than conventional farmers. Cabbage, kohlrabi and choy sum were the most common vegetables grown among conventional farmers. Mustard greens (2015) and kohlrabi (2016) were the most common crops, being grown by 50% of the organic farmers. The local farmers grew vegetables on fragmented plots of land they own.

Table 2.2 shows the mean farm size, revenue, input cost, profit, family labor and proportion of cash revenue and harvest, which is the value that the farmers might get if they can sell all of the vegetables they produce. Values of revenue, input cost and profit in 2016 are deflated so as to be directly comparable with 2015 amounts. *Mean vegetable farm size* was significantly different between the two groups ($p < 0.05$). Mean conventional farm size (0.1 ha) was double organic farm size (0.049 ha). While conventional farms could be up to one hectare area, the maximum organic farm is only 2000 meters square. *Average revenue per hectare* from growing vegetables was 132.6 and 133.3 million dong[1] for conventional and 115 and 92.8 million dong for organic in these two years. Average revenue and profit of conventional farms were slightly higher than those of organic farms. However, the maximum revenue per hectare from conventional farms (1,157 million dong in 2016) was much higher than the maximum revenue from organic farms (263.8 million dong in 2015). Some farms that had input costs higher than their cash revenue have below-zero profit. None of the farms with hired labor had below-zero profit.

The surveyed farmers grow vegetables both for selling and for family use. Surplus, unsold vegetables are used for giving to their children, relatives, neighbors and feeding the animals. The

[1] The exchange rate is 1 USD = 21,388 VND (2015) and 1 USD = 22,495 VND (2016) (*USD to VND Exchange Rate - Bloomberg Markets*)

proportion of revenue and the income that the farmers might be able to get if they can sell all of the vegetables they produced is indicated in Table 2.2. According to the result, conventional farmers got 79% of their harvest value in both 2015 and 2016 while organic farmers only got 73% and 67%. Redundant organic vegetables account for about 30% of the total amount of vegetables produced while that is 20% for conventional vegetables.

Table 2.2 Farm Management Characteristics

Per ha/year		Conventional				Organic			
		Mean	SD	Min	Max	Mean	SD	Min	Max
Vegetable farm size (ha)	2015	0.1	0.2	0.001	1	0.05	0.04	0.005	0.2
	2016	0.1	0.1	0.001	1	0.5	0.04	0.001	0.2
Vegetable revenue (million dong)	2015	132.6	149.6	0	1004	115.2	72.3	0	263.8
	2016	133.3	198.8	-0.06	1157	92.8	69.4	0	206.2
Vegetable input cost (million dong)	2015	28.5	29.7	0	214	18.8	12.6	4.2	43.5
	2016	32.0	50.4	-0.008	363.8	19.2	12.7	0	43.6
Vegetable profit (million dong)	2015	104.1	145.2	-58.8	1004	96.4	71.6	-14	254.1
	2016	101.3	175.4	-95.5	1157	73.5	67.2	-10.3	180.4
Family labor time (person days)	2015	1481	1678	0	10000	1284	778	285	2850
	2016	1478	1618	0	10000	1346	873	66.6	3240
Revenue/Harvest value (%)	2015	78	25	0	100	73	33	0	98.1
	2016	79	23.8	0	100	67	34	0	98.1
N		**69**				**15**			

Input cost of local farms included cost of seeds, fertilizer, and pesticides. Conventional farms had higher input cost per hectare than organic farms in both year. *Farm labor* includes labor for weeding, composting, spraying pesticides, preparing soil, planting, harvesting, processing and selling the products in the market. All farms used family labor as their main labor and most of them (80/95) only used family labor. Family labor (people days) is higher on conventional farms; however, the t test indicated that there was no significant difference between average family labor of conventional and organic farms. Hired labor is used the most during soil preparation period. Only one organic farm hired labor. Wages for family labor are identified based on wages family labor would get when working off farm and varied between 100,000 and 150,000 dong (USD 4.5 and 6.8) per day. Even when average input cost, revenue and profit were higher for conventional farms, ttest results show that the differences between the mean of revenue and profit are not significantly different from zero while average input cost is significantly higher for conventional farms.

2.2.3 Vegetable Marketing Channels

Most farmers (84.2%) brought their vegetables to retail in the nearby wet markets within their communes and district and to vegetable stalls along the highway. Usually, the close markets are only one kilometer away from their villages. The communal markets only open on certain days of the week, for example, the two most common markets are Chua market, which only opens on Tuesday mornings and Tan Tien market, which only opens on Thursday mornings. All the farmers often brought all of the products they had at home to the market to sell on the market day. As the markets are open markets, except for the people that have stalls to sell farming tools, clothes and breakfasts, farmers could choose their own place to sell their agricultural products.

44% of the farmers sold their vegetables at their garden to wholesalers coming into the villages to collect vegetables. They also sold to the wholesalers at the market. 11% brought their vegetables to sell outside of their district. Most of the time they sold their vegetables in the markets in Cao Phong, a neighboring district to Tan Lac or in Hoa Binh City, the capital of Hoa Binh province, about 30 kilometers from Tan Lac. Some sold their vegetables to restaurants within the local area. Only two of the organic farmers sold their vegetables to consumers in Hanoi, mainly through the Centre of Environment and Community Assets Development (CECAD), the NGO that supported them to grow organic vegetables. It was common that the farmers set the price for their vegetables based on different units, for example kilogram, bunch, bulb and head, for different types of vegetables and even for the same type of vegetables. One vegetable can be sold by kilogram or in bunch. Price was also changed during the market time. When the market started in the early morning, the price of a product could be higher than for the same product at the end of the day because people just wanted to sell all their vegetables by setting lower price so they did not have to bring the vegetables home.

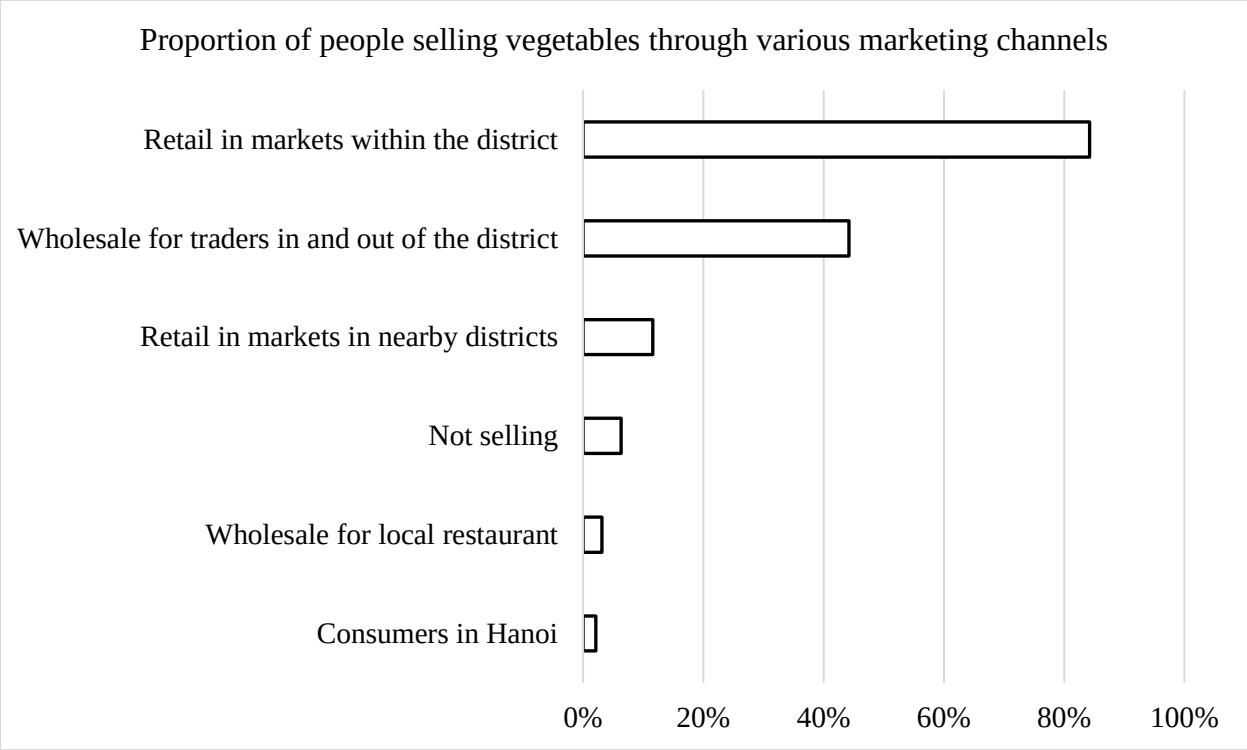

Figure 2.3 Proportion of farmers selling vegetables through various marketing channels

CHAPTER 3. MODEL

In this chapter, I develop two sets of empirical models to analyze:

1) whether organic vegetable production is more or less profitable than conventional production in the study site; and
2) whether farm management characteristics and market characteristics are correlated with a farmer's decision to adopt organic production practices.

To motivate the empirical investigation, I first review the conceptual framework that applies to these questions.

3.1 Comparative Profitability of Organic and Conventional Vegetable Production

3.1.1 Theoretical Model

I assume that, being rational economic actors, farmers make farm-level production decisions to maximize their profits. A review of previous research findings showed that economic benefit is a factor influencing many farmers' decisions to go organic or remain conventional. I assume that this is no different for farmers in Tan Lac. I assume farmers in the area choose the farming practice that brings the highest economic benefit. In this study, because comparative profitability of organic and conventional farming will be an important factor for farmers to consider when choosing to convert to organic production, I rely on profit to measure the farm's economic performance.

The basic profit function for vegetable production can be written:

$$\pi = \left(\sum_{k=0}^{n} p_k q_k - \sum_{j=0}^{m} w_j x_j\right) / A$$

where π is the total profit in VND per hectare that a farmer earns from his vegetable production, k is the index for crops, n is the total number of crops that a farmer grows, p_k is the price at which a

farmer sells crop *k* in the market (in VND per unit), q_k is the quantity of crop *k* that a farmer sells for cash (in the unit relevant for crop *k*). As mentioned in Chapter 2, the farmers in the area sell their vegetables, even the same kind, in different units. For example, farmer A sells his cabbage in kilograms and sets his price at 10,000 dong per kilogram while farmer B sells heads of cabbage and sets his price at 5,000 dong per head. Revenue is calculated based on the quantity of units sold and unit price. $\sum_{k=0}^{n} p_k q_k$ is the aggregate cash revenue that a farmer earns from selling all of his vegetables crops (in VND). In the survey, each farmer was first asked about the crops that they grew in 2015 and 2016. Most of the time the farmers grew the same vegetables on the same area with even the same quantity of seeds. Most of them also sold the vegetables in the same markets over the time, thus it was not too difficult for them to recall the types of vegetable and the amount they sold.

Farmers in the area could not always sell all the crops they produce. This might be because they could not estimate the maximum quantity they were able to sell in the market and produced an excessive amount or they could not sell a certain amount of vegetables that were not up to the quality consumers require. The excessive amount of output was usually given to their children, relatives, neighbors and/or used to feed animals. These unsold quantities are assumed to have 0 value because the surveyed farmers could recall how much they sold and earned while they could not remember how much vegetable they gave away. The farmers reported the price and quantity at which they sold the vegetables. Total revenue is the aggregate of revenue from all vegetables sold in 2015 and 2016.

Multiple purchased inputs are used in production; w_j is price of input *j* (in VND) and *m* is the total number of inputs used for vegetables production. x_j is the amount of input *j* (in unit of input). $\sum_{j=0}^{m} w_j x_j$ is total production cost (in VND). In addition to the cost of seeds, fertilizer and

pesticides, this production cost includes hired labor cost (in VND). Input cost is calculated as the amount that the farmers had to pay to buy inputs in 2015 and 2016. This price slightly varied among the farmers as they bought their inputs from different suppliers and at different time.

As most of the farmers work on their own farm, in theory, family labor needs to be considered as an input and a farmer's wage rate is the market price of his labor (Varian). However, in this study, when being surveyed, farmers reported different prices of labor they think they might get if working off farm. Therefore, it might lead to an inaccurate analysis if calculating the value of family labor into the model that way. Profit in this study should be understood to be profit before subtracting family labor cost or the cost of land. In other words, profit should be understood to be the returns to family labor and land. In the empirical model, family labor (in people days) will be taken into account as an explanatory variable. Total area planted to vegetables (in hectares) is denoted *A*.

Because the data span the 2015 and 2016 growing seasons, price inflation is taken into account when calculating 2016 values. The inflation indicator is taken from the report of the General Statistics Office of Vietnam in December 2016. All 2016 monetary values have been deflated so as to be compatible with 2015 amounts.

Factors affecting profit

Input costs, market prices and the amount of output sold have direct relationships with a farm's profitability. At the same time, these factors are influenced by household characteristics *(location, education level, age and family size)*, farm characteristics *(farm size, farm labor and number of crops)* and market characteristics *(market channels and opinions of consumers)*.

Price p_i is the market price, and may depend on *market channels* and also demand of *consumers and traders* for a certain product in a certain area. Output might be influenced by (1)

family labor, which is influenced by *family size* since most of the family members work on their farms, and might be affected by (2) the characteristics of the household head *(education and age)* and (3) farm characteristics *(farm size, farm labor and number of crops).*

The cost associated with vegetable production includes cost for hired labor, seed, fertilizer, pesticide and other costs, for instance cost for making herbal pest spray on organic farms.

$$C = C_{\text{hired labor}} + C_{\text{seed}} + C_{\text{fertilizer}} + C_{\text{pesticide}} + C_{\text{other}}$$

According to the nature of organic and conventional production, differences in production costs can lead to difference in profit. Input cost is determined by the level of inputs and their prices. While their price depends on the market price and might be determined by the *location of the farm*, the level of inputs is determined by the characteristics of the farms, such as *farm size, type of vegetables* (organic or conventional) and how diversified the crops are. Characteristics of households, for instance, *education and age of the household head*, might affect the decision of the farmers on the level and types of input being used. The next section presents the empirical model to compare profit from organic and conventional vegetable production.

3.1.2 Empirical Model

To test the hypothesis about the relative profitability of organic and conventional vegetable farming in the study site, linear regression is used. The models are estimated as unbalanced panels assuming household random effects. The dependent variable is profit per hectare. Explanatory variables are described in Table 3.1. The variable *organic*, which indicates the farming practice that a farmer follows to grow a certain plot of vegetables, is included on the right hand side of the regression equation as a binary indicator. *Organic* takes the value of 0 if the farmer grows conventional vegetables on the plot and 1 if the farmer grows organic vegetables on the plot.

Variable

Table 3.1 Descriptive Statistics for Profit Model

Variables	Description	Mean	SD.	Min	Max
	Dependent variable	95.3	141.9	-95.5	1157.8
profit	Profit from vegetables production (million dong per hectare per year)				
organic	1 = organic plot 0 = conventional plot	0.2	0.4	0	1
	Demographic information				
commune	1 = Thanh Hối 0 = Tử Nê	0.4	0.5	0	1
educ	1 = Secondary School and Higher 0 = Primary School	0.8	0.4	0	1
age	Age of household's head (years)	52	10.8	27	76
no_famem	Number of family members (people)	4.9	1.6	1	9
year	Production period: 2015 or 2016				

(Table 3.1 continues)

(Table 3.1 continued)

Vegetable farm characteristic		Mean	SD.	Min	Max
farmsize	Total area of the vegetable fields (hectare)	0.1	0.1	0.001	1
famlab	Number of family members multiple days of working on vegetables production and selling (person*days/hectare)	1449	1521	0	10000
cropdiversity	Number of vegetable crops each farm grows (crops)	5.2	2.9	1	17
	Market				
retailin	1 = Retail markets within the district 0 = Otherwise	0.9	0.2	0	1
retailout	1 = Retail markets in nearby districts 0 = Otherwise	0.1	0.3	0	1
wholesale	1 = Wholesale 0 = Otherwise	0.5	0.5	0	1
N		171			

Regression models

Three different models are developed to examine the relative profitability of organic and conventional vegetable production and factors that affect profit from vegetable production in the area. Model 1 is a simple model with the independent variable *organic*, controlling for *year* and *commune*. Model 2 adds to Model 1 economic explanatory variables (number of crops, vegetable farm size, family labor spent on vegetable production and marketing outlets). Model 3 adds to Model 2 non-economic variables (education and age of household's head, and family size). Models 2 and 3 include additional control variables, which may help better estimate the true correlation between *profit* and *organic*.

Model 1: Profitability and Organic

$$Profit = \beta_o + \beta_1 organic + \beta_2 year + \beta_3 commune + \in_i$$

Model 2: Profitability and Economic Independent Variables

$$Profit = \beta_o + \beta_1 organic + \beta_2 year + \beta_3 commune + \beta_4 farmsize + \beta_5 famlab + \beta_6 cropdiversity + \beta_7 retailin + \beta_8 retailout + \beta_9 wholesale + \in_i$$

Model 3: Profitability and both Economic and Non-economic Independent Variables

$$Profit = \beta_o + \beta_1 organic + \beta_2 year + \beta_3 commune + \beta_4 farmsize + \beta_5 cropdiversity + \beta_6 famlab + \beta_7 retailin + \beta_8 retailout + \beta_9 wholesale + \beta_{10} educ + \beta_{11} age + \beta_{12} no\_famem + \in_i$$

where β_o is a constant and β_1 to β_{12} are parameters for explanatory variables and $\in_i$ is an error term.

3.2 Characteristics of Farmers Adopting Organic Farming

3.2.1 Theoretical Model

Farmers are assumed to choose a practice that they expect to maximize their profit, while profit might be determined by the way a farmer manages his farm and the market for his products. Farm management characteristics and market characteristics are possibly correlated with a farmer choice of adopting organic production.

Assuming that farmer *i* maximizes his profit by choosing between conventional production ($y_i = 0$) and organic production ($y_i = 1$).

$$y_i = \begin{cases} 0 \; if \; E[\pi_i^o - \pi_i^c \,|\alpha_i, \;\; \beta_i, \;\; \gamma_i] \leq 0 \\ 1 \; if \; E[\pi_i^o - \pi_i^c \,|\alpha_i, \;\; \beta_i, \;\; \gamma_i] > 0 \end{cases}$$

where E is the expectation, conditional on α_i (characteristics of farmer i), β_i (farm management characteristics of farmer *i*), and γ_i (characteristics of the market). π_i^o is profit of organic farming and π_i^c profit of conventional farming.

To explain an ordinal response variable, three different models can be used: linear probability model, logit and probit. A linear probability model allows the probability to be outside the range [0, 1] and has other drawbacks, such as errors are heteroskedastic and have a non-normal distribution. For this reason, a logit or probit model seems to be a more suitable model to use in this case. The empirical model is presented in the next section.

3.2.2 Empirical Model

This analysis focuses on answering the question: are farm management characteristics and market characteristics correlated with the adoption of organic production among vegetables farmers in the area? Farmers are divided into 2 groups: organic and conventional, a probit regression model is used to analyze the demographic information, farm characteristics and market information from the household survey. Probit model is performed using 2015 data. As regards to farmers that grow

both conventional and organic vegetables, only the characteristics of their organic plot (vegetable farm size, family labor spent on organic production and number of organic crops) are included in the model. The result is expected to reveal the characteristics of the organic adopters in the study site.

Variables

Table 3.2 Descriptive Statistics for Adoption Model

Variables	Description	Mean	SD.	Min	Max
organic	1 = organic farm 0 = conventional farm	0.2	0.4	0	1
	Demographic information				
commune	1 = Thanh Hối 0 = Tử Nê	0.4	0.5	0	1
educ	1 = Secondary School and Higher 0 = Primary School	0.8	0.4	0	1
age	Age of household's head (years)	51.5	11.1	27	76
no_famem	Number of family members (people)	4.8	1.6	1	9

(Table 3.2 continues)

(Table 3.2 continued)

Vegetable farm characteristic		Mean	SD.	Min	Max
farmsize	Total area of the vegetable fields (hectare)	0.1	0.1	0.001	1
famlab	Number of family members multiple days of working on vegetables production and selling (person*days/hectare)	1413	1587	0	10000
cropdiversity	Number of vegetable crops each farm grows (crops)	5.5	3	1	17
	Market				
retailin	1 = Retail markets within the district 0 = Otherwise	0.9	0.2	0	1
retailout	1 = Retail markets in nearby districts 0 = Otherwise	0.1	0.3	0	1
wholesale	1 = Wholesale 0 = Otherwise	0.5	0.5	0	1
N		84			

Regression models

The variables used in the model are similar to the variables in Table 3.1 as it is assumed that a farmer's decision is always based on profit maximization. The only difference is that *organic* becomes a response variable. *Organic* equals 0 if the farmer grows conventional vegetables and 1

if the farmer grows organic vegetables. The estimation of the model will generate predicted probabilities for each response.

Pr (*organic* = 1 |*X*) = Φ (Xβ)

Φ (.) is the standard normal cumulative distribution function, X is a vector of independent variables, and β is a vector of unknown constants.

Model: Organic Adoption

$$Probit\ (organic) = \beta_o + \beta_1 farmsize + \beta_2 cropdiversity + \beta_3 famlab + \beta_4 retailin$$

$$+\beta_5 retailout + \beta_6 wholesale + \beta_7 X_7 + \in_i$$

where β_o is the constant, β_1 to β_7 are parameters for explanatory variables, X_7 is a set of control variables including household characteristics (*location, education, age, family size and total land)* and $\in_i$ is an error term.

CHAPTER 4. RESULTS AND DISCUSSION

This chapter presents empirical results of the models developed in Chapter 3. The analysis provides information about the comparative profitability of organic and conventional vegetables production and the characteristics of a farmer adopting organic practices in the area. Although results of the profit model help answer the motivating question about whether organic vegetable production is more profitable than conventional production in the study site, the results about the characteristics of organic farmers may contribute to answer the question about the changes that should be made to help vegetable farmers in the area become more successful.

4.1 Profit

4.1.1 Model Results

To answer the question of whether organic vegetable production is more or less profitable than conventional production in the study site, three linear regressions are used. In the three models, profit per hectare is the dependent variable. Explanatory variables for each model were specified in Table 3.2. These vary in each model. Model 1 is a simple model with the independent variable *organic*, controlling for *year* and *commune*. Model 2 adds to Model 1 economic explanatory variables (number of crops, vegetable farm size, family labor spent on vegetable production and marketing outlets). Model 3 adds to Model 2 non-economic variables (education and age of household's head, and family size). Models 2 and 3 include additional control variables, which may help better estimate the true correlation between *profit* and *organic*. Results of the regressions are provided in Table 4.1.

Table 4.1 OLS Results. Dependent Variable: Profit (million dong/hectare/year)

Variables	Model 1	Model 2	Model 3
Organic Plot	-55.4**	-41.8**	-41.5**
(0 = Conventional, 1 = Organic)	(22.5)	(20.3)	(20.5)
Year	-2.8	-1.8	-1.7
(0 = 2015, 1 = 2016)	(11.2)	(9.4)	(9.4)
Commune	56*	-16.8	-17.1
(0 = Tu Ne, 1 = Thanh Hoi)	(32.1)	(35)	(36.9)
Farm size	-	21	30.5
(hectare)		(78.1)	(79.5)
Family labor	-	0.05***	0.05***
(person days)		(0.009)	(0.009)
Number of crops	-	7.3*	7.3*
(Number of crops grown)		(4.1)	(4.1)

(Table 4.1 continues)

(Table 4.1 continued)

Variable	Model 1	Model 2	Model 3
Retail in the district	-	101	107
(1 = Yes, 0 = No)		(63.2)	(66)
Retail out of the district	-	86.6*	88.3*
(1 = Yes, 0 = No)		(48.4)	(51)
Wholesale	-	79.1***	79.4**
(1 = Yes, 0 = No)		(32.9)	(34.7)
Education	-	-	-27.8
(level of education)			(42.7)
Age	-	-	-0.2
(year)			(1.6)
Number of family member	-	-	-0.3
(people)			(10.8)
N Obs	171	171	171
R^2	0.03	0.18	0.18

Note: standard errors in parentheses. * indicates statistical significance: $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The models were estimated as unbalanced panels assuming household random effects.

Results from the three models show that whether a farmer grows organic or conventional vegetables significantly correlates with his profit from vegetables production ($p < 0.05$), whether controlling for other factors or not. A set of demographic control variables added to Model 2 to create Model 3 slightly changes the coefficients of variables in Model 2. An F-test is performed to test the joint significance of the set of demographic control variables and the result shows that they are not jointly significantly correlated with profit. The only difference among the three models is that when controlling for other factors, profit from vegetables of farmers in Thanh Hoi commune is lower than that of farmers in Tu Ne commune.

In Model 1, per hectare profit from growing organic vegetable is 55.4 million dong (2432 USD) lower than profit from conventional production. This figure is 41.8 million dong (1835 USD) and 41.5 million dong (1821 USD) in Model 2 and Model 3, respectively. Controlling for farm and household characteristics, the correlation between profit and organic production remains negative. Only the estimated magnitude of the profit gap is smaller.

Among farm characteristics (farm size, family labor and number of crops), family labor ($p < 0.01$) and number of crops ($p < 0.1$) are significant predictors of vegetable profit. The coefficients of the significant variables are the same in these models. When controlling for other variables, one person-day increase in family labor is correlated with 0.05 million-dong (22 USD) increase in per hectare profit. One added crop increases the per hectare profit by 7.3 million dong (321 USD). Demographic variables do not have any significant correlation with profit.

In the area, farmers sell their vegetables through a variety of market channels. Some wholesale their vegetables. Some retail theirs within the district and out of the district. Some sell their vegetables through all of the market channels mentioned above. Only two of the organic farmers sell their products to Hanoi. As there is a small number of people selling to Hanoi, this

marketing channel is not included in the model. According to results in Table 4.1, farmers that wholesale and retail their vegetables out of the district tend to obtain higher profits. The significance of these variables remains the same in these two models. Products from one hectare bring farmers that retail out of the district 86.6 million dong (3803 USD) (Model 2) and 88.3 million dong (3886 USD) (Model 3) more than farmers that do not retail out. Farmers wholesaling earn 79.1 million dong (3473 USD) (Model 2) and 79.4 million dong (3486 USD) (Model 3) per hectare more than farmers that do not wholesale.

4.1.2 Discussion

Comparative profit of organic and conventional vegetable production

Profit from organic vegetables is reported to be lower than profit from conventional vegetables. According to the farmers in the area, the price of organic and conventional vegetables should not differ because they are sold in the same markets. However, the price of an organic vegetable is sometimes lower than that of a conventional vegetable for a number of reasons. First, many consumers prefer beautiful unblemished vegetables, thus they do not want to buy organic vegetables with flaws caused by pests. They only agree to buy these vegetables if the sellers sell them at a lower price. Second, organic vegetables tend to be smaller in size in comparison with conventional vegetables, which also leads to a lower price. For example, from the same kind of seed, one conventional kohlrabi in the area might weigh 0.7 kilogram (1.5 lb) while one kohlrabi grown by an organic farmer only weighs about 0.3 to 0.4 kilogram (0.6 lb to 0.9 lb). Third, farmers in the area reported that the time needed to grow organic vegetables is greater. For instance, it takes 45 days for conventional kohlrabi to be ready to be sold but 60 days in the case of organic kohlrabi. Most farmers usually start growing vegetables at the same time of the year, thus, organic farmers always miss the early-season high price because their vegetables are harvested at the peak

of the harvest season and the market is flooded with output. At that time, even though the price of organic and conventional vegetables are the same, the price is lower than the price during the early season, thus disadvantaging organic producers who tend to have late harvests.

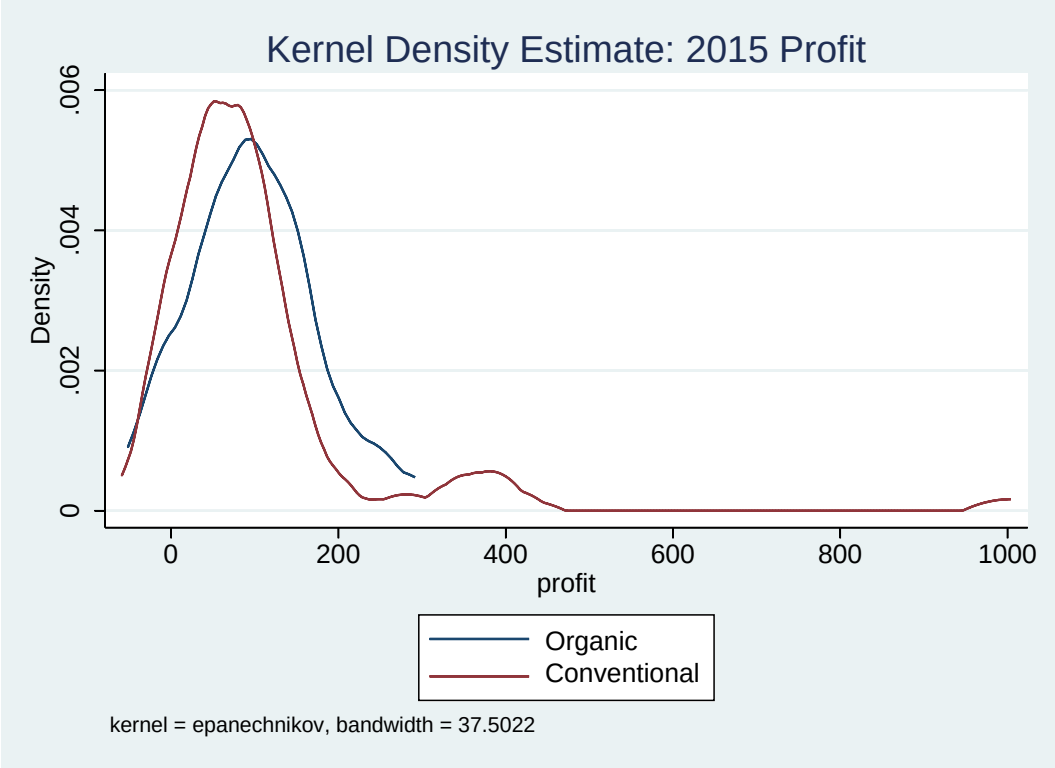

Figure 4.1 Distribution of Profit from vegetables, 2015

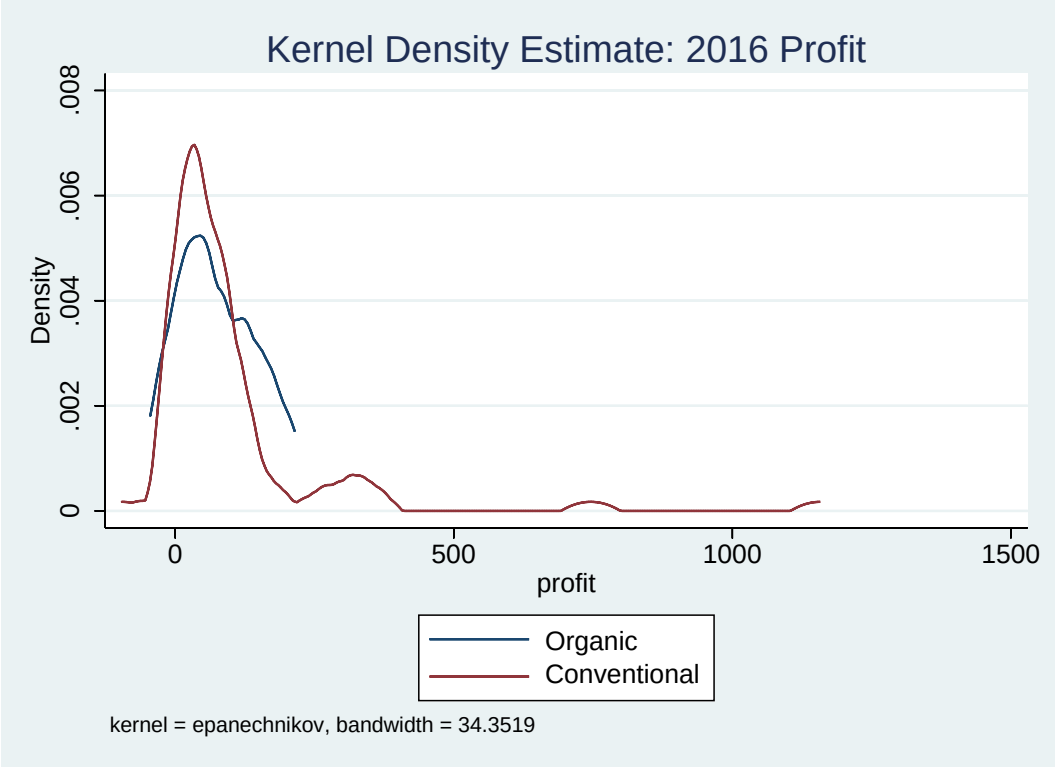

Figure 4.2 Distribution of Profit from vegetables, 2016

Even when on average in the sample, organic vegetable production is less profitable than conventional vegetable production, the distribution of profit shows that this result is driven by some extremely profitable conventional farmers in the sample. If conventional farmers who have profit higher than 300 million dong per hectare per year (13 observations) are taken out of the sample, profit from organic vegetable production is not significantly different from that of conventional production. The distribution also shows that there are organic farmers that even do better than many conventional farmers do. The existence of these outliers is not a mistake. They are believed to belong in this sample.

Correlation of independent variables and profit

Number of crops

According to the result, one added crop increases the per hectare profit. There may be four reasons behind this. First, farmers in the area usually watch each other and grow similar types of vegetables on their farms. As most farmers start growing their vegetables at the same time when the season comes, they tend to harvest the products at the same time. There is always a period in which a large quantity of the same vegetable is available in the market. When supply exceeds demand, the price of these vegetables falls, sometimes by a large amount. Farmers with more various crops can avoid the incident of excessive produce of the most popularly grown crops, thus increasing their profit. Secondly, as consumers always want to buy different vegetables for their family meals, it is possible that the more crops a farmer grows, the faster they can sell those in the market. An organic farmer reported that if she sold a variety of vegetables on a market day, she could sell them faster because one consumer can buy many types of vegetables from her at the same time as it is more convenient for them. Thirdly, more crops means higher priced crops can offset the loss of value from low-price crops. Finally, there is also a possibility that a farmer that grows a variety of vegetables seems to know better about vegetable production techniques and the market, when and where to sell those. Therefore, they can grow vegetables that not many others can grow and earn more from these crops. Crop diversification can be a risk management strategy for farmers in the area.

Market outlets

Vegetable farmers who retail out of the district and wholesale tend to earn more profit than farmers who do not do so. When selling out of the district, farmers usually bring their vegetables to Hoa Binh, a city that is about 30 kilometers away and Cao Phong, a wealthier neighbor district with

most farmers growing oranges. When selling to these places, the farmers can sell their vegetables at a higher price. Consumers in the city and more developed areas usually think the vegetables sold by farmers from their family gardens are safer than those sold by traders from Hanoi who collect the vegetables from bigger conventional farms that might use a lot of pesticides and agrochemicals. Consumers in these areas have higher incomes than consumers in Tan Lac, thus they may be willing to pay a higher price for the same type of vegetable sold in the local market. This also explains why vegetable farmers in Thanh Hoi commune earn less profit than vegetable farmers in Tu Ne. Thanh Hoi vegetable farmers usually sell their vegetables within the district local markets while farmers in Tu Ne also sell their vegetables to Cao Phong and Hoa Binh city. Farmers that wholesale normally have a good relationship with middlemen and may have good reputation for their products. Therefore, they can sell their products at a higher and more reliable price than farmers that sell their products at the market price, which usually fluctuates during the season. As there are always excessive amount of certain types of vegetables at peak season, farmers have to sell those at a very low price. Additionally, the wholesalers usually bring the vegetables to sell further away, thus they might get higher profit from the vegetables so they can offer the farmers a reasonable price in comparison with the local market price. Farmers in the area report that the wholesale price is often the same as the retail price in the local market. At the end of the market day, when farmers have vegetables left, the retail price falls even lower, making the local wholesale price sometimes even higher than the local retail price. In addition, when wholesaling, the farmers tend to be able to sell a majority of their products while it might not be the case if they only retail in the district where they have many competitors.

In summary, even in the same area, organic vegetables may bring less profit for the farmer than conventional vegetables. A conventional farmer that considers switching to organic

production only if it brings more economic benefit might not want to do so. However, he also needs to be aware that it was a transitioning period for the organic farmers in the area. Organic farmers were not familiar with the organic farming techniques. This led to a lower yield and maybe cost inefficiency, which lessened their profit. In addition, new organic farmers were not familiar with organic crops' length of growing period, thus they could not plan the planting time for better income. In addition, their products are not certified as organic products, thus these could not reach markets for organic products where consumers are willing to pay premium prices. Profit from organic vegetables in the study site can be improved when:

1) Organic farmers gain more experience in farming organically, thus they can choose which crops to grow and when to grow them to maximize their profit. Their products would also have more beautiful appearance. For example, if they know that it may take a longer time for an organic crop to grow, they may have to grow the crop earlier than the usual time to catch the early-season high price.
2) Organic vegetables in the area are certified as organic so the farmers can sell them to more market channels, for example stores and supermarkets in big cities where the demand for organic vegetables is high.

4.2 Characteristics of Organic Adopters

4.2.1 Endogeneity

Endogeneity becomes a potential concern when running the probit model. The suspect endogenous variable is the total *number of crops* each farmer grows. This is because it is possible that the decision of going organic and the decision on the diversity of the crops happen simultaneously. When one farmer decides to produce organic vegetables, he might, at the same time, decide which crops and how many crops he would grow, given his farm characteristics. He might decide to

diversify the crops, which he learnt from the organic trainings that crop diversification helps with pest control and soil improvement. Also, the number of crops a farmer usually grows might affect his choice to go for organic. For example, one farmer conventionally grows many different crops in a large area of land and is earning profit from the production. He does not have to spend much labor to deal with pests as he uses pesticides. However, when deciding to adopt organic production, given the limit of his family labor and there is no assurance of higher profit for organic products, he might want to keep growing conventionally. As endogeneity can lead to biased and inconsistent coefficient estimates, this problem should be addressed.

To examine the relationship between these two variables, I ran two different regressions, one with *organic* as a dependent variable and one with *number of crops* as a dependent variable. Control variables are the same in these two regressions. The results show that *organic* and *number of crops* are not significantly correlated in both models. Endogeneity does not exist in this case.

There is also a concern with retailin, retailout and wholesale being endogenous variables as the decisions of the farmers on going organic may be made at the same time as the decision on where to sell the products. However, in the study site, when switching to organic production, farmers did not plan on the market channels to which they would sell their products. They thought they could sell the vegetables to Hanoi as the market for organic vegetables in Hanoi was rising at that time but that did not work out well. They had to sell their vegetables in the local markets. Because all of the organic farmers already sold their vegetables in the market before, they all had the preferred market outlets. Farmers were asked whether they still sold in the same markets that they used to sell in before, a majority of them said yes. The most common reasons is that farmers already built relationships with consumers in these markets and they also did not know where else to sell their vegetables. It was easy for them to keep selling in these markets. Simultaneity seems

not to exist in this case. For these reasons, I assume the three variables indicating market channels are exogenous.

4.2.2 Probit Model Results

Table 4.2 Regression Results for *Organic*

Variables	Probit Model	
	Coeff.	M. eff.
Farm size	-10.2**	-2.1
	(4.7)	
Family labor	-0.00002	-0.000004
	(0.0002)	
Number of crops	0.005	0.001
	(0.07)	
Commune	-0.4	-0.08
	(0.2)	
Education	0.2	0.04
	(0.5)	
Age	0.06***	0.01
	(0.02)	
Number of family member	0.0004	0.00008
	(0.1)	

(Table 4.2 continues)

(Table 4.2 continued)

Variables	Probit Model	
	Coeff.	M. eff.
Retail in the district	-0.2	0.2
	(0.8)	
Retail out of the district	0.2	0.04
	(0.6)	
Wholesale	0.8	0.2
	(0.5)	
N Obs	77	
Log likelihood	-29	

Note: standard errors in parentheses. * indicates statistical significance: $p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

According to the probit model results, the adoption of organic production is significantly affected by vegetable farm size and age of household's head. According to the results, organic producers are smaller than conventional producers. This is also found by Veldstra et al.. Increase in *size of the vegetable farm* leads to the less likelihood that a farmer practices organic farming. If farm size goes up 1000 m^2, the probability to adopt organic production will decrease by 21.7%. One explanation is that farmers with larger vegetable farms do not want to invest in growing organically because there is still no market channel for organic products. Profit from organic production is, thus, not guaranteed while they can see that they need more labor for the organic farm. Small farmers can make use of the manure from their animals for composting but if they

want to expand the area growing organic vegetables, they need to buy manure from others. Together with the cost for manure, they also have to pay for transportation. In that case, they would rather buy fertilizer, which is more convenient and less expensive.

Older farmers are more likely to adopt organic farming. 10 year increase in age of household's head increases the probability of going organic by 10%. There are some research reporting that age is negatively correlated with the adoption of organic farming practice because younger famers tend to adopt new technology and acquire farming information via media (Souza et al.; Genius et al.). However, in the case of Tan Lac, it is possible that older farmers used to farm without using agrochemicals when they were young while younger farmers grew up in the time that agrochemicals were popularly used. Thus, older farmers can be more likely to accept the idea of organic farming practice that does not use agrochemicals.

There is one concern that income share of vegetable production may correlate with organic adoption choice. However, when running the probit model with this variable added, the result shows that income share of vegetable production does not significantly correlated with the adoption choice. Result is reported in Table 4.4.

Table 4.3 Regression Results for *Organic (with vegetable income share)*

Variable	Coefficient
Farm size	-10.2**
	(4.7)
Family labor	-0.0001
	(0.0001)
Number of crops	0.01
	(0.07)
Commune	-0.2
	(0.5)
Education	0.4
	(0.5)
Age	0.05**
	(0.02)
Number of family member	-0.02
	(0.1)

(Table 4.3 continues)

(Table 4.3 continued)

Variable	Coeff.
Retail in the district	-0.7**
	(0.7)
Retail out of the district	0.2
	(0.6)
Wholesale	0.5
	(0.5)
Vegetable income share	-0.04
	(0.06)
N Obs	84
Log likelihood	-31

Note: standard errors in parentheses. * indicates statistical significance: $p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

In summary, a household that is more likely to adopt organic farming would be described as a household with older household's head and smaller vegetable production area. It is important that local government and NGOs that support farmers in the area understand the characteristics of organic farmers to support them to be more successful and to provide those who want to go organic in the future with information that helps them make better decision.

CHAPTER 5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

This study provides information about the comparative profitability of organic and conventional vegetable production in Tan Lac district, a mountainous area in the North of Vietnam. In the study site, one hectare of organic vegetable production is 42 million dong (1840 USD) less profitable than one hectare of conventional vegetable production. A conventional farmer that wants to switch to organic production only because of profitability might not want to do so since during the transitioning period, he will not only get lower profit but also face many challenges when getting used to growing organically. A farmer that wants to switch to organic farming also because he cares about his family's health and the environment needs to understand the tradeoffs between the two farming practices before deciding whether to go organic. Each farmer might have his own choice given his farm and family characteristics. Farmers are usually said to only care about the short-term benefits when choosing their farming practices. However, it is a very hard choice for a farmer to choose a less profitable farming practice while he still struggles making ends meet, even when he knows that it may bring more benefits in the long-term.

5.2 Recommendations

Organic farming is considered a sustainable farming practice but it cannot be a one-size-fits-all solution for all farmers in all different regions. It is important to understand the farmers and the areas' characteristics before developing a plan for organic adoption. Recommendations for the study site are as follows.

Decision making process

Farmers who want to adopt organic production need to be sure of what they want before making a decision. In order for them to make the right decisions, farmers need to be provided with information about both benefits and challenges when switching to organic farming. One of the mistakes that the local NGOs made when they started supporting farmers in the site was that they did not make clear the challenges the farmers might face when farming organically. All that farmers heard was the benefits of going organic. It was obvious that the chance for price premiums attracted farmers the most. However, they did not know that a price premium does not even exist if products are not sold to the right market. When deciding to produce organic vegetables, farmers did not know about all the challenges awaiting. Thus, when faced with these difficulties, they are easily demotivated and at the same time have no solutions for the issues. This is one of the reasons that triggered the failure of organic farmers.

Production site selection

Farmers are always concerned about how to sell their products when thinking of switching to organic while forgetting that they may not even have a suitable field to grow organically. Although it was not possible in this study to measure underlying soil quality, this may be an important hidden factor that influences yield outcomes. Consideration of growing conditions is a step that was skipped when local NGOs chose whom to support. Organic production has special requirements for on-farm management. Therefore, it may be important to decide whether a field is suitable to grow organic products before starting to grow organically on it. If this step is skipped, it is possible that the products produced are not accepted in the organic market, leading to economic losses for farmers. The characteristics of the site also affect crop choice. Understanding this helps farmers

develop their plan for crop selection to make use of the advantages of their field to maximize their profit. The production site assessment should be consulted with experts in organic production.

Organic production knowledge and techniques

It is important that a vegetable farmer has good skills in producing organic vegetables. Most of the organic farmers in the site reported that they received negative comments of consumers on the appearance of their vegetables, which lowers the price of these. In fact, organic vegetables are not necessarily bad-looking. Farmers with better skills may be able to fix the technical issues and produce higher-quality products in a more efficient way. When there is no certification for the products in the area, quality of the products can sell themselves.

Production plan

Currently, the greatest potential market for organic vegetables grown in Tan Lac is Hanoi (68 miles from Tan Lac). To enter this market, farmers in Tan Lac have to compete with other organic producers who are closer to Hanoi and already have reliable marketing agreements with suppliers. Organic vegetables from Tan Lac do not have certification. The long transportation time may decrease the quality of the products. Transportation cost is also added to the price. If farmers in Tan Lac produce the same kinds of vegetables as the farmers near Hanoi, it is not likely that they can compete with those farmers. To be successful, organic vegetable farmers in the area need to develop their own selection of products that can be competitive.

Market channels

Potential markets for organic products need to be identified and established when a production plan is developed. The reasons for this are as follows.

First, the market for organic products is a niche market, thus it is harder for organic producers to enter than to enter a conventional vegetable market. If the farmers do not establish

the market in advance, it is possible that when the products are available, farmers will still not be able to enter the market, leading to economic loss.

Second, there is no market for organic products in the local area, thus the farmers have to sell these to the big cities. While there is no official certification for organic products in Vietnam and scandals of conventional vegetables being sold as organic vegetables in the big cities scare consumers, the best way is to sell their products through reliable suppliers. A relation with a supplier ensures a stable price and quantity sold. It is even better when suppliers participate in the production plan development and monitor the production. As a supplier normally knows about what consumers want, the production plan reflects consumers' demand. This solves the farmer's problem of excessive produce. Also, building a relationship with a supplier helps farmers know about their comparative advantage products to develop their production plan. This ensures that they do not grow the same products as other competitors.

Cooperation

During the transitioning period, it seems to be better for a farmer to start with a small farm size to gradually master his organic farming skills and have better choice of crops and growing schedule. This will help them learn to manage risks on a small farm before expanding their production. However, small production might also become a problem if the farmers want to sell to big buyers who require huge quantity and variety of vegetables on a daily basis. One solution for this would be for farmers to cooperate to sell to the same buyer. Doing so, the farmers do not miss a chance to sell to big buyers and at the same time can still manage their crops better.

It seems that farmers in the study site cannot develop organic production by themselves, at least in the near future. In order to complete these above-mentioned recommendations, they need support from the local government, NGOs and private sector. It is important that when developing

a project in the site, all stakeholders participate in developing the plan in order to be on the same page in supporting the farmers. Key-informant interviews reveal that the disagreement of the local government and the NGOs slows the projects down and hinders implementation.

5.3 Limitation and Future Research

Limitation

This study has the following limitations:

1) Small sample size
2) Data of two production periods (2015 and 2016) are collected at one time, which possibly leads to the bias that farmers report similar numbers for these periods.
3) As organic farmers in the sample include farmers that grow both organic and conventional vegetables, they may still have characteristics of conventional farmers. This may lead to some indifferent results relating to characteristics of the two groups in the models.
4) Results of the study are based on interviews with farmers. As they do not keep record of their production, there may be responses that reflect their perceptions instead of the real figures.

Further Research

This study examined whether organic vegetable production is a profitable alternative for conventional vegetable farmers in Tan Lac and what could be done to help organic vegetable farmers become more successful. The analysis was conducted primarily with a focus on production issues. Because the organic market is special, to be successful a farmer must have an understanding about the market before selling his or her products. In order to help the local government and farmers make better decisions on whether they should develop organic vegetable production, factors relating to markets (potential markets, suppliers' and consumers' requirements, price

premiums, competitors and challenges entering the markets) should also be analyzed. The farmers can incorporate what they know about the market in their production plans to be more successful.

To complement economic analysis, further research is needed on the tradeoffs between organic and conventional vegetable production in terms of environment and human health. This information would help the local government and the farmers think about a long-term sustainable plan for their production in the study site even if organic production is not currently an economically attractive solution for them. These studies should involve the local governmental officers in the data collection process so that they have a more complete understanding of the farmers' situation and how the government might help farmers develop more sustainable farming systems and a healthier food supply for Vietnamese consumers.

APPENDIX A. HOUSEHOLD SURVEY

TAN LAC SURVEY	HHID
DATE	VILLAGE
INTERVIEWER(S)	COMMUNE

SECTION A: Basic Information

A1	Name:
A2	Relation with the household's head:
A3	Years of education of household head: _____ yrs
A4	Household's type: ☐ Poor ☐ Near Poor ☐ Middle ☐ Upper Middle ☐ Rich
A5	Age of household head: _____ yrs old
A6	Number of household members: _____ members
A7	Number of family members working on farm:
A8	Current size of farm (in m^2) Forest land: _____ m^2 Land for subsidiary crops: _____ m^2 One-crop rice land: _____ m^2 Two-crop rice land: _____ m^2 Other (……..):_____ m^2
A9	In the last two years (2015 & 2016) did the size of your farm change? Yes or No If YES, describe: (e.g. did you buy or sell any land, give land to children, etc.?)
A10	What are your family income sources in 2015 and 2016?

Sources	2015	2016

	Animal husbandry		
	Forest Plantation		
	Rice		
	Vegetables		
	Fruit trees		
	Firewood		
	Working off farm		
	Others		

SECTION B: Vegetables and organic vegetables production

B1. According to you, what is organic vegetable?

B2. Did you/your family members participate in the organic vegetables growing group / organic vegetables growing trainings?

Yes or No

If Yes, go to Question B3, B4, B5, B6

If No: Go to Question B7

B3. Please list all trainings participated

	When	Content of the training	Organizer	Length of training
1				
2				
3				
4				
5				

B4. What are the biggest changes in your farming practices after the trainings?

-

-

-

B5. What are difficulties when applying knowledge learnt from the trainings?

-

-

-

B6. What are the difference between organic vegetables and the vegetables you produced before?

-

-

-

B7. What crops did you grow in 2015 and 2016?

2015

Vegetables	Size (ha)	Harvest time (When and how long)	Unit	Total amount harvested	Quantity sold	The remaining (Subsistence or waste)	Price (VND/unit)	Income (VND)	Organic	Non-organic

2016

Vegetables	Size (ha)	Harvest time (When and how long)	Unit	Total amount harvested	Quantity sold	The remaining (Subsistence or waste)	Price (VND/unit)	Income (VND)	Organic	Non-organic

B8. Input costs (VND/year)

2015

Vegetables (From B7)	Organic	Non-organic	Seeds	Fertilizer	Pesticides	Tools	Others

2016

Vegetables (From B7)	Organic	Non-organic	Seeds	Fertilizer	Pesticides	Tools	Others

B9. Labor costs for growing vegetables in 2015 and 2016 (VND/ha/year)
2015
Organic vegetables production

	Weed	Fertilizing	Spraying	Cultivating	Planting	Harvesting	On Farm Processing	Selling
Family labor								
Days								
Wage								
Hired labor								
Days								
Wage								

2015
Conventional vegetables production

	Weed	Fertilizing	Spraying	Cultivating	Planting	Harvesting	On Farm Processing	Selling
Family labor								
Days								
Wage								
Hired labor								
Days								
Wage								

2016
Organic vegetables production

	Weed	Fertilizing	Spraying	Cultivating	Planting	Harvesting	On Farm Processing	Selling
Family labor								
Days								
Wage								
Hired labor								
Days								
Wage								

2016
Conventional vegetables production

	Weed	Fertilizing	Spraying	Cultivating	Planting	Harvesting	On Farm Processing	Selling
Family labor								
Days								
Wage								
Hired labor								
Days								
Wage								

B10. Where did you sell your vegetables?
Organic vegetables

Market channels	Percent of total sale	
	2015	2016
Retail in the district (Who and Where)		
Retail out of the district (Who and Where)		
Wholesale		
Others		

Conventional vegetables

Market channels	Percent of total sale	
	2015	2016
Retail in the district (Who and Where)		
Retail out of the district (Who and Where)		
Wholesale		
Others		

B11. Why don't you sell organic vegetables to the buyers of the non-organic vegetables or vice versa? *(Only ask this question if there is a difference between buyers of organic and non-organic vegetables)*

B12. Are your products certified? If yes, by which organization?

B13. Do you still sell organic vegetables where you mentioned in Question B10? Yes or No
Why?

B14. What challenges do you face when growing your organic vegetables?

- ☐ Technical issue *(eg: seeds problem; veggies do not grow to the expected size; when to grow and harvest, making fertilizer, etc.)*
  Specify:
- ☐ Pests
  Specify:
- ☐ Land contaminated with synthetic pesticides previously used
- ☐ Lack of money to invest in new crop every season *(eg: organic seeds, fertilizers, tools, etc)*
- ☐ Overproduce some products and under produce some other products
  Specify:
- ☐ Others:

B15. What challenges do you face when selling your organic vegetables?

- ☐ Lower or equal price to conventional vegetables

- ☐ Difficult to find where to sell the products
- ☐ Products do not meet the requirements of the buyers / consumers (both quantity and quality)
  Specify:

- ☐ High transportation cost for organic vegetables when selling outside of the district
- ☐ Others:

B16. What do buyers tell you about your vegetables?
Positive:

Negative:

B17. Do you have a plan to continue growing organic vegetables in the upcoming years?
Why?

B18. What should be changed to make you keep growing organic vegetables and be beneficial from that?
Yourself:

Local government:

Other organizations:

APPENDIX B. QUESTIONS FOR GROUP DISCUSSION

Participants: Leaders of the villages and local civic organizations (Farmers' Association, Women's Union, Veterans' Association, Youth Union)

1. Households Classification

Type of household	Proportion	Main assets	Main income

2. How many households are growing organic vegetables in the village?
3. What are the types of vegetables that the villagers usually grow? What are the most common types of vegetable grown in the village? What makes them the most common types?
4. What are the reasons why you do (or don't) choose to grow organic vegetables?
5. What are the advantages and disadvantages that organic farmers in the village face?
6. What are the differences between organic and conventional vegetable production in the village?
    - Comparative input costs
    - Comparative labor need/labor cost
    - Markets
7. Do you think growing organic vegetables is a good income source for farmers in the district/communes? Why?

8. What should be changed to help traditional and organic vegetables growers have better income from growing vegetables?

   The growers:

   The local government:

APPENDIX C. QUESTIONS FOR KEY-INFORMANT INTERVIEWS

Organic Buyers (Including private enterprises)

1. Where do you normally buy organic vegetables from?
2. What are the reasons why you buy organic vegetables from some farmers and not other farmers?
3. What are the problems, if any, you face when you buy organic vegetables form the farmers, especially farmers from Tan Lac district?
4. What are your requirements for buying organic vegetables from farmers? *(eg: certificate, transportation distance, quality, quantity, etc.)*

Local Officials

1. Does the province and district have any programs that support organic farmers (both production and marketing)?
2. What are the advantages and disadvantages when implementing those programs (if any)?
3. Do you think growing organic vegetables is a good mean of income generation for farmers in the district/communes? Why?
4. What should be improved to help organic farmers be beneficial (/earn more income) from growing organic vegetables?

Non-governmental Organizations

1. What are the advantages and disadvantages your organization face when supporting farmers to grow organic vegetables? What are the lessons learnt from your projects?
2. What should be done to help organic vegetables growers increase their income and better their lives?

3. What should be improved to help organic farmers be beneficial (/earn more income) from growing organic vegetables?

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