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Agricultural Policy, Off-farm Income, and Farmland Values: The Case of South Korea

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AGRICULTURAL POLICY, OFF-FARM INCOME, AND FARMLAND VALUES: THE CASE OF SOUTH KOREA

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ABSTRACT

Farmland plays a dual role for farm business households; it can be both a production cost and an asset. As a production cost, farmland affects farm production decisions. As an asset, farmland comprises 80% of the total farm households' assets. Farmland is used in producing agricultural products for current farmers, and provides rental revenue for retired farmers in the form of pensions (Offutt, 2003). Globally, the total land available for farming is decreasing due to non-farming demand for land. For example, in South Korea, the farmland area has decreased from 1,737 thousand hectares to 1,711 thousand hectares[1]. However, from 2009 to 2013, farmland values actually increased as a result of growth in net farm income.

The primary goal of this dissertation is to examine the impact of farm household income on farmland values. Currently, off-farm income and government agricultural subsidies are the main sources of total household income, so I will assess the impact of off-farm income and government subsidies on farmland values in South Korean farm households. The majority of previous studies on off-farm income, government agricultural subsidies, and farmland values have been conducted using data from the United States or other developed countries. This dissertation contributes to the literature by investigating the impact of off-farm income and government subsidies in Korean agricultural households. Korea is a country which mainly imports its agricultural goods, and is comprised of small family farms. Examining Korea's situation will improve the decision making of farm policymakers and researchers who are interested in reducing agricultural subsidies and increasing the economic well-being of Korean farm households.

[1] The 2009 and 2013 Korea Farm Household Economic Survey Data (Korea Statistics).

Chapter 2 presents the agricultural status, agricultural policy and the state of off-farm income of South Korea. With a clear understanding of the agricultural situation in Korea, Chapter 3 reviews the body of relevant literature. In Chapters 4 and 5, a theoretical farmland value model and data are described. Chapters 6 and 7 discuss an unconditional quantile regression and results. Finally, Chapter 8 is the summary and concluding remarks.

CHAPTER 1: INTRODUCTION

1.1. Overview of This Study

Farmland is an important asset for all farm households. In 2013, farmland comprised about 53 percent of total farm assets in South Korea.[2] Farmland provides agricultural products for present farmers and provides rental revenue for retired farmers in the form of pensions (Offutt, 2003). In addition, farmland is one of the essential inputs, including labor and capital, that has a production cost, and affects farm production decisions.

In Korea, the trend of total land area is increasing; however, farmland area is simultaneously diminishing. From 2009 to 2013, total land area in South Korea increased from 9.9 million hectares to 10 million hectares, but during the same period farmland area decreased from 1,737 thousand hectares to 1,711 thousand hectares. However, historically farmland values have increased with growth in net farm income and market price. Figures 1.1 and 1.2 show the average farmland area and farmland value per area in South Korea from 2008 to 2012 based on the Korea Farm Household Economic Survey (FHES). Among the approximately 2,500 farm households, the average farmland area per farm was stable from 2008 (12,389 acres) to 2010 (12,394 acres). In 2011, farmland per farm increased to 12,580 acres, but it decreased to 12,567 in 2012. The value of farmland per area increased from 29,862 won/acre in 2008 to 34,783 won/acre in 2012.[3]

[2] The 2013 Korea Farm Household Economic Survey Data, surveyed 2,347 sampled farmers (Korea Statistics).
[3] Won (₩) is the Korean monetary unit, where $1=₩1,109 (12.09.2014) Korea Exchange Bank.

Various factors such as farm productivity, innate quality, artificial efforts, amenity, location, and urbanization influence farmland value (Sherrick and Barry, 2003; Livanis et al, 2006). Most of these determinants are inherent. According to the 2008-2012 Korea FHES data,

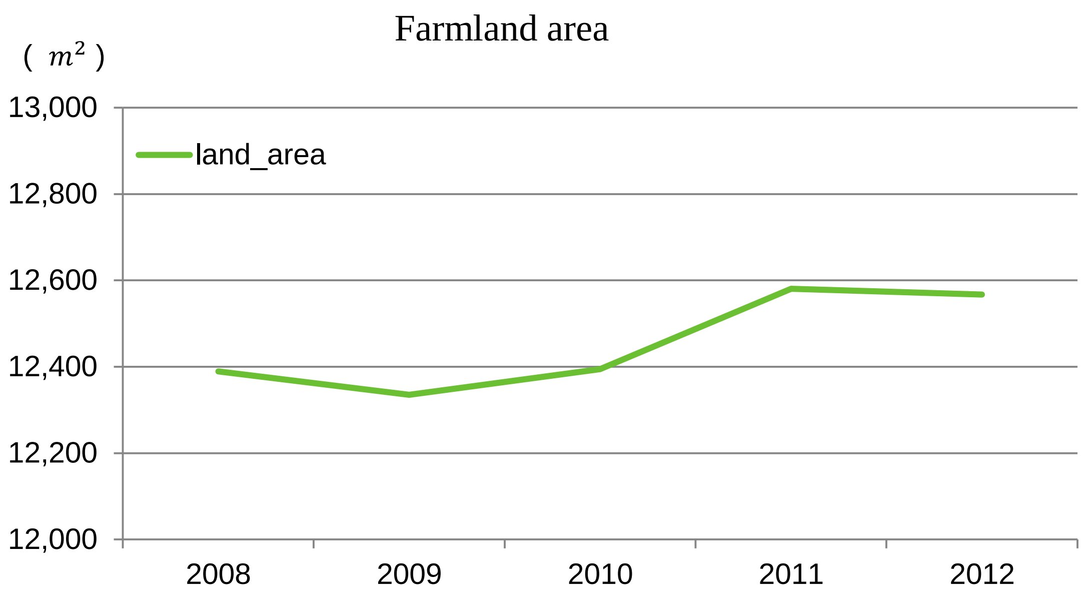

Figure 1.1. Average farmland area of South Korea (2008-2012)
Source: 2008-2012 Korean Farm household Survey (Korea Statistics).

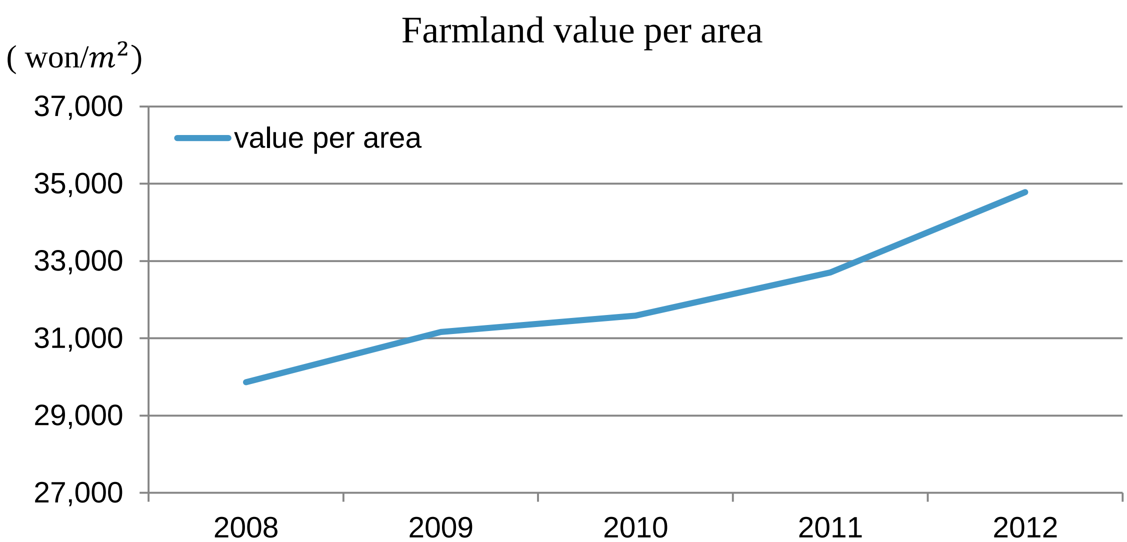

Figure 1.2. Farmland value per acre of South Korea (2008-2012)
Source: 2008-2012 Korean Farm Household Survey (Korea Statistics).

among the 16 Si and Do (categorized provinces similar to city and county in the United States), the value of farmland in Seoul, Busan, Daegu, Incheon, and Kyeonggi-do is higher than other regions. These areas are metropolitan cities inhabited by over one million people. From 2008 to 2012, the value of farmland in the Jeju-do region also increased. Jeju-do is a popular area for tourism, so many barren or non-arable areas have been developed for travelers and investors. Meanwhile, Gwangju, Gangwon-do, and Jeolla-do have lower farmland values than other regions.

Other significant factors in determining farmland value are off-farm income and agricultural policies (in the form of government subsidies). Off-farm work is especially important because, besides monetary rewards, it provides fringe benefits, such as protection from income variability, availability of health insurance, and pension or retirement income. Yet the share of off-farm income to total farm income is much lower in countries such as South Korea. According to over 2,000 Korean farm households surveyed in 2013, only 44% of total farm household income came from off-farm work; fortunately, the share has been gradually increasing (Korean Statistics, 2014).

Government payments (or government subsidies) and off-farm income are important sources of income that improve or increase total farm household income. Furthermore, they have a positive influence on farmland values. Mishra and Moss (2013) investigated the impact of off-farm income on farmland values and argued that increased farm household income, through higher off-farm income, is able to raise the auction value of farmland. Using quantile regression, they found that off-farm income had a positive relationship with the value of farmland. Similarly, government subsidies can also affect farmland value. For example, Goodwin and Mishra (2003) found that government payments have a significant impact on farmland values. However, if land values increase, then the benefits move from producers to landowners.

Most studies on how government subsidies and off-farm income affect farmland values are conducted in the United States and Western Europe. In fact, no studies have focused on South Asia, and particularly South Korea – a newly industrialized country. The purpose of this dissertation is to assess the impact of off-farm income and government subsidies on farmland values in South Korea. South Korea is an agricultural import country where most farm households are classified as small family farms. About 70% of the total land is located in mountainous areas, so arable land is limited and farmland values are relatively high. Recall, farmland is an important factor in production agriculture. Additional factors affecting farmland values in South Korea have not been investigated by researchers.

Figure 1.3 shows trends in farm household income and government subsidies in Korea using the Korea Farm Household Economic Survey (FHES). This data shows that total farm household income increased slightly from 31.4 million won to 32 million won during the 2008-12 time period. Within farm household income, income from off-farm work is greater than the income from farming. Also, the share of off-farm income increased, while the share of farming income decreased. Off-farm work can be separated into two parts: business work (self-employed) and employed work (working for wages and salaries). Employed income is the main resource of off-farm income. Government subsidies are smaller than off-farm income; however, they are higher than off-farm business income and less than employed income. In South Korea, as is the case in the United States, government subsidies and off-farm income are important sources of income for farm households.

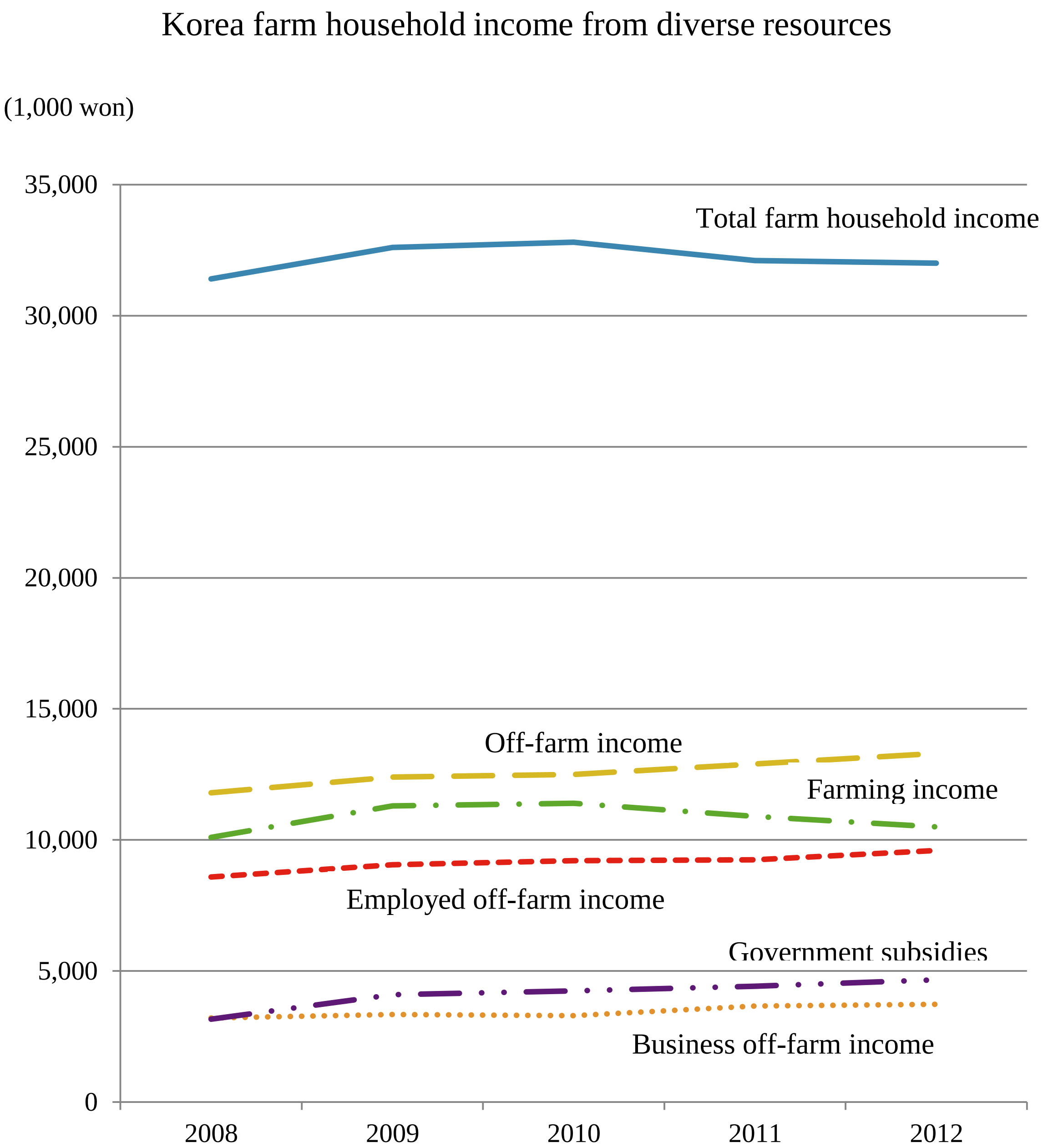

Figure 1.3. Farm household income and government subsidies in South Korea (2008-2012)
Source: Korean farm household economic data

1.2. Purpose of This Study

The value of farmland is an essential indicator of a farm household's well-being. The goal of this dissertation is to study how government subsidies and off-farm work impact farmland values in South Korea. Specifically, this dissertation seeks to determine the impact of government subsidies and off-farm income on farmland values among South Korean farm households. To examine this, the unconditional quantile regression method is used. Quantile regression helps to deal with outlier problems and to understand the distribution of the data (Cameron and Trivedi, 2010). It can be separated into the conditional quantile model and the unconditional quantile model according to the restriction of distribution of the covariate variable. The conditional quantile model is easy to apply and commonly used; however, the estimated results are easily changed, in accordance with adding control variables in the model. The goal of the unconditional quantile regression is to examine the variation on the marginal (unconditional) quantile distribution of the outcome variable according to covariate changes (Firpo, Fortin, and Lemieux, 2009). Since unconditional quantile regression is not influenced by the distinct variables, it is more generally interpreted. After analyzing, the estimated OLS and unconditional quantile regression coefficients will be represented graphically to compare the estimation results between the two models.

Currently, South Korea is not commonly studied in the literature. It has a different socioeconomic, cultural, and geographic background than the United States or Europe. Examining South Korean farm households provides insights into the behavior of small family farm households where government subsidies are higher than in the U.S.

1.3. The Organization of This Study

Chapter 2 will present the agricultural status of South Korea, such as agricultural policy and off-farm labor. After understanding the Korean agricultural situation, a literature review will be presented in Chapter 3. This chapter will present the determinants of farmland values and its relationship to off-farm income and government subsidies. Chapter 4 will outline a theoretic farmland value model, and in Chapter 5, a discussion of the Korean Farm Household Economic Survey (FHES) will be followed by an empirical model and unconditional quantile regression method. Chapter 6 will examine and discuss the results of the estimated empirical model. The final chapter is allocated to summary and concluding remarks.

CHAPTER 2: BACKGROUND

2.1. Overview and Agricultural Status of South Korea

South Korea, also referred to as Korea, is located in Northeast Asia. It lies between China in the West and Japan in the East and is considered to be an important geographical area. After the Korean War in 1953, the peninsula was divided into North Korea and South Korea based on the Korean Demilitarized Zone (DMZ), which crosses the 38th parallel North. The total population of Korea was about 50 million in 2011; it is projected to be 51 million in 2015. Approximately 20% of the total population lives in the capital city, Seoul.[4] About 70% of land in Korea is mountainous. The total land area is approximately 100,033 square kilometers, similar in size to the State of Kentucky in the U.S. (104,659 square kilometers).[5] Based on 2011 data, the population density in South Korea is about 497 persons per square kilometer. The South Korea administrative district is split into 16 regional governments. These are similar to counties in the United States and consist of 1 special city, 6 metropolitan cities, 8 provinces, and 1 special self-governing province. There are also local governments (77 cities, 88 districts, and 69 boroughs).

In the early 1960s, South Korea was referred to as one of Asia's "four dragons" alongside Taiwan, Hong Kong, and Singapore. These so-called Newly Industrializing Countries (NICs) showed rapid economic growth after World War II. Between 1970 and the 1990s, South Korea's GDP growth rate averaged over 5% per year. However, after the financial crisis in 1997, South Korean economic growth stagnated. The South Korean government took bailout money from the International Monetary Fund (IMF) to secure the economy. By 2012, the real GDP growth rate

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[4] Sources: Korean Statistical Information Service (KOSIS), Korean Census in 2010, and the Bank of Korea.

[5] Sources: http://english.visitkorea.or.kr/enu/AK/AK_EN_1_1_1.jsp (Korea Tourism Organization), http://en.wikipedia.org/wiki/Geography_of_South_Korea (Geography of South Korea), & http://kentucky.gov/ (State of Kentucky website).

had fallen to 2.3%. It rallied back up to 3% in 2013, but had dropped back even further by the second quarter of 2014, to 0.5%. At that time, the nominal GDP was $1,304 billion, the nominal GNI was $1,316 billion, and the GDP per capita was $25,973 in 2013; the unemployment rate was 3.3% and employment-population ratio was 61% (August 2014).[6] The exchange rate in Korea is 1,069won (₩) - 1US$ (2014.10.7). In 2013, exports, which included semiconductors, petroleum products, and cars, totaled $559,632 million, and imports - primarily crude oil, semiconductors, and natural gas - totaled $515,586 million. The main trade partners included the United States, China, and Japan.[7]

Similar to other developed countries, the agricultural economy in South Korea is sluggish. The agriculture sector has been neglected in order to develop sophisticated industries which accelerate economic growth. Although agriculture was ignored on a grand scale, it still played a crucial role in the economic wellbeing of rural farm households in South Korea. The agricultural sector has implications on food security, maintaining rural communities, and environmental and local conservation. Therefore, for policymakers to develop a full and accurate picture of South Korea's economy, it is important to understand the status of agriculture there.

The staple food of South Korea is rice; therefore, early Korean farmers focused on the production of rice. However, because of an increased rice supply from high yielding production technology, reduction in rice consumption, and mandatory rice imported by the World Trade Organization, Korean farmers have diversified farm production (42% paddy rice; 24% vegetables & wild greens; 15% fruits; 9% food crops; and 5% livestock farm households in 2013).[8]

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[6] Sources: Korean Statistical Information Service(KOSIS), IMF, and the Bank of Korea.

[7] Source: Korea International Trade Association (http://www.kita.net).

[8] Source: STATISTICS KOREA (http://www.kosis.kr).

The majority of Korean farmers own small-scale family farms. In 2013, the total agricultural land area was 1.7 million hectares, which comprised of 963,876 ha of rice and 747,560 ha of dry fields. In the same time period, 9,984 farm households lived on uncultivated land, while 1.1 million farm households lived on cultivated land. Seven hundred forty-four thousand and sixty-two farm households (65.7% among the cultivated land residents) lived on an area under 1 hectare, and 10,704 farm households (0.95% of the cultivated land residents) had 10 hectares and over.[9]

Agriculture was the main industry in the 1960s, but the share of agriculture growth in the GDP has shrunk ever since industrial growth took over. Data shows that, in 2013, 6.3% of total households were engaged in farming work and vocational farmers comprised 5.7% of the total population. During the same time period, 5.9% employed persons worked in the agricultural sector. As of 2013, the agricultural sector consisted of 1.9% of the nominal GDP, 2.3% if forest and fishery areas were included.[10]

According to the Farm Household Economic Survey (FHES), total farm household income, which includes farm income, off-farm income, transfer income, and irregular income, increased from 26.9 million won in 2003 to 34.5 million won in 2013. Until 2006, farm income (12 million won) was greater than off-farm income (10 million won), but since 2007, off-farm income has exceeded farm income; indeed, off-farm income accounts for 45% of the total farm household income while farm income contributes only 29%. In the same data resource, assets were 400 million won and the debt of farm households was 27 million won. Twelve percent of

[9] Source: STATISTICS KOREA (http://www.kosis.kr).
[10] Source: STATISTICS KOREA (http://www.kosis.kr).

farm households had no profits, 51% of farm households earned 1 to 10 million won, and only 3% of farm households gained over 100 million won in total sales.[11]

2.2. Agricultural Policy and Government Subsidies of South Korea

South Korean agricultural policy has changed alongside political, social, and economic development. Before industrialization in the 1960s, historical events also affected the agricultural policy. During the Japanese colonial era from 1910 to 1945, South Korea was used primarily for rice production as a food supplier. During this time, South Korean agricultural policy focused on the increase of rice productivity and the regulation of the rice market to stabilize supply and price. In 1949, after being liberated from Japan, South Korea conducted farmland reform to deal with Japanese-owned farms and to distribute farms to tenant farmers who would eventually become farm owners. The tenant farmers did not receive fair contracts with the farm owners. However, during the process of purchasing farms, farmland reform increased farm productivity (Lee et al., 2011).

There were some specific goals for agricultural policies for the period following the Korean War. Kim and Lee (2003) scrutinized the South Korean agricultural policy by decade. During the 1950s, agricultural policies focused on solving the food problem and stabilizing prices. After the Korean War (1950-1953), infrastructure in South Korea was abolished and its economy lagged behind that of North Korea. The South Korean government created economic policies to provide a stable source of food and fiber to combat hyperinflation and invested in reconstruction and national defense to restore confidence in the government. To improve the food problem, the government controlled the sale price so as to regulate the quantities of rice in

[11] Source: STATISTICS KOREA (http://www.kosis.kr).

the market. In this period, the government implemented a policy that kept the price of rice stable. After the Korean War, foreign aid was routinely accepted, and the import of grains was imposed to alleviate the food shortage and seek price stability. However, imported agricultural products caused a surplus of food and led to a reduction of the price of agricultural goods. These results diminished farming income.

Until the early 1960s, agriculture was considered an important economic driver. In the second half of the 1960s, in an effort to reestablish the agricultural sector, agricultural policy concentrated on increasing production of agricultural goods and creating a farm-price-support system. In 1961, the Korean government enacted the Price Maintenance of Agricultural Products Act. The government could now purchase, make collateral loans, and export subsidies to maintain a reasonable price level. To increase provisions, they reclaimed and cultivated land. However, despite the efforts to improve food production, agricultural production fell short of self-sufficiency along with two bad harvests in the late 1960s.

From the late 1960s until the late 1970s, the South Korean economy grew rapidly. During the 1970s, farm policy focused on the double grain price system, progress and productivity, and the improvement of agricultural technology. In the double grain price system, the government bought main staple grains from farmers and sold them to consumers at a lower cost. This led to invigoration of technical developments and the development of new grains. In this period, 'Tongilbyeo,' a mix of Japonica and Indica rice, was developed leading to the achievement of self-sufficiency; unfortunately, however, the rice was vulnerable to weather and vermin. In addition, crops at higher incomes and livestock technology were increased. The government initiated 'Saemaeul-Undong' or 'The New Village Movement' for comprehensive development of agricultural areas. This movement focused on constructing programs such as SOC and improving not only farm households' incomes but also rural environmental development.

Starting in the late 1970s, South Korea confronted huge challenges which affected the agricultural market. In the 1980s, under pressure to open the agricultural market to foreign counties, the government's role in the market decreased, and the foreign market became dominant. To comply with the opening market, an agricultural restricting policy was conducted. The policy focused on improving farm structure, fostering large-scale professional farmers, and creating non-farm income to enhance farm productivity and efficiency. In this period, non-agricultural work was actively introduced, and farmers pursued new income resources such as producing high-income crops or livestock in conjunction with their original farming work. In 1989, 'Agricultural development comprehensive plans' started to emerge. These aimed to enhance productivity, competitiveness, and stability of income as the scale of farming grew and technology accelerated, which enabled agricultural land mobility and an improvement of rural life.

In the 1990s, South Korean agricultural policy focused on preparing and opening the agricultural market. The settlement of Uruguay Round in 1993 and the establishment of the WTO (World Trade Organization) in 1995 intimidated domestic farmers. Therefore, the South Korean government endeavored to stabilize farmers' incomes and lessen the effect of imported agricultural products through the enhancement of non-agricultural income and the improvement of the agricultural structure. In 1991, the 'Farming and fishing villages' structural improvement plan' was enacted to enhance competitiveness. To fulfill government policies, economic supports are imperative. Therefore, government subsidies, mainly in the form of payments or loans, accompanied government policies. After the 1990s, to protect the agricultural market from opening, the government invested heavily in farmers and rural areas.

To examine government subsidies in South Korea, Lee et al. (2011) separated the South Korean agricultural policy into two time periods: the time prior to the agricultural market opening and the time after the agricultural market opening. The first period was further subdivided into three parts: pre-1960, 1961-1976, and 1977-1992. In order to explain the after market opening period, the authors categorized the period into three sectors denoted by presidential terms: 1993-1997, 1998-2002, and 2003-2007. Since government policies and subsidies are related to politics, it is meaningful to see the effect of changing political power on policy.

Between 1993 and 1997, the 14th President Young-Sam Kim under the 'New Agricultural Administration' slogan allocated 42 trillion won for 'Farming and fishing villages.' These funds were to support structural improvement work and were to be dispensed over a 10 year period, from 1992-2001. This investment and loan program was meant to consolidate agriculture and fishery's power and to give motivation to rural areas. The plan lasted from 1992-1998 and total expenditure was 35 trillion won. In addition, from 1994-2004, 15 trillion won was allocated for the 'Farming and fishing villages' special tax.' This tax was used to enhance agricultural competitiveness and improve rural amenities, lifestyle, and welfare. In this period, the main goals of agricultural policies were to form competition by restricting agriculture and establishing a production base. At the same time, the government was heavily subsidizing farmers to protect the sector from the WTO.

From 1998-2002, the 15th president, Dae-Jung Kim, signaled the start of a challenging time for the South Korean economy. The year before he came into office, in 1997, South Korea had a currency crisis and received relief money from the International Monetary Fund (IMF). In accordance with the economic crisis, many farmers went bankrupt and relinquished their farming work. Agricultural policymakers reacted with six main objectives to recover the agricultural economy and to design a new paradigm: to nourish sustainable agriculture; to increase competitiveness; to foster the exportation of agricultural products; to strengthen agricultural trade power; to improve rural welfare; and to stabilize farm management (Lee et al., 2011).

In 1999, the ‘Agriculture and farm village development plan’ was founded and the ‘Agriculture and farm village fundamental law’ was enacted. In 2001, direct payment for paddy rice farming was instituted. If a farmer had a rice paddy, then he/she would earn payment by hectare to compensate for the multifunctionality and publicity of agriculture. In 2002, direct payments were made for the preservation of rice income. This policy supported and maintained the income of rice farmers; it had fixed and flexible payment options. Flexible payment meant that the government compensated 85% of the difference between the targeted price and the average rice market price each year. In 2003, farmland law was enacted and rice product control was conducted. To support the policy form 1999-2004, 45 trillion won was allocated for the total investment and financing.

From 2003-2007, the 16th president, Mu-Hyun Roh, focused his agricultural policies on market oriented farms, welfare, rural development, non-farm income creation, and food industrialization. In 2003, the ‘Special law of farmer and fisherman debt relief’ program was conducted; meanwhile, the government also published a mid-long term plan for the investment and financing of 119 trillion won. In the plan, about 66% of funds were planned for subsidies (payments) and 34% for financing. Half was given directly to farmers, while the other 50% was subsidized to invest in SOC and R&D. These subsidies were meant to support enhancement of agricultural competitiveness (65%), stability of management and income (16%), food safety and distribution (9%), and local development and welfare (10%) (Park et al.). This plan would run for a 10-year period from 2004-2013. Unlike previous government subsidies, which used funds from the national treasury, local government, and self-payment, this subsidy only came from the national treasury.

The main usage of the fund was to stabilize farm management, farm household income, and grain market management. In 2014, a special law passed for the improvement of quality of life for those involved in agriculture, forestry and fishing. Previous agricultural policies were focused on the support of SOC, production base, and the enforcement of competition. In this period, agricultural policy was diverse and focused on both farming individuals and farm production.

Kim and Lee (2003) pointed out that South Korean agricultural policy changed over time. In the early stages (pre-1970s), the goal was to achieve economic growth, to create low grain price polices, and to conduct land reform. But beginning in the 1970s and throughout the 1980s, the goal of agricultural policy focused on protecting agriculture, creating a two-tier price scheme via the government purchase program, supporting productivity enhancement programs, and encouraging farmers to adopt new technologies. Since the late 1980s, agricultural policies have shifted further in an effort to make agriculture more market-oriented and less reliant on subsidies. Specifically, domestic support systems were modified to include a direct payment. However, this change conflicted with the WTO agreement of 1995. Thus, land reform, investment, and loan programs were initiated to conform to the WTO agreement[12] (Kim and Lee, 2003).

Current agricultural policies are diverse. For example, the government has implemented programs to ensure food safety, target farm programs, promote environmentally friendly agricultural production, support large scale farms, and improve rural residential life. The 2008 Organization for Economic Cooperation and Development (OECD) report points out that the Korean government implemented agricultural policy reforms that, in many aspects, were broadly consistent with the principles of transparency, targeting, flexibility, and equity outlined in the OECD Ministerial Council Statement. Agriculture in South Korea needs to be allowed to evolve into an efficient, modern enterprise that provides a positive economic contribution to society in line with other sectors of the economy.

The OECD Ministerial Meeting recommended that, among other policy reforms, efforts could be made to diversify income sources of agricultural households. Specifically, it suggested promoting investment in education, transport, health, and housing infrastructure. The desirability of rural areas and the opportunities for off-farm work would be increased, thereby enhancing food security among South Korean farm households. Nonetheless, evidence presented above suggests that today farm families in South Korea also receive agricultural subsidies. Literature in agricultural economics provides ample evidence that such subsidies can result in production distortions as well as labor reallocation between farm and off-farm work (Mishra and Goodwin, 1997; Goodwin and Mishra, 2006; Ahearn, El-Osta, and Dewbre, 2006; El-Osta, Mishra and Morehart, 2008).

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[12] According to Ministry of Agriculture and Forestry since signing the Free Trade Agreements, under WTO, South Korea has seen many changes. For example, decrease in foodstuff self-sufficiency; decrease in farm households and farming population; decreasing in the area of farmland; aging population in rural areas; increased income gap between rural and urban areas.

Although the WTO and other agricultural exports countries are pressing South Korea to diminish subsidies, it is not a simple change to make. Under the goals for economic growth during the early stage, the agricultural area was ignored. To compensate, South Korean farmers relied on government payments or farm subsidies. According to OECD agricultural policy data from the year 2000, the producer support estimate (PSE) was 66.1% compared to the OECD average which was 32.3%. Although the PSE decreased to 44.6% in 2010, it rose back up to 52.5% by 2013; during the same period, the OECD average was 18.2%. Therefore, the amount of producer support in South Korea is approximately three times the OECD average.[13] South Korea's policy support towards its agricultural sector ranks among the world's highest.[14]

In 2015, the planned amount of government subsidies for agriculture is 14 trillion won, another increase (3.4%) compared to the 2014 budget. The main goals of the 2015 budget are to secure agricultural and food products for future industrialization, enhance competitiveness, prepare disaster prevention for food safety, maintain farm income and management safety, enhance farm household welfare, promote high value-added food industry, impose agricultural marketing and price stabilization, and discover new agribusiness items. Table 2.1 shows how government subsidies are planned by section or by product. Among the working expenses, over 60% of the total subsides are accounted for by grain management and agricultural marketing, reinforcement constitution of agriculture, and stabilization of farm income and management sections. Item-wise, rice production receives 37% of the subsidies from the government.

[13] http://www.oecd.org/tad/agricultural-policies/producerandconsumersupportestimatesdatabase.htm

[14] Rice, soybean and barley are the most heavily supported commodities but beef; pork and dairy also receive some support.

Table 2.1. 2015 planned government subsidies in Korea

Type	Contents	₩ one hundred billion	%
Section	Working expenses	137,369	97.5
	Agriculture & farming village	127,992	90.8
	Reinforcement constitution of agriculture	29,618	21.0
	Stabilization of farm income and management	26,546	18.8
	Improvement of welfare	4,560	3.2
	Development of farming village	12,661	9.0
	Grain management & agricultural marketing	33,998	24.1
	Construction agricultural production base development	20,610	14.6
	Food industry	8,369	5.9
	Other business expenses	1,008	0.7
	Fundamental expenses	3,571	2.5
Product	Rice production	52,962	37.6
	Horticulture & special production	21,556	15.3
	Livestock	15,042	10.7
	Food industry	8,369	5.9
	Other	43,011	30.5
Total	Total expenditure	140,940	%

Source: Ministry of Agriculture, Food and Rural Affairs (www.mafra.go.kr).

In sum, the two mainstream policies still strive to strengthen self-sufficiency and to reduce the income gap between farmers and people working in other industrial sectors. The government has fought to adjust adequate rice prices for both consumers and producers. It’s also important to recognize that South Korea places significant importance on self-sufficiency in food staples and achieving income parity between rural and urban households. However, Park et al., (2011), in their discussion of the government subsidies, identified some problems that interfere with these values. First, government subsidies actually weaken rather than strengthen agricultural self-reliance. Government payments have been provided for average farmers, not potential or competitive farmers, and farmers came to rely on these funds. Second, direct payments were concentrated on rice paddies, which caused an excess in supply of rice. Third, the management and administration of the subsidization program was largely inefficient.

2.3. Off-farm Income of South Korea

Farm household income is comprised of agricultural income, non-agricultural income, transfer income, and irregular income. Agricultural income from farming work has diminished due to unstable agricultural production, high production costs including farm labor cost, and low competitive prices compared to imported agricultural products. A decrease in farm income motivated an increase in off-farm income to offset the reduced farm household income. Therefore, off-farm income plays an important role in maintaining income stability for the farm household.

South Korean farmers are no exception. Figure 2.1 shows the trend of deflating total farm household income based on the 2010 GDP deflator in South Korea. Total farm household income is the sum of the regular income and irregular income. Regular income consists of net farm household income and transfer income. Net farm household income is the sum of farming and non-farming income. In Figure 2.1, total farm household income increased until 2006, when it decreased slightly before rising again in 2012. Among the total farm household income, farm income comprised a higher portion than off-farm income. However, since 2007, off-farm work contributed more to the total farm household income than farming work.

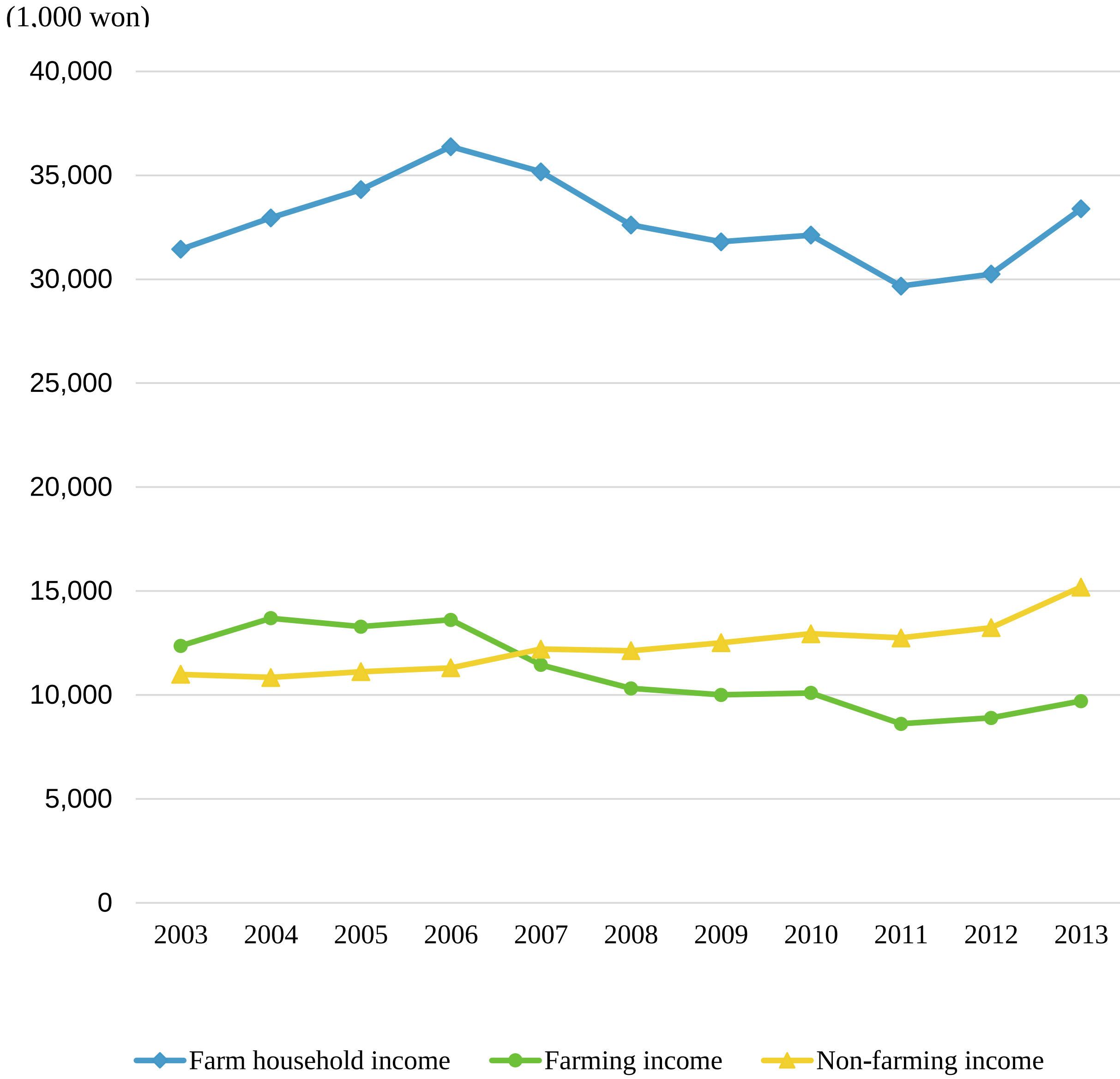


Figure 2.1. Trend of total farm household income
Source: Korea Statistics, Bank of Korea

Table 2.2 represents the trend of total farm household income in South Korea. Until 2006, farming income was the main source of income for a South Korean farm household. However, since 2007, off-farm income has been greater than farm income. According to South Korean agricultural policy terminology, off-farm income includes part-time (or side-work) income and non-business income. Side-work income is earned from doing business unrelated to agriculture; non-business income can come from employed income and property income. The percentage of off-farm income increased from 35% to 45.5% of the total farm household income between 2003 and 2013. During the latter part of this time period, from 2008 to 2012, irregular income decreased; meanwhile, transfer income, which mainly comes from government subsidies, steadily increased.

Table 2.2. Trend of total farm household income in Korea (2010=100), (unit: 1,000 won)

Year	Farm household income	Farming income	Non-farming income	Transfer income	Irregular income	% non-farming income
2003	31,436	12,365	10,991	2,375	5,705	35
2004	32,956	13,693	10,845	3,416	5,001	32.9
2005	34,312	13,290	11,118	4,587	5,315	32.4
2006	36,377	13,617	11,303	5,502	5,956	31.1
2007	35,167	11,448	12,208	5,455	6,057	34.7
2008	32,610	10,314	12,129	5,651	4,516	37.2
2009	31,800	10,008	12,516	5,656	3,619	39.4
2010	32,121	10,098	12,946	5,610	3,467	40.3
2011	29,673	8,615	12,745	5,367	2,946	43
2012	30,245	8,896	13,241	5,472	2,636	43.8
2013	33,389	9,705	15,189	5,652	2,843	45.5

Source: Korea Statistics, Bank of Korea

Based on the rate between farm income and off-farm income, farm households can be separated as full-time, class 1 part-time, and class 2 part-time farmers. Full-time or professional farmers earn income solely from farming work. Class 1 part-time and class 2 part-time farmers earn income from both farming and non-farming work. Class 1 part-time farmers earn more via their farming income than their non-farming work, while class 2 part-time farmers have higher non-farming income than farming income.

Table 2.3 shows the comparison of the total farm household income by farm type. Full-time farmers' farm household income is less than class 1 or 2 part-time farmers' farm household income. Class 1 part-time farmers typically earn more income overall than class 2 part-time farmers. However, since 2010, class 2 part-time farmers' income has been greater than the other types of farmers. Comparing 2010 and 2013, the ratio of household income between full-time verses class 2 part-time was 68.5% to 62.5%. From Table 2.3, one can observe that non-farming income has an important role in maintaining a higher total net farm household income.

To stimulate off-farm income, the South Korean government implemented diverse policies and laws in periods. Naewon Oh and Unsoon Kim (2001) researched the off-farm income policy and suggested future policy direction. They mentioned that off-farm income policy was conducted in four stages. The first stage started with a side-work complex to stimulate the idle farm labor and agricultural resources from 1967-1972. In the side-work complex, by-products of agricultural production, small manufactures, and special crops and livestock were produced. In the second stage, 1972-1983, Saemauel factory businesses were prosecuted. In accordance with the Saemauel movement, many small factories were built in rural areas that used local raw material or produced labor-intensive products. In the third stage, 1983-1990, rural industrial complex and tourism farms were encouraged to obtain income from outside the farm. In addition, job training was conducted to lead the farmers to adopt non-farm work. In the fourth stage, 1990-present, off-farm income policies have dwindled due to focus on agricultural structural policies. Therefore, the established rural industrial complexes, tourism farms, special complexes, and agricultural processing industry declined (Naewon Oh and Unsoon Kim, 2001).

Table 2.3. Total farm household income by farm type (2010=100), (unit: 1,000 won)

Year	Farm type	Farm household income	Farming income	Non-farming income
1995	Full-time	29,732	20,713	2,429
	Class 1 part-time	37,195	23,381	7,858
	Class 2 part-time	34,067	6,145	22,101
2000	Full-time	24,106	14,920	2,911
	Class 1 part-time	36,506	21,562	9,042
	Class 2 part-time	34,922	6,373	22,658
2005	Full-time	28,646	16,255	2,756
	Class 1 part-time	42,750	20,929	10,885
	Class 2 part-time	42,454	3,363	29,101
2010	Full-time	26,793	14,063	3,448
	Class 1 part-time	33,824	14,620	8,719
	Class 2 part-time	39,086	1,793	29,280
2013	Full-time	25,981	12,472	4,015
	Class 1 part-time	37,770	17,576	11,416
	Class 2 part-time	41,562	2,338	32,226

Source: Korea Statistics, Bank of Korea

In 2010, a law of support for off-farm activities was enacted. The support provided included consulting, infrastructure, and technology to farmers who are involved in off-farm work. Recently, in 2015, the Korean government aimed to promote agriculture as a sixth industry, connecting it to the other primary industries in South Korea, such as food processing, tourism, and the farm-village industry. From November 7-13, 2013, the Korea Rural Economic Institute (KREI) conducted an on-line survey on farmers' awareness of the off-farm income expansion policy. Although this survey yielded 241 responses, the surveyed farmers were KREI reporter farmers, who have higher income and education level than average farmers. Therefore, the results would be rather biased. The results show that farmers supported 'agritourism and rural experience' as the most beneficial policy to elevate off-farm income among nine choice options: (1) agritourism and rural experience, as mentioned; (2) rural industrial complex; (3) agricultural processing industry; (4) specialty product complex; (5) traditional food; (6) local festival; (7) lodge and farm-stay; (8) production, processing, and direct marketing of agricultural product; (9) other. The highest portion of off-farm income resources were from agritourism and rural experience, agricultural processes, self- or other employment, and earned income working near a city. (KREI Weekly agriculture & rural village trend. 2013.11.25. vol. 46).

Similar to other countries, off-farm income is considered an essential factor of the total farm household income. Therefore, one can assume that off-farm income influences not only total farm household income, but also other farm household characteristics and decision making. Diverse natural and human factors determine farmland value; off-farm income might be related to farmland value. In the next section, we will study how off-farm income affects farm land values based on the literature review, and in later chapters we will explore the Korean farm household situation empirically.

CHAPTER 3: LITERATURE REVIEW

In order to understand the effect of off-farm income and agricultural policies on farmland values, we are able to start with outcomes from previous studies. This chapter will focus on three topics. First, it will review the empirical evidence on determinants of farmland values. Second, it will discuss the relationships between farmland values, off-farm income, and government subsidies, paid as a part of agriculture policy. Third, there will be a review of the farmland pricing models.

3.1. Determinants of Farmland Value

Farmland is a peculiar asset with holding immobility and low liquidity. It is an essential asset that comprises about 80% of total farm household assets (USDA, 2005). Unlike other financial assets, diverse factors such as farm productivity, amenity, and location determine the value of farmland. Several researchers have explored the factors affecting farmland values. Sherrick and Barry (2003) argued that farmland values are associated with "environmental issues, natural amenities, good-neighbor practices, water rights, zoning additions, takings, and green practices."

Based on the literature review, the factors affecting farmland values can be broadly classified into three categories: (1) farmland productivity; (2) environmental and socioeconomic characteristics; and (3) uncertainty. The original physical traits of farmland can be used to approximate farm productivity, and higher farmland productivity is positively correlated with farmland values. Miranowski and Hammes (1984) estimated the impact of soil productivity, measured through various soil characteristics, on farmland values. They categorized the soil characteristics as topsoil depth, potential erosivity (RKLS), and soil acidity (PH). The authors found that topsoil depth and PH were positively correlated with farmland values. However, RKLS had a negative effect on farmland values. Based on Iowa farmland data from 1978, the authors found that adding an additional inch of topsoil increased the marginal value of farmland between $12 per acre to $31 per acre.

With regard to soil characteristics, Palmquist and Danielson (1989) focused on the erosion and drainage capacity of land as determinants of farmland values. They used a hedonic farmland value model, based on North Carolina data. To measure erosion, the authors used soil loss on farmland and soil quality. For the drainage, soil wetness was included as a dummy. The authors found that wet soil decreased land prices by 25%, a loss of $374 per acre, and sensitivity to soil erosion also reduced farmland price. Evidence showed that cropland was more valuable than forest land, and tobacco farms and better soil quality were positively related to farmland values.

Environmental and socioeconomic factors such as distance to cities, farm household characteristics, and financial index were also considered as determinants of farmland values. Based on the von Thunen regional land use theory, Livanis et al. (2006) estimated a farmland valuation model. Specifically, the authors estimated the impact of urban sprawl on the farmland values. The log-linear farmland valuation model disintegrated into net agricultural earnings, net non-agricultural earnings from development, and conversion risk due to urban pressure. The authors used a stepwise generalized spatial 3SLS estimator (GS3SLS) to estimate their model. They found farmland values were positively related to net returns to agriculture, the median house value, and the accessibility index.[15] Specifically, the authors found that a $1 increase in agricultural net returns, a $1,000 increase in median house price, or a 1% increase in the accessibility index, caused farmland value to increase by $4.16/acre, $11.6/acre, or $3.09/acre,

[15] Livanis et al. (2006) used ‘accessibility index’ as proxy of urban pressure, it is measured by distance between given place to multiple cities adjusted the population.

respectively. In accordance with urbanization, Schmitz and Just (2003) showed that after urbanization, farmland could be used for housing, investment resources, and industrialization. The price of farmland thus might also be affected.

Financial concepts are frequently applied to explain farmland values. For example, Sherrick and Barry (2003) found a negative correlation between farmland value and financial market indexes (such as the Dow Jones Index and Standard & Poor's). In contrast, they found a positive correlation between farmland value and inflation indicators such as the Consumer Price Index (CPI) and Producer Price Index (PPI). As a fixed asset, farmland values show a certain trend with financial indicators.

Uncertainty is also an important factor in determining expected future farmland value. Moss et al. (2003) examined farmland values in the presence of uncertainty using an option-pricing model based on 1910-2000 U.S. data. To calculate the present value of the farmland, they measured the certainty equivalence by multiplying the observed risky cash flows and projected cash flows instead of the discount rate. As a result, the variability in real interest rates and agricultural returns reduced the certainty equivalence of farm assets, and therefore, led to lower farmland values.

Comprehensively, Huang et al. (2006) examined the factors affecting farmland values in Illinois. Considering the spatial differences of farmland values, the authors applied the spatial-lag hedonic farmland pricing model. As the determinants of farmland values, they included production attributes (i.e., tract size, land class, and soil productivity rating), neighborhood traits (i.e., Beale rural-urban continuum code, population density, income per capita, distance to Chicago, and distance to other cities with a population of over 50,000), environmental and structural characteristics (i.e., swine farm density, and scale of swine farm), and inflation. The authors found that soil productivity, population density, and personal income each had a positive effect on farmland values. Meanwhile, parcel size, rurality, distance to large cities, and swine operator density had a negative effect on the farmland values in Illinois.

3.2. Farmland Value, Government Subsidies, and Off-farm Income

The aforementioned studies show the common factors that determine farmland values. In addition to farmland characteristics and socio-economic characteristics, however, off-farm income and government subsidies appear to also affect farmland values. These factors help increase total farm household income, and an abundance of studies have shown the important role of government payments (or subsidies) on farmland values. For instance, the literature shows that loan deficiency programs, marketing loans, transition support, crop insurance, and conservation programs have an impact on farm household income due to employing farmland. Elimination of government subsidies, then, would diminish farmland values (Sherrick and Barry, 2003). According to the ERS/USDA Agricultural Outlook in 2001 Report, using a hedonic land price model and Agricultural Resource Management Survey (ARMS) 2000 data, farm commodity programs and urban influence tend to increase farmland values. Of total farmland value, 19.7% ($62 billion) came from government payments.

To estimate the capitalized effect of government payments on farmland values, Barnard et al. (1997) estimated linear regression and non-parametric regression models. In the farmland value equation for the linear regression, direct government payments, non-agricultural influences, soil quality, irrigation status, and climate variables were considered. The authors found that government payments, fruit and vegetable farms, and index of population were significant factors affecting farmland values. For the non-parametric regression, 20 U.S. Land Resource Regions (LRR) conducted spatial analysis. In the LRR13 area (which includes the

Corn Belt)[16] the authors found that a 100% decrease in direct government subsidies would cause the cropland value to decrease by 30%. The research further illustrated the different effects of government subsidies by region. In Texas, the southern Corn Belt, parts of North Carolina, Georgia, and Alabama, the capitalized effect of direct payments on cropland was as high as 50%. In eastern North Dakota, Kansas, the southern Lake States, and the northern Corn Belt, the effect of government programs on cropland value was about 10-20%.

Goodwin et al. (2003), using the present value model, examined how agricultural revenues, government policy, and urbanization influenced the value of agricultural land. They separated the government subsidies into three programs: Loan Deficiency Payment (LDP), Agricultural Market Transition Act Payments (AMTAP), and disaster payment. They found that government support programs were significantly related to farmland values. The LDP had the largest effect. LDP payments increased farmland value per acre by approximately $8.

Similarly, Devadoss and Manchu (2007) analyzed the impact of government subsidies, net farm income, financial index, and demographic characteristics on farmland values using data from the Snake River Valley counties in Idaho. Using the net present value model, they separated farm income into market returns and government payments, assuming government payments have a greater influence on farmland values than market returns due to stability. Using a fixed panel data model, the authors found that government payments had a positive effect on farmland values, but it was not significant. They agreed with the study conducted by Gardner (1987) that if government subsidies contribute a small portion to the total farm income, then the effect of government payments on farmland values would be minor. Net farm income, wheat yield, population, and credit availability have positive effects on farmland values. One can

[16] LRR13 regions encompass 9 U.S. states: IL, IN, IA, MN, MO, NE, SD, OH, and WI.

conclude that capitalized net farm income, productivity, and urbanization are important factors affecting farmland values. In addition, increased government payments reduce farming risk and support farm household income, which contribute to raising farmland values. Conversely, the authors found that interest rate, property tax rate, and debt-to-asset ratio had negative effects on farmland values.

Besides government subsidies, off-farm income can also enhance the total farm household income and further raise farmland values. Compared to the research on the impact of government subsidies on farmland values, the studies which focus on the effect of off-farm income on farmland values are scarce. Mishra and Moss (2013) considered the differences of farm characteristics and immobility in farmland. Based on the auction bidding price theory, they induced the single bid price equation, adding the difference in the hedonic characteristics of farmland to investigate the impact of off-farm income on farmland values. They argued that off-farm income increases total farm household income, and hence is able to raise the auction value of farmland. Using quantile regression, they found that off-farm income had a positive effect on farmland values. In addition to off-farm income, the authors found that government subsidies also had a significant effect on farmland values.

Most studies described above have been conducted in the United States. However, Awasthi (2014) explored the socioeconomic factors that affect farmland values in India. Using the land valuation model, he considered farm operator age, education level, amount of family labor, portion of farming income, farmland productivity, and location. He found that age and the distance of farmland from the main road or village had negative effects on farmland values. Conversely, education, dependency on farming income, and land productivity had positive effects on farmland values. Although the significance of age and education were minor, education was not commonly dealt with in literature on farmland values.

Aforementioned studies have focused broadly the farmland values in the U.S., Canada, and European countries. However, none of these looked at South Korea to examine the effect of government subsidies and off-farm income on farmland values. This is a serious oversight, as South Korea was agriculture-driven; unfortunately, after industrialization, the agricultural sector only comprised 6% of Gross Domestic Product (GDP). To try to strengthen the sector, the South Korean government has subsidized farm households and farm industry. Over time, then, South Korea has become known among OECD countries for heavily subsidizing agriculture. Since the government has a substantial role in South Korean agriculture, we expect a greater impact of government subsidies on farmland value in South Korea than for other small countries where agriculture is subsidized. Therefore, this dissertation studies the impacts of off-farm income and government subsidies on farmland values in South Korea.

3.3. Farmland Pricing Model

Changes in farmland values have been a frequent topic of interest in agricultural economics literature over the past four decades. This focus on farmland prices is related to the inherent instability in the farm sector and to several characteristics of farmland in particular. Lence and Miller (1999) noted that farmland accounts for a significant proportion of the agricultural balance sheet. Changes in farmland values lead directly to significant changes in farm sector wealth (Schmitz, 1995). In a recent comparison of rates of return between farm and non-farm businesses, Hopkins and Morehart (2000) show that non-farm businesses generate much higher sales from their assets than agriculture. They suggest that farmland may be responsible for this inefficiency through the capitalization of government payments.

Despite the importance of farmland values for the sector, empirical efforts to explain the fluctuations in land values have met with limited success. In general, studies that have attempted to explain land values using present value models have found that farmland values exhibit at least short-term price bubbles (Schmitz, 1995; Schmitz and Moss, 1996; Featherstone and Baker, 1988; Falk, 1991). Several studies have recently explained this behavior based on transaction cost models (Lence and Miller, 1999; Chavas and Thomas, 1999). Lence and Miller (1999) determined that changes in land values are typically bounded by transaction costs (brokerage fees) in the short run. Thus, empirical results classified by rational bubbles in the present value models may actually be effected by transaction costs.

Kost (1968) compared the rates of return for farm real estate and common stocks from 1950 to 1963. His results showed a lower rate of return and a lower standard deviation for farm real estate than for common stocks. According to portfolio theory, one would expect investors to accept a lower rate of return only if the standard deviation were lower. But Kost suggests two additional reasons why people might accept a lower rate of return from farm real estate: the degree of leverage and non-economic factors. Kost (1968) reasoned that since the leverage factor was greater for farm real estate than other investments, the entrepreneur might be willing to accept a lower rate of return on invested capital. In this case, the entrepreneur would not be as likely to invest in farm real estate if he/she were not allowed to use borrowed money.

Melichar's (1979) capital assets pricing (CAP) model showed that the rapid growth in real current return to assets led to large annual capital gains and low rates of current return to assets. He pointed out that capital gains could result from a growing stream of net returns. One measure of the return attributed to land is the rent a tenant would pay to acquire control of the land. A fundamental and recurring assumption is that the value of the land is equal to the discounted stream of returns from the land. The research by Melichar led others to the acceptance of the relationship between cash rents and land values.

Unlike previous studies that focused on the aggregate demand for land, Shalit and Schmitz (1982) used individual farm-level data and the life cycle model to analyze farmland accumulation and farmland prices. They found that savings and accumulated real estate debt were the main determinants of high land prices. Accumulated debt was a greater predictor of farmland prices than farm income and consumption.

Phipps' (1984) study analyzed the theoretical and empirical relationship between farm-based residual returns, the opportunity costs of farmland, and farmland prices. Given this theoretical relationship, Phipps tested the relationship between returns and farmland prices using Granger causality. In the aggregate, residual farm-based returns unidirectionally "caused" farmland prices. These findings supported the capitalization hypothesis of Melichar (1979). Specifically, the results suggest that farmland prices are determined mainly within the farm sector. Furthermore, Phipps' results support the use of adaptive expectations processes in structural farmland price models.

A point of contention in the farmland pricing literature has been the specification of expected returns. In the capitalization model, the value of land is often formulated as the capitalized value of the expected future stream of earnings. However, these expectations are unobservable. Burt (1986) developed an econometric model of the capitalization formula to explain the dynamic behavior in farmland prices. He emphasizes the expectation process by formulating a second order rational distributed lag on net crop share rents received by landlords to model the dynamics of land prices. This specification performed well in conditional out-of-sample forecasts. Further, he found that neither the expected rate of inflation nor an exponential trend on rent expectations had a significant effect on land prices.

Alston (1986) analyzed the effect of inflation on the growth of U.S. farmland prices for the years 1963-1982. The 1970s saw U.S. farmland prices experience dramatic real growth and several studies had postulated that the cause might be either expected inflation increase or real growth in net rental income. However, Alston's research showed the effect of inflation to be theoretically ambiguous. He conducted an empirical analysis using U.S. and international farmland price growth and found that it could be explained by real growth in net rental income to land. Increases in expected inflation did have a negative effect on real land prices, but the effect of inflation was comparatively small.

In large part, the formulations of Melichar (1979), Phipps (1984), Burt (1986), and Alston (1986) depict the long-run equilibrium in the farmland market. However, other studies have examined whether farmland prices exhibit short-run price anomalies referred to as speculative or rational bubbles. A bubble can occur when the actual market price depends on its own expected rate of change. Price bubbles arise from three necessary conditions: durability, common beliefs, and scarcity. Farmland is durable and while the market for farmland can become subject to common beliefs, some analysts question the assumption that the supply of farmland is perfectly inelastic (Tegene and Kuchler, 1991). The shrinking availability of farmland may lead to price bubbles.

The model estimated by Featherstone and Baker (1987) allows for both long-run equilibrium and analysis of short-run fluctuations. Featherstone and Baker studied the dynamic response of real farm asset values to changes in net returns and interest rates using vector auto regression (VAR) for 1910-1985. They concluded that net rents could not explain a substantial share of farmland price change, suggesting that there may be purely speculative forces in farmland price determination. The authors concluded that shocks in real returns to assets or real interest rates led to a process in which real asset values overreacted. Further, their results suggest a market with a propensity for bubbles.

Tegene and Kuchler (1991) found the present value model to be valid under the assumption of adaptive expectations, but not under rational expectations. Rational expectations imply that the policy influence will be felt quickly or will be encouraged as transitory and therefore have little impact. They found that when asset values are influenced by government interactions in markets, expectations raise questions regarding the speed and magnitude of price changes. In their view, the lack of rationality may occur because farmland markets display significant transactions costs (as postulated by Lence and Miller (1999) and Chavas and Thomas (1999)). They conclude, however, that volatility of the farmland market has not yet been measured relative to transaction costs.

Traditional time series regression analyses have supported the underlying basis of the capitalization model in which changes in returns to farming explain changes in farmland prices. However, recent studies using cointegration analysis have found that land rents and prices do not have the same time series properties. Falk (1991) studied the plausibility of the constant expected returns version of the present value model as an explanation of farmland prices. Using Iowa farmland price and rent data over the 1921-1986 period, formal results indicate that, although farmland price and rent movements are highly correlated, price movements are not consistent with the implications of this model. There appear to be persistent predictable excess positive and/or negative returns in the Iowa farmland market. One possible explanation of the model's failure is that rational bubbles characterize the farmland market. However, the presence of such bubbles does not appear to characterize the situation and Falk argues for other explanations. Falk suggests that the failure of farmland values to cointegrate with agricultural returns may be attributed to changes in the farm discount rate over time. These changes could either result from fluctuations in relative risk or in the risk-free interest rate.

Schmitz (1995) analyzes the potential existence of boom/bust cycles for farmland in the United States and Canada. His results indicate that since farmland prices tend to be in equilibrium in the long run, the present value model for farmland cannot be rejected. However, in the short-run, error terms from the estimated model are correlated. Thus, information on recent farmland price movements can be used to forecast changes in asset values in the short-run. By definition, these results are consistent with rational bubbles. Schmitz and Moss (1996) extend the results to U.S. states with similar results.

Moss (1997) reexamined farmland valuation by focusing on the relative explanatory power of returns to agricultural assets, interest rates, and inflation. Moss used a statistical formulation of information provided by these individual regressors to examine the sensitivity of farmland values to changes in these variables and found that about 82% of the bits of information are contributed by inflation. Using the Theil approach and regional data, Moss, Erickson, and Perruso (1999) extend the earlier work of Moss, examining whether farmland values are spatial in nature. Results indicated that farmland values are highly regional in nature and that land values have been relatively stable over time.

Chavas and Thomas (1999) developed a dynamic model of farmland prices that includes non-additive dynamic preferences, risk aversion, and transactions costs. Their econometric findings indicate that both risk aversion and transactions costs have significant effects on land prices. Lence and Miller (1999) used Iowa farmland data (1910-94) to investigate whether the farmland "constant-discount-rate present value model" is due to transactions costs. Econometric tests indicate that this model is consistent with typical transactions costs assuming a one-period holding horizon, but not when an infinite-holding horizon is considered.

3.4. Contributions of This Study

There is a plethora of studies on the determinants of farmland values. Diverse environmental, farmland quality, socioeconomic, and financial situations have been found to relate to farmland values. However, literature on the impact of off-farm income and government subsidies on farmland values is slim. In particular, the capitalization of off-farm income into farmland values has not been investigated thoroughly. Furthermore, not many studies have examined the effect of government subsidies and off-farm income on farmland values in South Korea. After industrialization, the share of the agricultural sector in South Korea diminished and its dependency on government subsidies is high compared to other OECD countries. Since the government's role in agriculture is so important in South Korea, the impact of government subsidies on farmland value in South Korea might be greater than in other small agricultural subsidized countries.

Specifically, the contribution of this dissertation is as follows. First, to our knowledge, this is the first study to estimate the impact of off-farm income and government payments of South Korean farm households. Recall that agriculture in South Korea is heavily subsidized and consists of small farms; additionally, entry into farming is highly restrictive. Secondly, we contribute by using longitudinal farm-level data. Results from this study could help policymakers to design agricultural policies that encourage growth in the non-farm economy, particularly when the severe limitations on the capacity of the overall agricultural sector like that of South Korea is not able to absorb the existing supply of labor.

CHAPTER 4: FARMLAND VALUE MODEL

The farmland value model has been studied through various pricing models, mainly the hedonic pricing model and present value model. Chicoine (1981) used a hedonic pricing model which assumed that farmland value is heterogeneous. He pointed out that the implicit farmland quality was urban benefits such as social services, environmental amenities, and transportation. Recently, Xu et al. (1993) developed a general stochastic hedonic model and Huang et al. (2006) also used a hedonic land pricing model which assumed farmland structure to be a single market.

In addition, the Net Present Value (NPV) model has developed which assumes that land value relies on discounted annual returns (Melichar, 1979; Gardener, 1987; Goodwin, Mishra and Ortalo-Magné, 2003). Under the assumption of adaptive expectations, but not under rational expectations, Tegene and Kuchler (1991) found the Net Present Value model to be valid. Rational expectations imply that policy influence will be felt quickly or will be encouraged as transitory and therefore have little impact. Schmitz and Just (2003) set up the land-price model considering both agricultural and non-agricultural usages. The farmland value is the maximization of the sum of the expected net rental rate for agricultural activity and for urban development. Goodwin, Mishra and Ortalo-Magné (2003) applied a Net Present Value model to explain the factors affecting farmland values. Farmland value is the expected net return of assets considering the adjusted discount rate. In a recent study, Mishra and Moss (2013) developed a farmland model based on auction theory, which assumed a successful bid combined into a single value.

According to the Net Present Value model, farmland value is assumed as expected net return on assets for a future period. For instance, Goodwin, Mishra and Ortalo-Magné (2003) expressed the farmland value, under the risk-natural farmers and constant-discount rate assumptions, as follows:

$$L_t = \sum_{i=1}^{\infty} \frac{E_t(A_{t+i})}{(1+r)^i}, \quad (1)$$

where L_t is farmland value, A_{t+i} is net return of the asset in time t+i, r is discount rate, and E_t is the expectation operator in time t. If the net return of the asset is stable over time and the variables are constant, then the farmland value equation can be expressed as

$$L_t = \frac{A^*}{r} = kA^* \quad (2)$$

where A^* is the constant net return of the asset and k is the discount factor. Since farmland assets increase with market price and income, net return of assets A^* will change with the growth rate h annually. Therefore, the farmland value equation can be rewritten as

$$L_t = \frac{(1+h)A^*}{(r-h)}. \quad (3)$$

Goodwin, Mishra and Ortalo-Magné (2003) suggest that uncertainty is an important factor to estimate farm assets; if a farmer is risk-averse then he or she is less likely to appreciate the farmland value. In addition, in light of income resources, the authors assumed the impacts on the farmland value will be diverse. Similarly, Weersink (1999) divided the farmland value model into agricultural income, non-agricultural revenues, and government subsidies. The farmland value model is as follows:

$$L_t = \sum_{i=1}^{\infty} (A_1^i E_t F_{t+i} + A_2^i E_t NA_{t+i} + \sum_{j=1}^{k} A_{3j}^i E_t G_{j,t+i}), \quad (4)$$

where F is the expected net revenue from farming work, NA is expected net return from non-agricultural application, and G is the expected income from government subsidies.

However, aforementioned models considered expected future values. In the market, buyers and sellers assess the farmland value based on its current worth, taking into account future value or asset risks. Therefore, Mishra and Moss (2013) postulated that farmland price is merged to one value. They underlined the heterogeneity of quality of farmland value and set up the bid equation including hedonic characteristics of farmland and different individual demands (i.e., bidding) for the farmland. They presumed that the successful bid of farmland value combined one value according to traits of farmland and individual preferences. The basic farmland value model of Mishra and Moss (2013) is

$$L_i(a) = \frac{R_A(a)}{r} \ , \tag{5}$$

where $L_i(a)$ is a one bidding price of farmland, $R_A(a)$ is asset return based on hedonic attributes of the agricultural land (a), and r is an interest rate. In the farmland value auction, the determinant of farmland price does not only include characteristics of farmland, but also characteristics of bidders. The preferences of lifestyle or financial status can have an influence when people estimate the price (Mishra and Moss, 2013). Then, the farmland bid model can be rewritten as

$$L_i(a,b) = \frac{R_A(a)+E(b)}{r(b)} \ , \tag{6}$$

where b is a characteristic of the individual bidder, $E(b)$ is value measured by individuals on the farmland, and $r(b)$ is interest rate of individuals' assets. Specifically, hedonic attributes of farmland $R_A(a)$ and individual $E(b)$ can be shown as

$$R_A(a) = f(farm\ productivity, location, remoteness\ to\ big\ cities, soil\ quaility, irrigation, \dots) \tag{7}$$

$$E(b) = g(asset, off-farm\ income,\ management\ ability, age, education, urban/rural\ life\ preferences,\ risk\ accptance\ degree, \dots) \tag{8}$$

In this dissertation, I will use South Korean farm household economic survey data. The data are not available for physical variables of farmland; instead, I can use farm product type, farmland scale, and a location dummy as proxies for farmland characteristics. To represent individual characteristics, net farm income and farm household characteristics (or unemployment status in the place, total population in the area) will be added.

Since government payments and off-farm income are the main resources that improve farm household income and reduce farm risk, these two factors are influential in determining the farmland price. Therefore, they will also be included in the farmland valuation model. The model can be written as

$$E(b) = F_i(b) + OFF_i(b) + GP_i(b) + C_i(b) + SO_i(b). \quad (9)$$

Equation (9) shows that farmland value is the sum of the farm income ($F_i(b)$), off-farm income ($OFF_i(b)$), government subsidies ($GP_i(b)$), farm and farm household characteristics ($C_i(b)$), and socioeconomic traits ($SO_i(b)$) of the farmer.

CHAPTER 5: SOUTH KOREAN FARMLAND CHARACTERISTICS AND FARM HOUSEHOLD ECONOMIC SURVEY (FHES) DATA

5.1. Korean Farmland Characteristics

South Korea is a peninsula located between the East Sea to its south and east and the Yellow Sea to its west. Although the time zone is the same across the country, weather and topography differ by location. Over 70% of the total land area is mountainous, and the north-eastern part of the peninsula is hilly due to the Taebaek mountain ranges. Meanwhile, the western and southern parts of the country have ample rivers and flatlands, suitable for agriculture. Currently, the South Korean land is divided into 16 districts.

Figure 5.1 shows the administrative district map of South Korea which denotes the 16 districts and cities. The 16 districts consist of Seoul, Busan, Daegue, Incheon, Gwangju, Daejeon, Ulsan, Kyonggi-do, Gangwon-do, Chungcheongbuk-do, Chungcheongnam-do, Jeollabuk-do, Jeollanam-do, Gyeongsangbuk-do, Gyeongsangnam-do, and Jeju-do. ‘Do’ refers to an autonomous local entity, of which South Korea has nine. Kyonggi-do is located outside of Seoul. The smallest of the cities is Jeju-do, with a population of about 600,000. Recently, Jeju-do became Jeju Special Self-Governing Province, which reduced the restrictions on foreign investment.

Seoul is called Seoul Special City; it is the capital of South Korea. According to 2013 data, the area of Seoul is 605.25 km^2 and about 10 million people reside there. Busan, Daegue, Incheon, Gwangju, Daejeon, Ulsan are categorized as Metropolitan Cities, and each is highly populated. Busan is the second biggest city and first trade port in South Korea. According to 2013 data, Busan is 765.94 km^2 in area and has a population of 3.5 million.

Figure 5.1. Administrative district map of South Korea

Daegue is located in Gyeongsangbuk-do, which has an area of 884.46 km^2 and a population of 2.5 million (2011). According to 2013 data, Incheon has 1,002.07 km^2 area with a population of about 2.8 million people. The biggest city in the Jeollanam-do district is Gwangju. It has an area of 501 km^2 and about 1.5 million inhabitants (2012). Daejeon is located on the western coast of South Korea with a population of 1.5 million (2012). Ulsan is a popular industrial city, with a population of about 1.2 million people and a land area of 1,057.1 km^2 (2013).

Depending on location resources and environment, the agricultural production is diverse in South Korea. Table 5.1.shows the land usage in South Korea. From 2009 to 2013, the total land increased by 0.37%; however, arable land decreased by 1.46%. In the case of the arable land, the share of rice paddy land area decreased from 58.2% to 56.3% but the share of field products (such as fruits and vegetable farms) actually increased from 41.8% to 43.7%.

Table 5.1. Land Usage, South Korea

(Unit: ha)

Year	2009 (A)	2010	2011	2012	2013 (B)	Rate of change ((B-A)/A *100)
Total land	9,989,741	10,003,308	10,014,823	10,018,808	10,026,625	0.37%
Arable land	1,736,798	1,715,301	1,698,040	1,729,980	1,711,436	-1.46%
-Rice paddy	1,010,287	984,140	959,914	966,076	963,876	-4.59%
-Field (farm)	726,511	731,161	738,126	763,904	747,560	2.9%
Forest land	6,370,304	6,368,843	-	-		-
Other	1,882,639	1,919,164	-	-		-

Source: Korean statistics (http://www.kosis.kr)

More specifically, Appendix 1 presents utilization of arable land by regions from 2010 to 2013. In 2013, total South Korean land area was about 10 million hectares (Table 5.1); total arable land was about 1.7 million hectares. Among the arable land, rice paddies consist of 56% and field areas are comprised of 44%. As expected, Seoul has the lowest amount of arable land and this amount decreased, along with the available arable land in Busan, Daegue, and Kyeonggi-do, from 2010 to 2013 (Appendix 1). The highest amounts of arable land are found in Jeollanam-do, Kyeongsangbuk-do, and Chuncheongnam-do. These areas, along with Jeollabuk-do and Jeju-do, saw an increase in amount of arable land during the same three-year period.

The utilization rate is the ratio of cultivated area to total arable land area.[17] The overall utilization rate decreased from 104.8% to 101.1% during 2010 to 2013, but the utilization rate of rice paddies in Seoul increased from 50% to 90.9% in the same period. On average, Gwangju, Chungcheongbuk-do, Chungcheongnam-do, Jeollabuk-do, Jeollanam-do, and Jeju-do have a utilization rate of more than 100%. These regions generally experience warmer weather, so they're able to practice multiple cropping. In general, Jeollanam-do, Kyeongsangbuk-do, and Chuncheongnam-do are the main rice-producing areas. Kyeongsangbuk-do and Jeju-do have a high portion of orchards; the areas are popular for apples and tangerines, respectively. Jeju-do, Gangwon-do, and Jeollanam-do have large ranches that are available for livestock production. Finally, Gangwon-do and Kyeongsangbuk-do have significantly higher proportions of forestlands than other areas.

Table 5.2 reports the quantities of livestock. For example, beef cattle are mainly raised in Kyeongsangbuk-do, Jeollanam-do, and Chuncheongnam-do, which consist of large plains. The dairy industry is popular in Gyeonggi-do, which is close to Seoul, and milk can be easily sold in

[17] Utilization rate might be greater than 100 because cultivated area includes multiple seasoned farming.

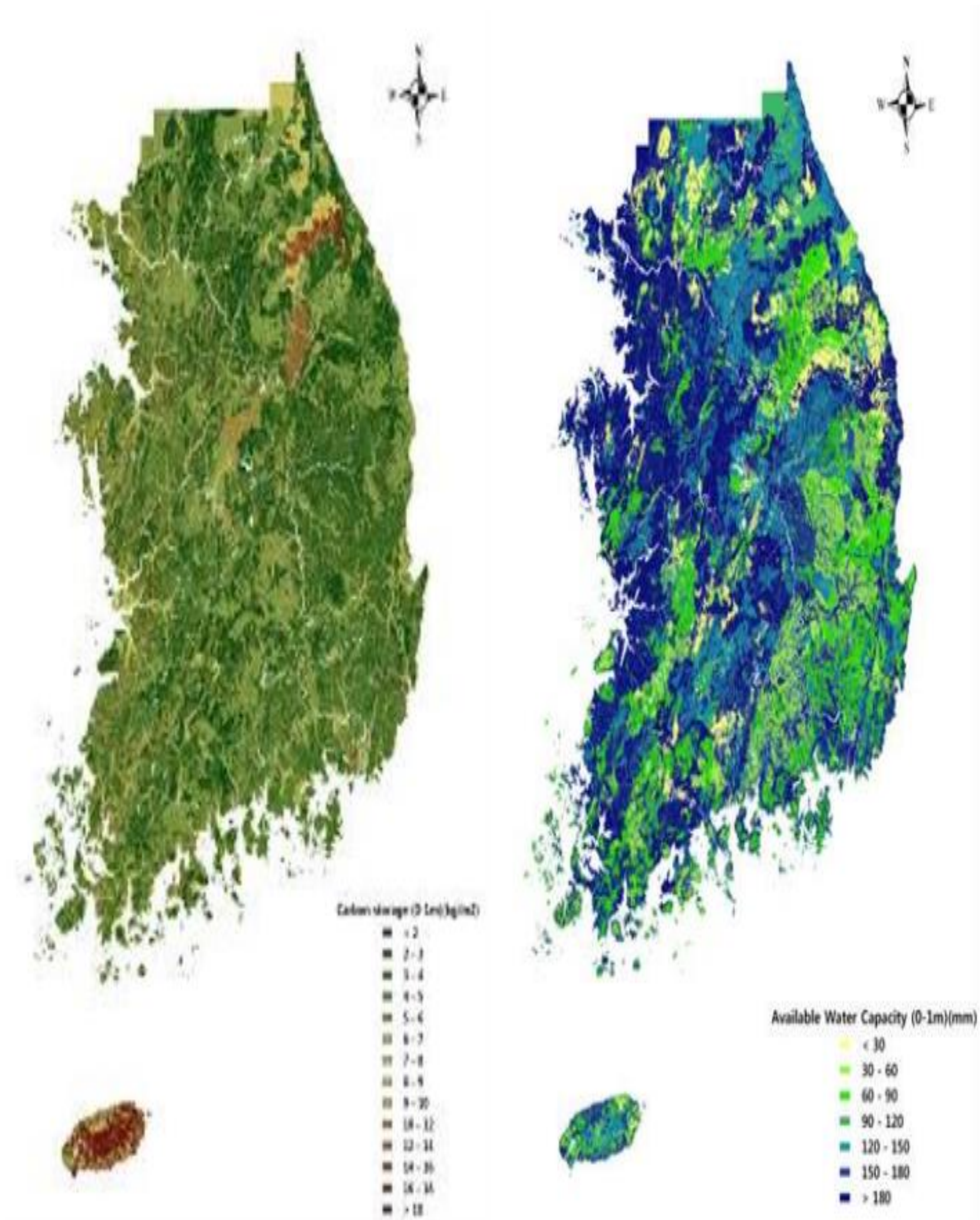
Seoul. Finally, farmers in Gyeonggi-do and Chuncheongnam-do specialize in hog and chicken farming, while Jeollanam-do and Jeollabuk-do specialize in duck farming.

Table 5.2. Livestock, by type and region in 2014

(Unit: number)

Area	Beef cattle	Dairy cattle	Hog	Chicken	Duck
Total	2,817,154	427,782	9,858,314	158,986,837	7,100,588
Seoul	324	113	30	0	0
Busan	2,023	746	6,038	26,075	0
Daegue	19,960	1,596	12,890	439,000	0
Incheon	20,984	2,936	33,165	890,950	0
Gwangju	7,178	572	3,016	232,975	0
Daejeon	5,511	0	1,062	57,150	0
Ulsan	27,936	990	33,611	450,301	0
Gyeonggi-do	261,915	167,151	1,752,926	34,038,232	467,483
Gangwon-do	197,725	17,302	436,970	5,343,592	26,125
Chungcheongbuk-do	204,610	23,329	606,217	11,277,391	808,878
Chuncheongnam-do	377,850	81,388	1,978,792	31,285,845	291,480
Jeollabuk-do	330,829	30,937	1,140,444	27,221,673	1,829,841
Jeollanam-do	461,523	28,717	1,004,808	17,158,301	3,102,949
Kyeongsangbuk-do	597,149	38,496	1,237,743	20,077,647	49,400
Kyeongsangnam-do	269,929	29,130	1,066,427	9,149,637	512,358
Jeju-do	31,709	4,381	544,175	1,338,070	12,075

Note: The numbers are averaged of 2014 quarters data.
Source: Korean statistics (http://www.kosis.kr).



(Soil carbon storage;) (Available water capacity; mm)

Figure 5.2. Soil carbon storage and available water capacity of Korea (Hong et. al., 2010).

Note: Map scale is 1:25,000.

Recall, the literature points out that soil characteristics and precipitation are important factors in determining farmland values since they influence farm productivity. Before checking the properties of the surveyed farmland, one can prospect South Korean soil properties. Figure 5.2 represents soil carbon storage and available water capacity (Hong et. al., 2010). Soil characteristics are influential to farm households in helping decide which crops to grow. Carbon storage and water usability could influence farmland values. Hong et. al. (2010) concluded that overall in South Korea, the "mean value of carbon density is about 5 kg/m^2, and available water capacity is about 154 mm." The west coast, middle region, and the northern part of the volcanic island of Jeju tend to have higher water capacities, due to their proximity to waterfront. Jeju also has a higher carbon content than other regions, which may boost farmland values on the island.

The RDA SIS website for soil characteristics provides information by a small village unit known as Li. South Korean district units are separated into Gwanyuk-Si (metropolitan city) / Do > Si / Gun / Gu > Eup / Myeon / Dong > Li. This dissertation will use the Korean Farm Household Economic Survey Data (FHES) from 2008 to 2012. The survey was conducted using sampled farm households (over 2,000 farm operator households). It provides 16 administrational districts. In FHES data the location information is provided Gwanyuk-Si or Do. Therefore, the detailed area information of RDA data will not be suitable for this model.

5.2. Korea Farm Household Economic Survey (FHES) Data

The data used in this study were obtained from the 2008 to 2012 Farm Household Economy Survey (FHES) of South Korea. The FHES is administered annually and collects information about farming practices, demographics, and financial status from approximately 2,800 farm households. The survey changes the sample of farmers every five years. In other words, over each five year period, the sample consists of the same farm households. These farm households operate farms of about 10 acres (1,000) or more, or generate annual sales (of farm products) of at least 500,000 won. We are using the most recent data available: the 2008 to 2012 FHES. It's important to note that not included in the survey are single households, foreign households, non-family households, business farms having over five regular employees, and semi-farm households such as churches, schools, agricultural and test sites.

The survey is conducted using an interview method. There are two types of logs: a questionnaire and an original register. The questionnaire is conducted monthly and has items about the current state of the farm households, assets (for example, land, buildings, machinery, and intangible assets), debts, and financial assets. The original register is surveyed twice per year (early year and late year) and has questions regarding cultivated crops, livestock, receipts, expenses, agricultural labor hours, agricultural production cost, and the amount of grain consumption and stock.

In the farm household survey data, the farm household income is segregated into sources of income as shown in Figure 5.3. In Figure 5.3, the total farm household income is separated into regular income and irregular income. Regular income can be divided into net farm household income, which includes income from farming and off-farm work, and transfer income. Transfer income includes government subsidies and private subsidies. In this study, net farming income will be defined as farm household income, shown in Figure 5.3 as 'Farm Income.'

In addition to the FHES data, population and unemployment rate data were obtained from the South Korean Statics department, and the information regarding distance from Seoul data was collected from DistanceFromTo.net; it is used as a proxy variable to access the off-farm income.

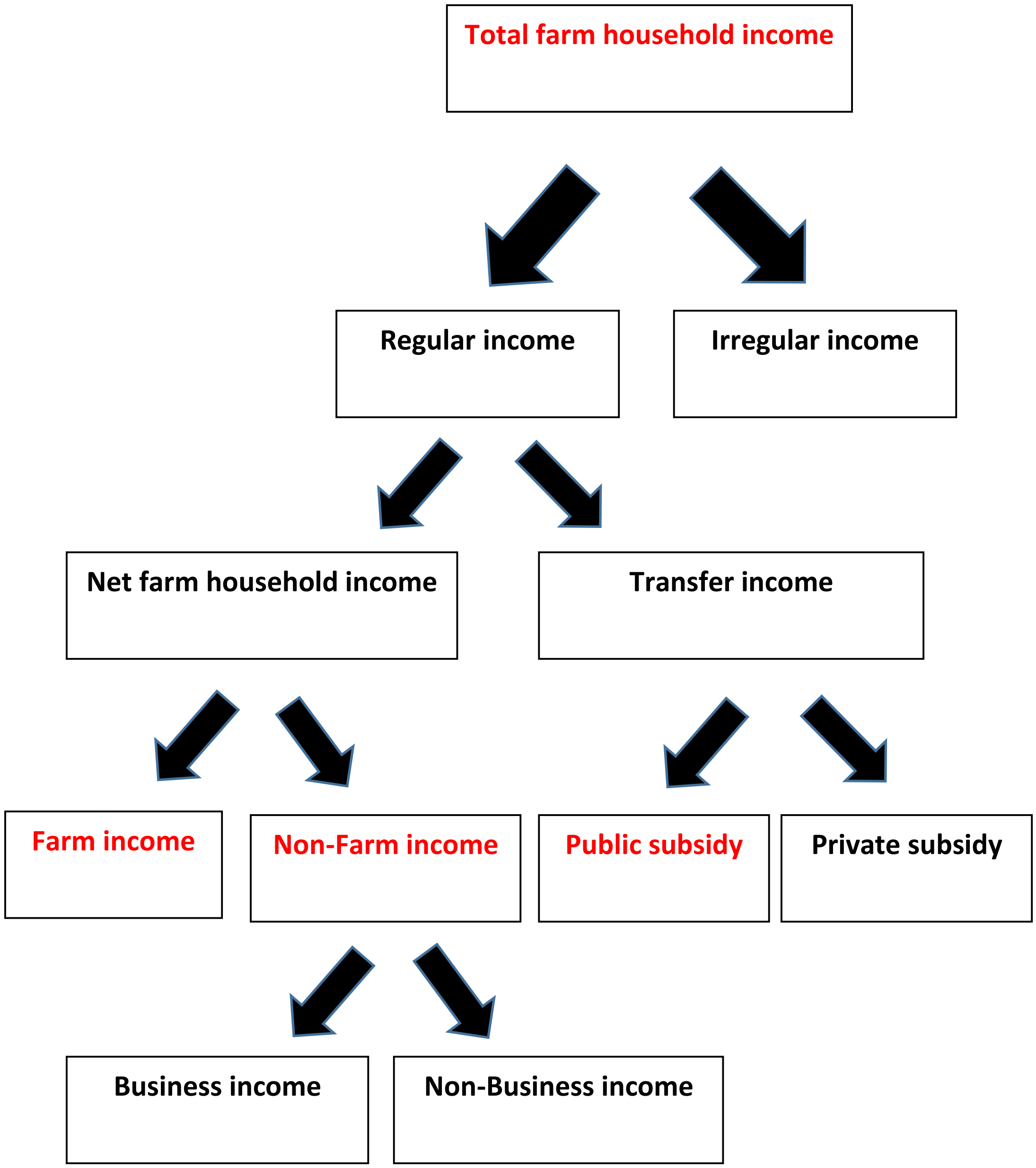


Figure 5.3. The structure of total farm household in the Korean Farm Household Economic Survey
Source: Korea Farm Household Economic Survey (FHES) Data

Based on the previous studies, one can select the influential factors related to farmland values. Table 5.3 presents the variable definitions and summary statistics. After merging various datasets from 2008-2012, there were 13,255 total observations; after removing observations on missing farmland values or farmland area data, a total of 12,642 farm household samples remained, which averages out to approximately 2,500 households per year.

Table 5.3 shows that the dependent variable, farmland value per hectare (₩1,000,000/ha), has been steadily increasing. South Korean farmland value is determined by country officials and assessed land price. In this survey, farmland value data were collected by the farmers' reports. The monetary values, such as farming income, off-farm income, government subsidies, debt, assets, and farmland values were deflated to obtain real values. To attain abundant information from the South Korean Statistics Department and Geographical website, we collected the population density, unemployment rates, and distances from Seoul data by regions.

From 2008 to 2012, the shape of farm income to household decreased and off-farm income share increased; interestingly, however, farming income per area also increased. Government subsidies steadily increased over the five year period. On average, 60% of the farmers participated in off-farm work, while 40% of the farmers focused exclusively on farming work. The survey reports farm type into nine categories. These include paddy rice, fruit, vegetable, special production (for instance: cigarettes, ginseng, and mushrooms), flowers, upland crop, livestock, and others. The survey also separates "other than farming" job, when off-farm income to the household is greater than income from farming.

For my analysis, I have classified farm types into five categories. These include grains (paddy rice and upland crop), fruit and vegetable, special products and flowers, livestock, and others. About a quarter of the farmers produce paddy rice and upland crops, 33% specialize in fruit and vegetable production, and 7% specialize in livestock and livestock products.

In addition to the survey data, I will also take into account influential socioeconomic variables. For example, if the city is urbanized, there is a greater opportunity to find off-farm work and demand for farm land to be converted into housing, shopping centers and industrial complexes.

Table 5.3. Data summary and descriptions

Variable	Definition	Pooled	2008	2009	2010	2011	2012
Farmland value	Farmland value per ha (₩1,000,000 /ha)	323,604	319,138	321,738	315,981	321,882	339,084
Farm income	Net farm income per ha (₩1,000,000 /ha)	26,914	23,398	29,835	30,046	26,150	25,140
Off-farm income	Off-farm income per ha (₩1,000,000 /ha)	51,949	54,180	51,150	50,089	51,715	52,615
Government subsidies	Government subsidies per ha (₩1,000,000 /ha)	15,365	10,566	13,203	15,964	17,982	19,058
Debt-to-asset ratio	debt/asset	0.08	0.09	0.09	0.08	0.07	0.07
Off-farm work	Full time farmer=0, off-farm work=1	0.58	0.56	0.58	0.58	0.60	0.58
Crop farms	=1 if crop (paddy rice, upland crop) farms	0.25	0.30	0.25	0.22	0.24	0.23
Fruit & vegetable farms	=1 if fruit and vegetable farms	0.33	0.28	0.30	0.34	0.36	0.36
Special crops & flower farms	=1 if special crops and flower farms	0.04	0.06	0.06	0.05	0.03	0.03
Livestock farms	=1 if livestock farms	0.07	0.06	0.09	0.09	0.05	0.06
Other types farms	=1 if other harvested farms	0.31	0.31	0.30	0.30	0.32	0.32
Population density	Person/km^2	418.58	395.89	413.80	420.03	426.88	436.05
Unemployment	Unemployment rate %	2.44	2.28	2.54	2.70	2.43	2.26
Distance	Distance from Seoul, km	191.63	192.18	191.41	191.77	191.15	191.64

Source: 2008-2012 Korea farm household economic data.

(Table 5.3. Continued)

Variable	Definition	Pooled	2008	2009	2010	2011	2012
Metro	=1 if metro city, =0 otherwise	0.04	0.04	0.04	0.04	0.04	0.04
Region1	Seoul	0.00	0.00	0.00	0.00	0.00	0.00
Region2	Busan	0.01	0.01	0.01	0.01	0.01	0.01
Region3	Daegue	0.01	0.01	0.01	0.01	0.01	0.01
Region4	Incheon	0.01	0.01	0.01	0.01	0.01	0.01
Region5	Gwangju	0.01	0.01	0.01	0.01	0.01	0.01
Region6	Daejeon	0.00	0.00	0.00	0.00	0.00	0.00
Region7	Ulsan	0.01	0.01	0.01	0.01	0.01	0.01
Region8	Gyeonggi-do	0.11	0.11	0.11	0.11	0.11	0.11
Region9	Gangwon-do	0.10	0.10	0.09	0.10	0.10	0.09
Region10	Chungcheongbuk-do	0.09	0.09	0.09	0.09	0.09	0.09
Region11	Chuncheongnam-do	0.12	0.12	0.12	0.12	0.12	0.12
Region12	Jeollabuk-do	0.12	0.12	0.12	0.12	0.12	0.12
Region13	Jeollanam-do	0.13	0.13	0.14	0.13	0.13	0.13
Region14	Kyeongsangbuk-do	0.12	0.13	0.13	0.13	0.12	0.12
Region15	Kyeongsangnam-do	0.11	0.11	0.11	0.11	0.11	0.11
Region16	Jeju-do	0.06	0.05	0.05	0.06	0.06	0.06
Year 2008	If year=2008	-	1	0	0	0	0
Year 2009	If year=2009	-	0	1	0	0	0
Year 2010	If year=2010	-	0	0	1	0	0
Year 2011	If year=2011	-	0	0	0	1	0
Year 2012	If year=2012	-	0	0	0	0	1
Observation		12,642	2,515	2,528	2,527	2,517	2,555

Source: 2008-2012 Korea farm household economic data.

Therefore, urbanization, population density, unemployment rate, and distance to big cities are included as factors in the model. For the purposes of this paper, population density and unemployment rate data were collected by region. In South Korea, among the 16 regions, two, Gwangyeok-si and Teukbyeol-si, are considered to be metropolitan areas and seven are considered to be metro cities: Seoul, Teukbyeol-si, Busan, Daegue, Incheon, Gwangju, Daejeon, and Ulsan Gwangyeok-si. The average population density of these regions is about 418.6 persons/km^2, the unemployment rate was about 2.44%, and the average distance from Seoul was about 191 km.

Finally, to assess the regional effects such as soil type and weather, this study considers all 16 regions: Seoul, Busan, Daegue, Incheon, Gwangju, Daejeon, Ulsan, Gyeonggi-do, Gangwon-do, Chungcheongbuk-do, Chuncheongnam-do, Jeollabuk-do, Jeollanam-do, Kyeongsangbuk-do, Kyeongsangnam-do, and Jeju-do. In the empirical model, I include only six regions based on their proximity to each other.

CHAPTER 6: UNCONDITIONAL QUANTILE REGRESSION WITH PANEL DATA

The ordinary least squares (OLS) method analyzes the conditional mean values of regressors. If the response variable has many outliers, then the estimated OLS coefficients can be biased. Quantile regression is useful in dealing with outlier problems and to understand the distribution of the data (Cameron and Trivedi, 2010). Quantile regression uses conditional quantile functions and adopts the percentiles or quantiles of observations as a dependent variable instead of one point estimates.

Quantile regression was developed by Koenker and Bassett (1978). They introduced “regression quantiles” using the conditional distribution. Based on the theory of Koenker and Bassett (1978), Koenker and Hallock (2001) fostered conditional quantile regression and estimated quantile regressions for Engel curves and infant birthweight. Recently, Frölich and Melly (2010) stated that since wages and income tend to move upward unequally, it is more useful to focus on the distribution of the dependent variables than on mean effects.

Powell (2014) analyzed the impact of the 2008 economic catalyst on household labor income assuming the incentives would be influenced by different earning distributions using quantile treatment effects. He used monthly data and evaluated a quantile regression for panel data (QRPD) with fixed effects. He designed the monthly earnings distribution of single or monthly earnings distribution of couples as a treated group, and earnings distributions of no rebates for singles and couples as an untreated group. He found that the rebate variable decreased earnings from labor. The effect was greater in higher quantiles. For example, $1 of rebate receipt diminished labor earnings by about nine cents in the 20th quantile, and about 10 to 15 cents in the 25th to 75th quantile.

The conditional quantile regression model is

$$Q_q(y|x,q) = x'\beta_q \text{ and } Prob\big(y \le x'\beta_q|x\big) = q \text{ and where } q \in (0,1), \tag{10}$$

where the range of quantile q is 0 to 1, Q_q is the conditional quantile regression function, x is regressors, y is outcome variable, and $Q_q(y|x,q)$ means that the conditional quantile regression function is linear in x, q. β_q is the estimate value in quantile q, and $Prob(\cdot)$ is the probability density ·function (Greene, 2011). The cumulative distribution function is $F(y_q) = q$ and $y_q = F^{-1}(q)$ (Cameron and Trivedi, 2010). The objective function to minimize the qth estimator β_q is to minimize the sum of the under-prediction and over-predictions (Greene, 2011) as follows:

$$\begin{aligned}(\beta_q) &= \min \sum_{i:y_i \ge x_i'\beta_q}^{n} q|\,y_i - x_i'\beta_q| + \sum_{i:y_i < x_i'\beta_q}^{n} (1-q)|\,y_i - x_i'\beta_q| \\ &= \textstyle\sum_{i=1}^{n} k(\,y_i - x_i'\beta_q|q)\end{aligned} \tag{11}$$

$$\text{where } k\big(y_i - x_i'\beta_q|q\big) = k\big(e_{i,q}|q\big) = \begin{pmatrix} qe_{i,q} & if\ e_{i,q} \ge 0 \\ (1-q)e_{i,q} & if\ e_{i,q} < 0 \end{pmatrix}.$$

The minimized estimator $Q(\beta_q)$ is asymptotically normally distributed and its distribution is (Cameron and Trivedi, 2010):

$$\widehat{\beta_q} \xrightarrow{a.s.} N(\beta_q, A^{-1}BA^{-1}) \tag{12}$$

where $A = \sum_i q(1-q)x_i\,x_i'$, $\mathrm{B} = \sum_i f_{e_{i,q}}(0|\,x_i)x_i x_i'$, $f_{e_{i,q}}(0|x_i)$ *is density of* $e_{i,q}$ *at* 0.

The above equation (12) shows the cross sectional data method. Using this equation, one can develop the longitudinal data. Abrevaya and Dahl (2008) connected the quantile regression and panel data method and analyzed the factors that can affect birth weight, which was used as the dependent variables for the 10%, 25%, 50%, 75%, and 90% distribution.

For the panel data analysis of quantile regression, fixed effect estimation is commonly processed. Fixed effect quantile regression assumes that the individual heterogeneity effect is the shifter of the q-quantile distribution for the dependent variable, and this individual effect can be separable as an additive term (Koenker, 2005; Abrevaya and Dahl, 2008; and Powell, 2013). Koenker (2005) and Canay (2011) estimated the quantile regression with fixed effects using panel data. They stated that the heterogeneity term in the fixed effect model is a shifter of the intercept and is not changed by the quantile. The panel data model with fixed effects is

$$y_{it} = \alpha_i + x'_{it}\beta + U_{it}, \qquad i = 1, \dots, N,\ t = 1, \dots, T \tag{13}$$

where y_{it} is the dependent variable, α_i is individual heterogeneity, x'_{it} is exogenous variables, and U_{it} is the idiosyncratic error term.

The conditional quantile model for panel data with fixed effects is:

$$Q_{y_{it}}(\tau|x_{it}) = \alpha_i + x'_{it}\beta(\tau). \tag{14}$$

The conditional quantile model is easy to apply and commonly used. However, the estimated results are easily changed, in accordance with adding control variables in the model. To avoid these problems, the unconditional quantile regression was introduced. The goal of the unconditional quantile regression is to examine the variation on the marginal (unconditional) quantile distribution of the outcome variable according to covariate changes (Firpo, Fortin, and Lemieux, 2009). Since unconditional quantile regression is not influenced by the distinct variables, it is more generally interpreted. Therefore, this study will use the unconditional quantile regression. Using Korean farm household economic data, I will examine the distribution changes of farmland values, with a focus on off-farm income, government payments, and other control variables.

This study follows the unconditional quantile method developed by Firpo, Fortin, and Lemieux (2009) using longitudinal data. Firpo, Fortin, and Lemieux (2009) used the Recentered Influence Function (RIF) to investigate the unconditional quantile regression. The Influence

Function measures the minuscule change of a real-valued function, and its special case is Recentered Influence Function. The Influence function of the th quantile (Firpo, Fortin, and Lemieux, 2009) is

$$IF(Y;\ q_\tau) = \frac{\tau - \mathbb{1}\{Y \le q_\tau\}}{f_Y(q_\tau)} \tag{15}$$

where Y is outcome variable, q_τ is population τth quantile of the unconditional distribution of y, $\mathbb{1}\{\cdot\}$ is indicator function, and f_Y is the marginal distribution density of y. If the Y is the under the quantile (q_τ), then the influence function is $\frac{\tau-1}{f_Y(q_\tau)}$, and if the Y is the over the quantile (q_τ) then the influence function is $\frac{\tau}{f_Y(q_\tau)}$. The RIF is sum of the τth quantile and influence function and can be written as

$$\begin{aligned} RIF(Y;\ q_\tau) &= q_\tau + IF(Y;\ q_\tau) \\ &= \frac{\mathbb{1}\{Y > q_\tau\}}{f_Y(q_\tau)} + q_\tau - \frac{1-\tau}{f_Y(q_\tau)} \\ &= k_{1,\tau} \cdot \mathbb{1}\{Y > q_\tau\} + k_{2,\tau} \end{aligned} \tag{16}$$

where, $k_{1,\tau} = \frac{1}{f_Y(q_\tau)}$, $k_{2,\tau} = q_\tau - k_{1,\tau} \cdot (1-\tau)$.

The expectation of RIF, i.e., unconditional quantile regression is written as

$$\begin{aligned} E[RIF(Y;\ q_\tau|X = x)] &= k_{1,\tau} \cdot E[\mathbb{1}\{Y > q_\tau\}|X = x] + k_{2,\tau} \\ &= k_{1,\tau} \cdot Pr[Y > q_\tau|X = x] + k_{2,\tau}. \end{aligned} \tag{17}$$

The derived unconditional partial effect, $\beta(\tau)$, is

$$\begin{aligned} \beta(\tau) &= \int \frac{dE[RIF(Y;\ q_\tau|X = x)]}{dx} \cdot dF_X(x) \\ &= k_{1,\tau} \cdot \int \frac{dPr[Y > q_\tau|X = x]}{dx} \cdot dF_X(x). \end{aligned} \tag{18}$$

For empirical estimation, we need to estimate the feasible RIF, such as:

$$\widehat{RIF}(Y;\ \widehat{q_\tau}) = \widehat{q_\tau} + \frac{\tau - \mathbb{1}\{Y \le \widehat{q_\tau}\}}{\widehat{f_Y}(\widehat{q_\tau})}. \tag{19}$$

One can regress $\widehat{RIF}(Y;\ \widehat{q_\tau})$ on x_i. The objective function to estimator of the τ-th quantile $\widehat{q_\tau}$ is

$$\widehat{q_\tau} = \arg\min q \sum_{i=1}^{N} (\tau - \mathbb{1}\{Y_i - q \leq 0\})(Y_i - q). \quad (20)$$

To estimate the feasible density of Y, $\widehat{f_Y}$, Gaussian kernel density method will be used:

$$\widehat{f_Y}(\widehat{q_\tau}) = \frac{1}{N \cdot S_Y} \cdot \sum_{i=1}^{n} K_Y\left(\frac{Y_i - \widehat{q_\tau}}{S_Y}\right), \quad (21)$$

where, S_Y is a positive scalar range, and K_Y is a kernel function. In sum, to solve above equations, Firpo, Fortin, and Lemieux (2009) suggested that first, estimate q_τ from from τ-th quantile in the sample, and density $f_Y(q_\tau)$ from the kernel methods. From the binary variable, according to Y is under q_τ or not, $\mathbb{1}\{Y \leq q_\tau\}$ can be solved. Finally, the estimated RIF function can be regressed on explanatory variables X. Since longitudinal data from 2008 to 2012 will be used, in the RIF regression, year dummy will be adopted.

CHAPTER 7: RESULTS AND DISCUSSION

In this chapter, I conducted OLS regression and unconditional quantile regression. Before starting the analysis, a correlation test checked the mutual relation among the farmland value, off-farm income and government subsidies. There were low correlation problems among all the variables: 0.29 correlation coefficient between the off-farm income and farmland value; 0.12 between the off-farm income and government subsidies; and 0.04 between farmland value and government subsidies.

On the other hand, 16 region variables represented a collinearity problem, so I reduced the 16 regions into six regions based on their proximities to one another. The criteria used to combine the regions are the same that were used by the old Korean provision standards. The capital region, where 12% of the sampled farm households reside, includes Seoul, Incheon, and Kyeonggi-do. The Chungcheong-do region includes Daejeon, Chuncheong buk-do, and Chuncheong nam-do. The Gyeongsang-do region includes Daegu, Ulsan, Busan, Kyeongsangbuk-do, and Kyeongsangnam-do. The Jeolla-do region includes Gwangju, Jeollabuk-do, and Jeollanam-do. Gangwon-do and Jeju-do are each their own region. On average, 52% of the sampled farmers lived in either the mountainous Gyeongsang-do region or the Jeolla-do region, which is located in the plains.

Recall the main focus of this dissertation is to assess the relationship between off-farm income, government subsidies, and farmland values. To do this, it is meaningful to examine the distribution of these three variables.

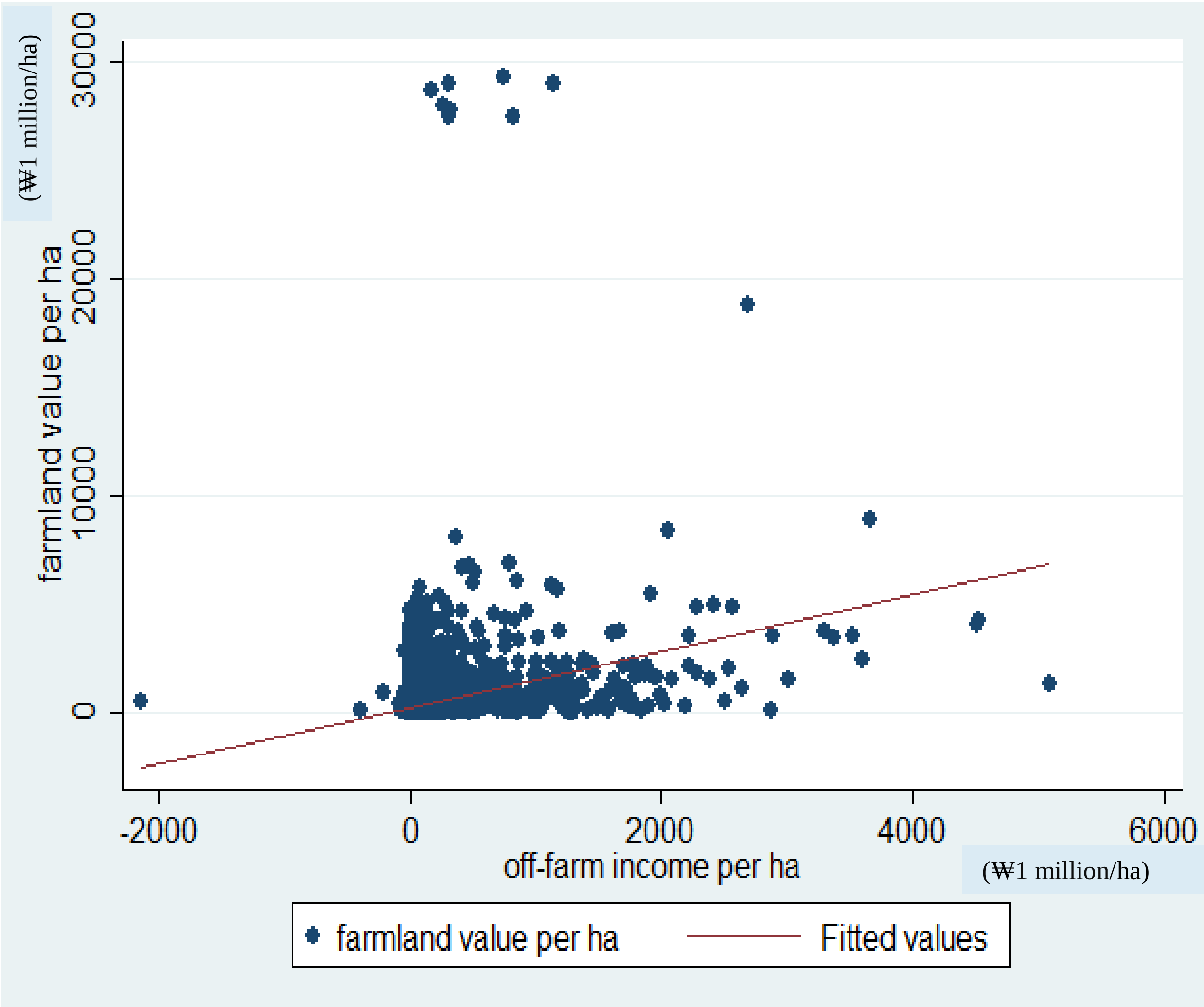


Figure 7.1. Land value per hectare against off-farm income (₩1 million/ha)

Figure 7.1 shows the graph of the farmland value per hectare[18] against off-farm income per hectare, and Figure 7.2 presents a graph of the farmland value per hectare against government subsidy payments per hectare. In Figure 7.1, the tendency of higher farmland value per hectare is skewed from ₩0 to ₩2,000 million per hectare of off-farm income. In the same range, there are outliers showing high farmland value per hectare. In this graph, due to outliers, it is hard to find a specific relationship between the two variables; some low-income households had lower farmland

[18] Farmland value, off-farm income, and government subsidy payments are deflated based on 2010=100.

values, while other low-income farmers had higher farmland values. Similarly, in Figure 7.2, we observe outliers in the case of government payments and farmland values. Beneficiaries of large government payments owned inexpensive farmland. Therefore, from the two figures, it is clear that the data needed to be transformed. Specifically, to find the relationship, the variables are changed into logarithm form.

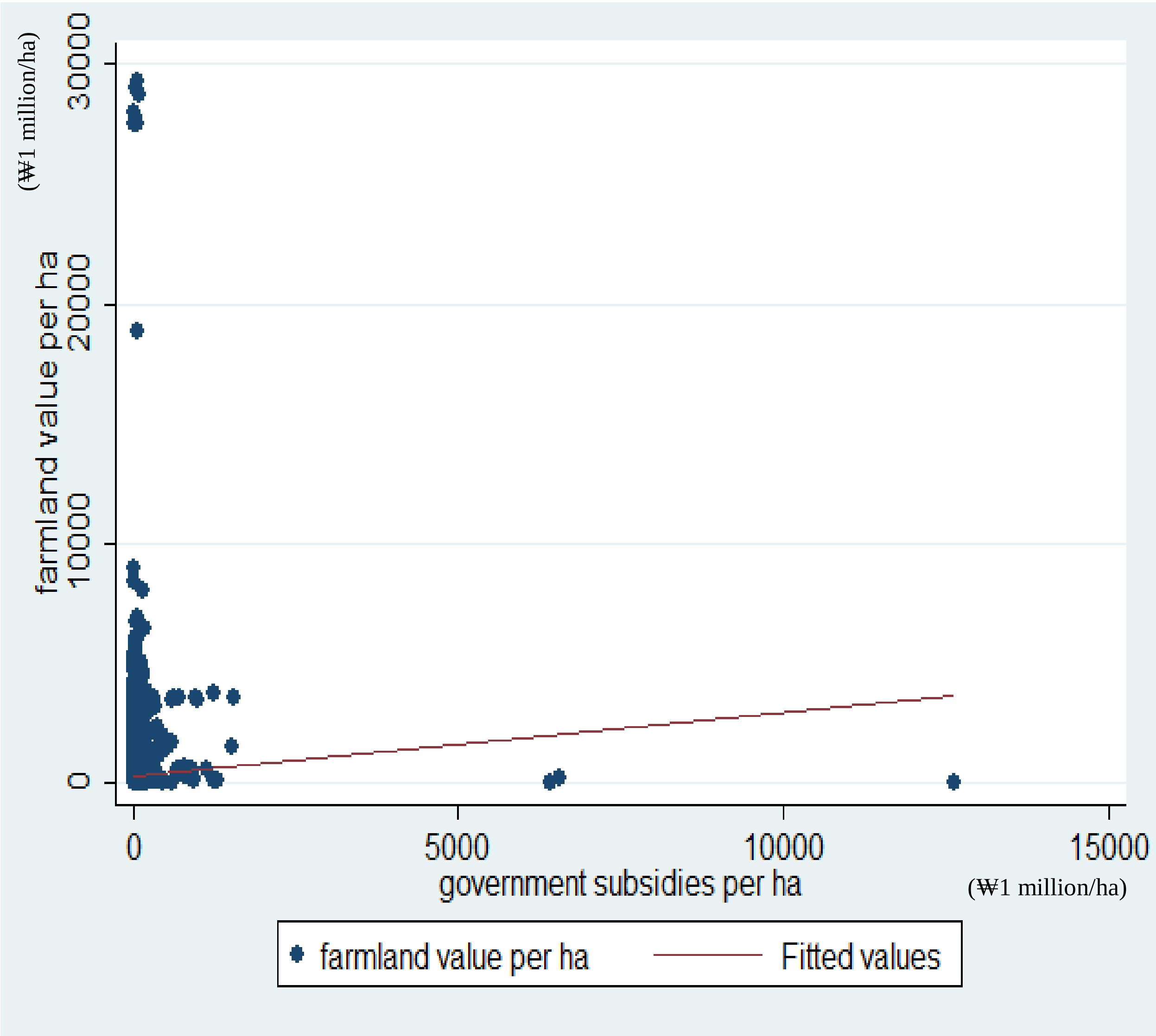


Figure 7.2. Land value per hectare against government subsidy payments (₩1 million/ha)

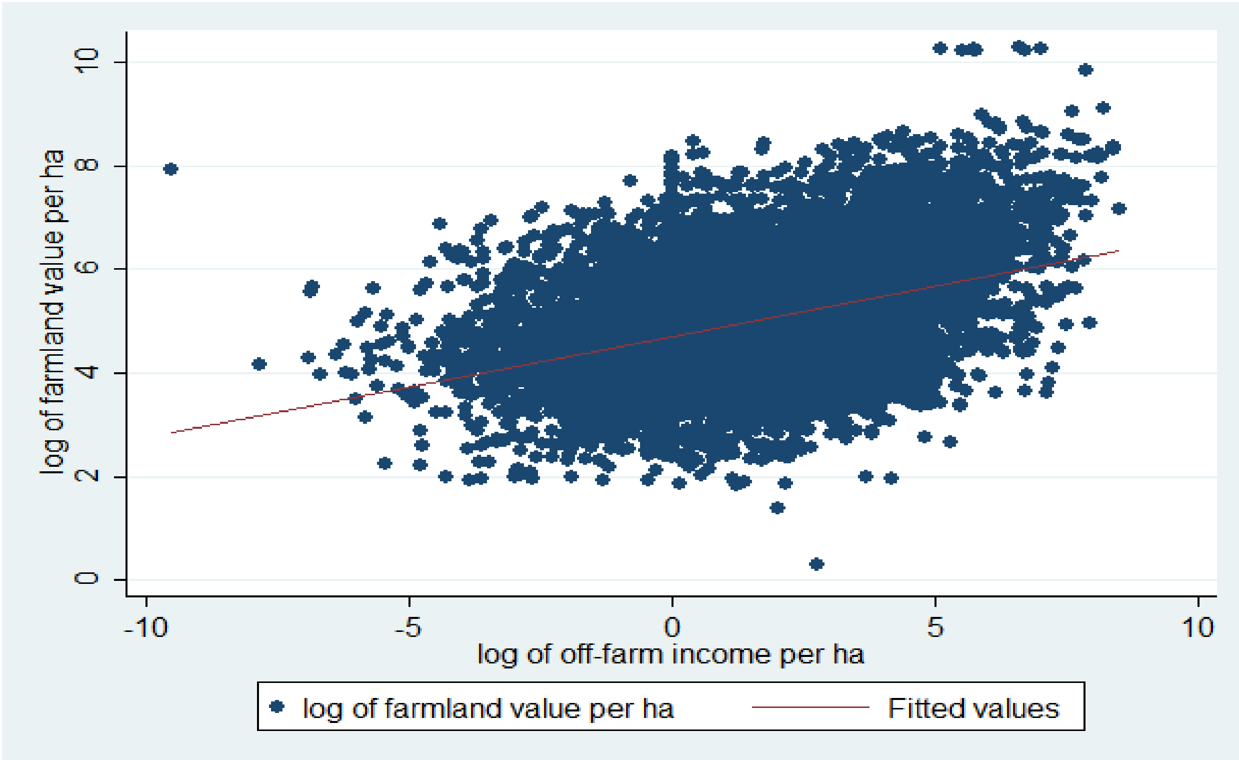


Figure 7.3. Log land value per hectare against log off-farm income

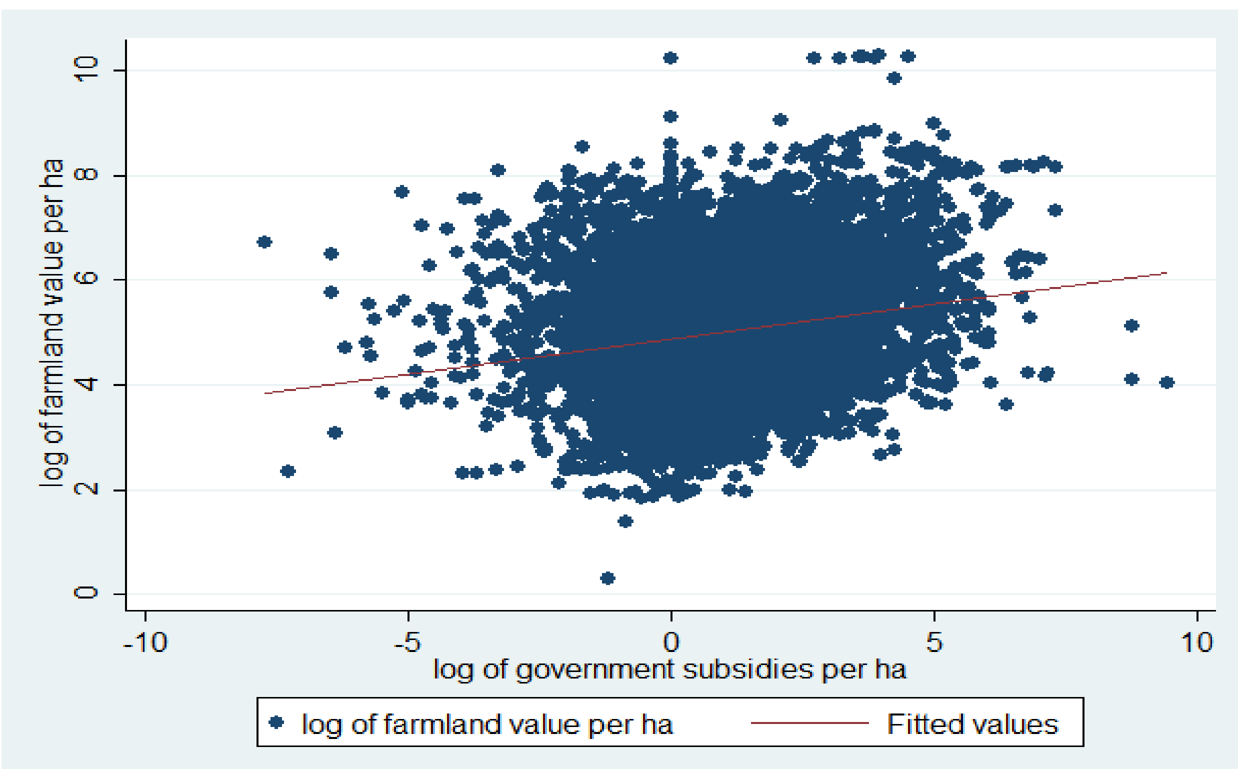


Figure 7.4. Log land value per hectare against log government subsidy payments

Figures 7.3 and 7.4 represent a scatter plot of transformed farmland value, off-farm income, and government subsidies as natural log form. The transformed data shows a less skewed tendency and higher correlation – a trend could be easily tested. Therefore, the transformed log data will be used for analysis.

Figure 7.5 shows the quantiles of farmland value and displays symmetry. When it is based on quantile, the distribution of farmland value is diverse, so quantile regression is better than the OLS regression method. Quantile regression has two methods: the conditional quantile and unconditional quantile regression. Since the estimate of the conditional quantile is easily changed by adding control variables, the estimate of unconditional quantile regression is generally interpreted and preferred. In this dissertation, three models were estimated using unconditional quantile

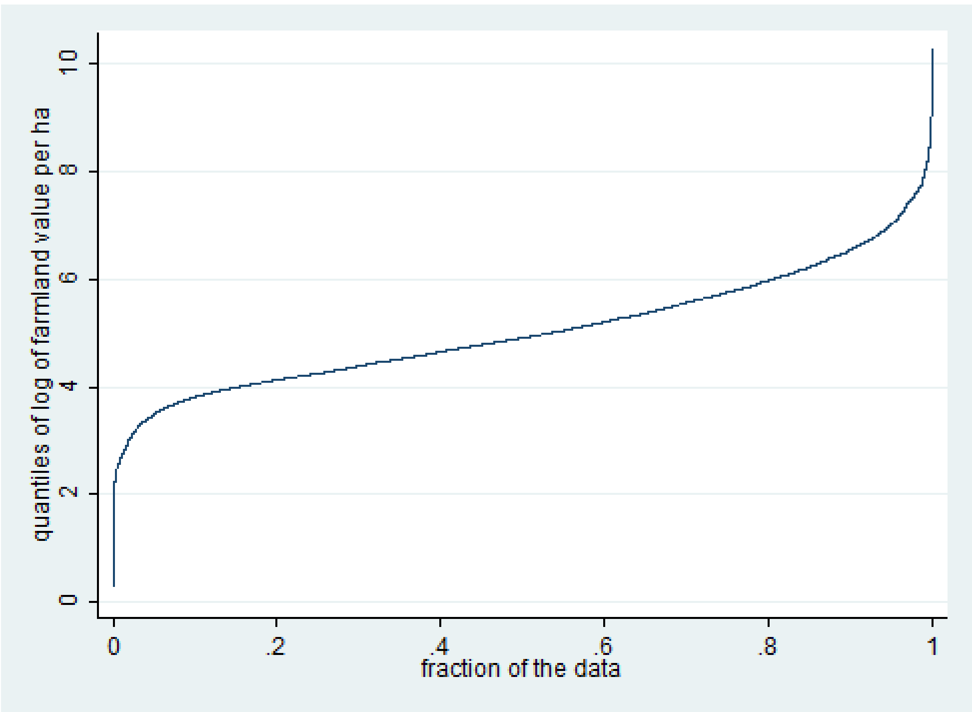


Figure 7.5. Quantile plot of land value per hectare

regression. The first model includes government subsidies as an independent variable, the second model assesses off-farm income exclusively, and the third model assesses the impact of government subsidies and off-farm income, along with other variables, as independent variables.

7.1. Model 1: Farm Income and Government Subsidies

Model 1 considers the impact of farm income and government subsidies payments on farmland values. This model excludes the off-farm income variable. The R^2 for the OLS regression in model 1 is 0.397. Farm income and government subsidies have a positive and significant effect on farmland values. In the OLS model, a 100% increase in government subsidies increases farmland value by 12.1%. However, the estimates are much larger in the upper quantiles; they increase from 7% in the 25th quantile to about 15% in the 90th quantile. Debt-to-asset ratio - solvency effect - has a negative effect on farmland values; the absolute value is higher in the higher quantile.

Farm types also have a different effect on farmland values. In the lower quantile, fruit and vegetable and other special crop producers have lower farmland values than crop farms. However, in the upper quantile, fruit and vegetable and special crop farmers have higher farmland values compared to crop farms. The population density has a positive and significant effect on farmland values, in both the OLS and the quantile models. A 1% increase in population density increases farmland value by 0.03% and 0.06% in the OLS and 90th quantile, respectively. Apparently, other regions have lower farmland values, compared to the capital region (base group).

Table 7.1. Models of log total farmland value per hectare via OLS and unconditional quantile regression (Model 1)

Variables	OLS	10th quantile	25th quantile	50th quantile	75th quantile	90th quantile
Log(farm income)[19]	0.102*** (0.00565)	0.0882*** (0.00708)	0.0620*** (0.00588)	0.0913*** (0.00695)	0.130*** (0.00962)	0.135*** (0.0144)
Log(government subsidies)[20]	0.121*** (0.00612)	0.0938*** (0.00735)	0.0738*** (0.00593)	0.0945*** (0.00727)	0.146*** (0.0104)	0.154*** (0.0151)
Log(debt to asset ratio)	-0.226*** (0.0440)	-0.0757 (0.0800)	-0.0594 (0.0620)	-0.278*** (0.0602)	-0.395*** (0.0735)	-0.202* (0.0901)
Fruit & vegetable farms	-0.0252 (0.0204)	-0.157*** (0.0320)	-0.0912*** (0.0269)	0.0507 (0.0287)	-0.0174 (0.0344)	0.0917* (0.0424)
Special crops & flower farms	0.0220 (0.0411)	-0.260*** (0.0638)	-0.145** (0.0489)	0.0295 (0.0542)	0.115 (0.0626)	0.496*** (0.0929)
Livestock farms	-0.0873** (0.0293)	-0.111* (0.0510)	-0.0358 (0.0407)	0.0126 (0.0443)	-0.0962 (0.0534)	-0.241*** (0.0590)
Other types farms	0.383*** (0.0209)	0.0887** (0.0290)	0.222*** (0.0247)	0.407*** (0.0281)	0.540*** (0.0373)	0.648*** (0.0481)
Population density	0.00037*** (0.00002)	0.0001*** (0.00002)	0.00015*** (0.00002)	0.00025*** (0.00004)	0.00035*** (0.00005)	0.00065*** (0.00006)
Distance from Seoul	0.000267 (0.00025)	-0.0011** (0.0004)	-0.0012*** (0.00034)	0.000416 (0.000323)	0.000436 (0.000404)	0.00126* (0.000577)
Gangwon-do region	-0.945*** (0.0451)	-0.224*** (0.0490)	-0.222*** (0.0442)	-1.028*** (0.0588)	-1.897*** (0.0837)	-1.543*** (0.126)
Chungcheong-do region	-0.867*** (0.0391)	-0.0528 (0.0380)	-0.0639 (0.0361)	-0.877*** (0.0489)	-1.862*** (0.0752)	-1.636*** (0.119)
Kyeongsang-do region	-1.111*** (0.0571)	-0.340*** (0.0817)	-0.407*** (0.0687)	-1.159*** (0.0717)	-1.814*** (0.0990)	-1.606*** (0.152)

Robust standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

[19] Unit of farm income is 1 million won per hectare.
[20] Unit of government subsidies is 1 million won per hectare.

(Table 7.1 continued)

Variables	OLS	10th quantile	25th quantile	50th quantile	75th quantile	90th quantile
Jeolla-do region	-1.554***	-0.345***	-0.847***	-1.826***	-2.434***	-2.016***
	(0.0648)	(0.0862)	(0.0785)	(0.0822)	(0.112)	(0.170)
Jeju-do region	-0.600***	0.592***	0.578***	-0.663***	-1.236***	-1.677***
	(0.111)	(0.167)	(0.142)	(0.146)	(0.192)	(0.273)
Year=2009	-0.0574*	-0.0441	-0.0426	-0.0525	-0.0494	-0.0874
	(0.0242)	(0.0350)	(0.0288)	(0.0331)	(0.0424)	(0.0546)
Year=2010	-0.0794***	-0.0444	-0.0525	-0.0947**	-0.0885*	-0.0855
	(0.0240)	(0.0351)	(0.0288)	(0.0331)	(0.0422)	(0.0548)
Year=2011	-0.0989***	-0.0936**	-0.0780**	-0.115***	-0.0986*	-0.106
	(0.0245)	(0.0358)	(0.0291)	(0.0332)	(0.0425)	(0.0553)
Year=2012	-0.0366	0.0132	-0.0193	-0.0511	-0.0335	-0.0712
	(0.0242)	(0.0336)	(0.0287)	(0.0332)	(0.0428)	(0.0557)
Intercept	5.467***	3.966***	4.546***	5.473***	6.769***	6.962***
	(0.0416)	(0.0427)	(0.0395)	(0.0511)	(0.0802)	(0.126)
N	12642	12642	12642	12642	12642	12642
adj. R2	0.397	0.079	0.195	0.256	0.284	0.205

Robust standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 7.6 shows the differences of estimated results between the OLS model and the unconditional quantile model. From the 65th quantile, the coefficient of the log of government subsidies is higher than the OLS coefficient. Generally, the coefficients of log of farming income, log of debt per asset, and population density increase as the quantile is higher.

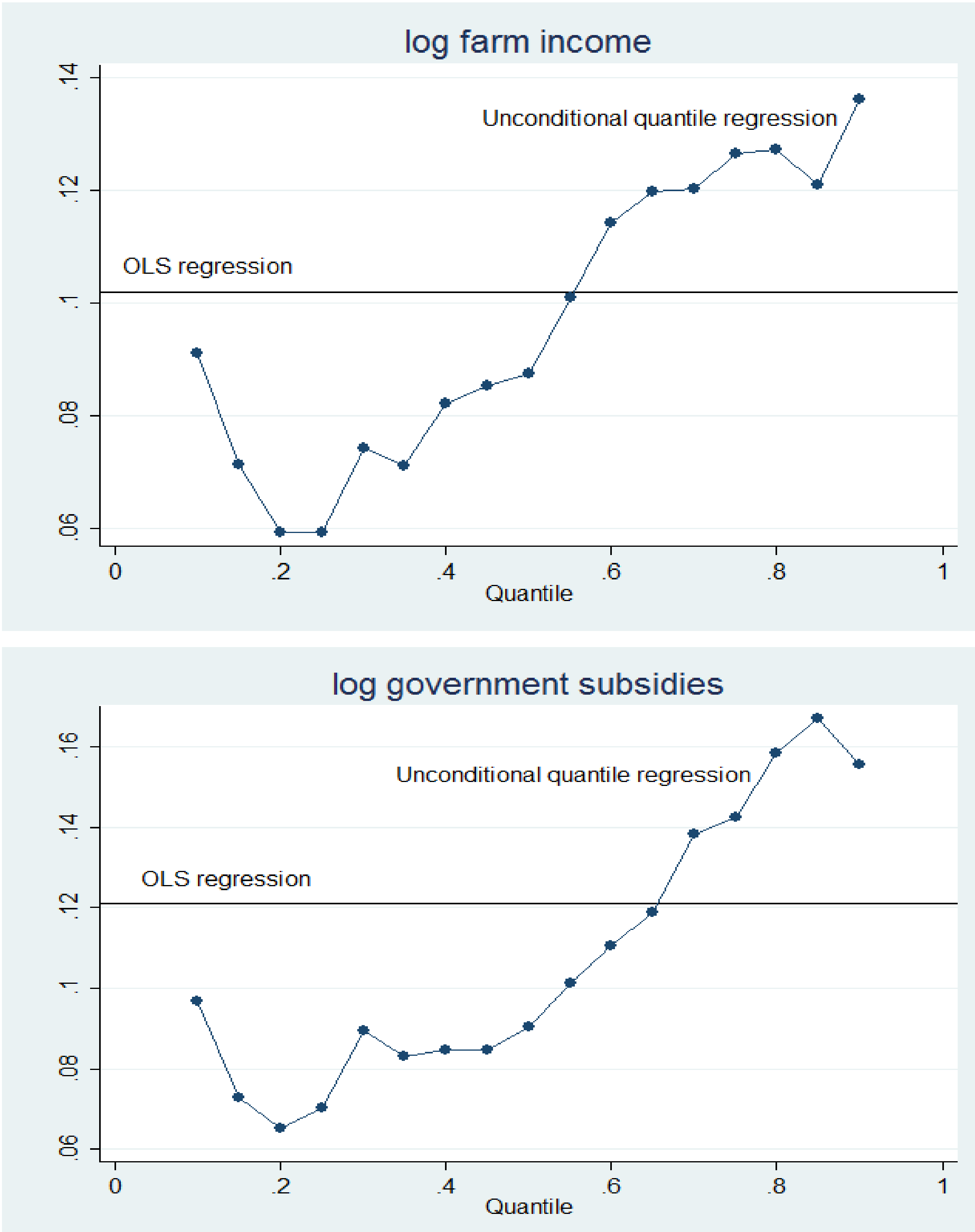


Figure 7.6. OLS and unconditional quantile regression coefficients for each regressor (Model 1)

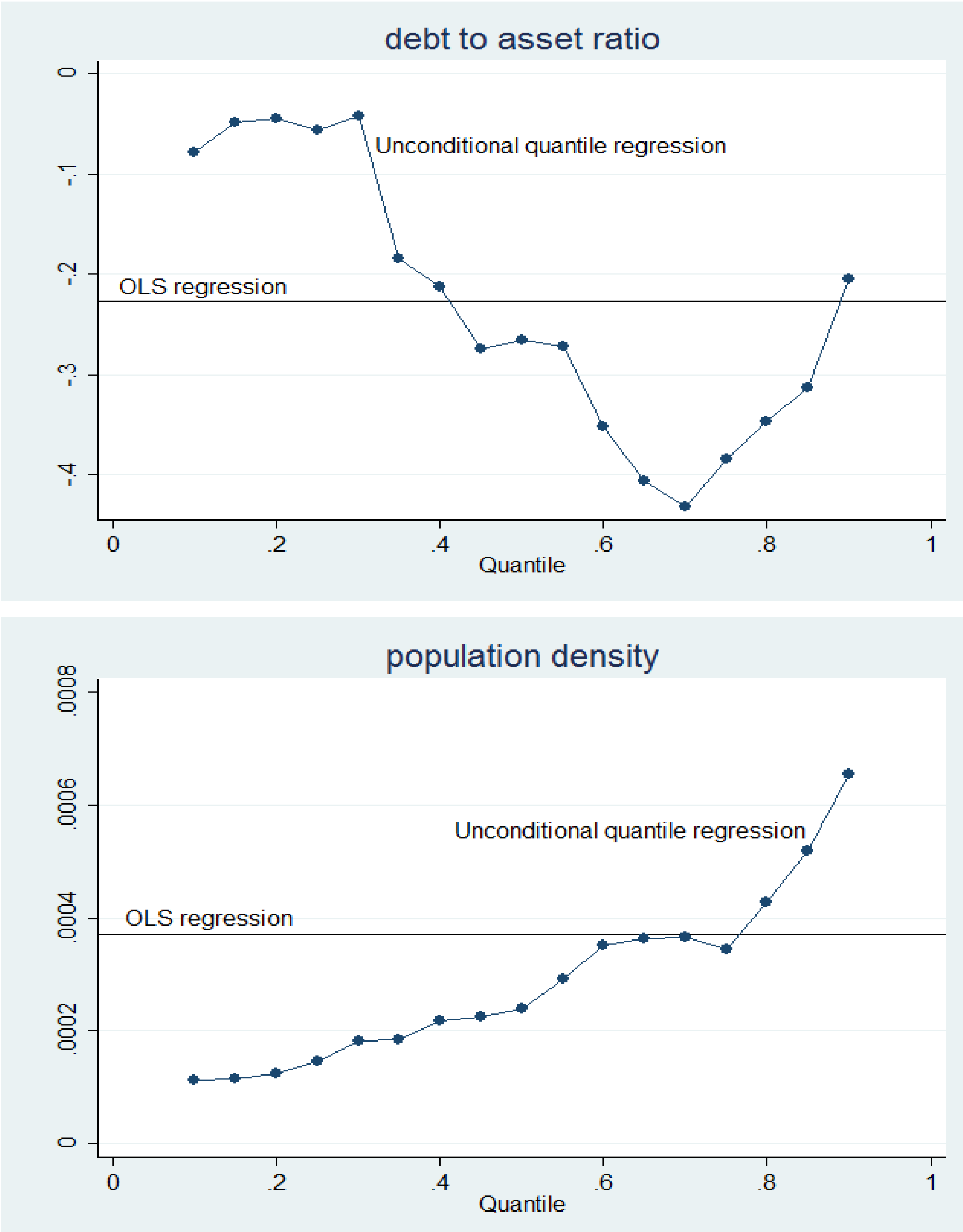


Figure 7.6 continued

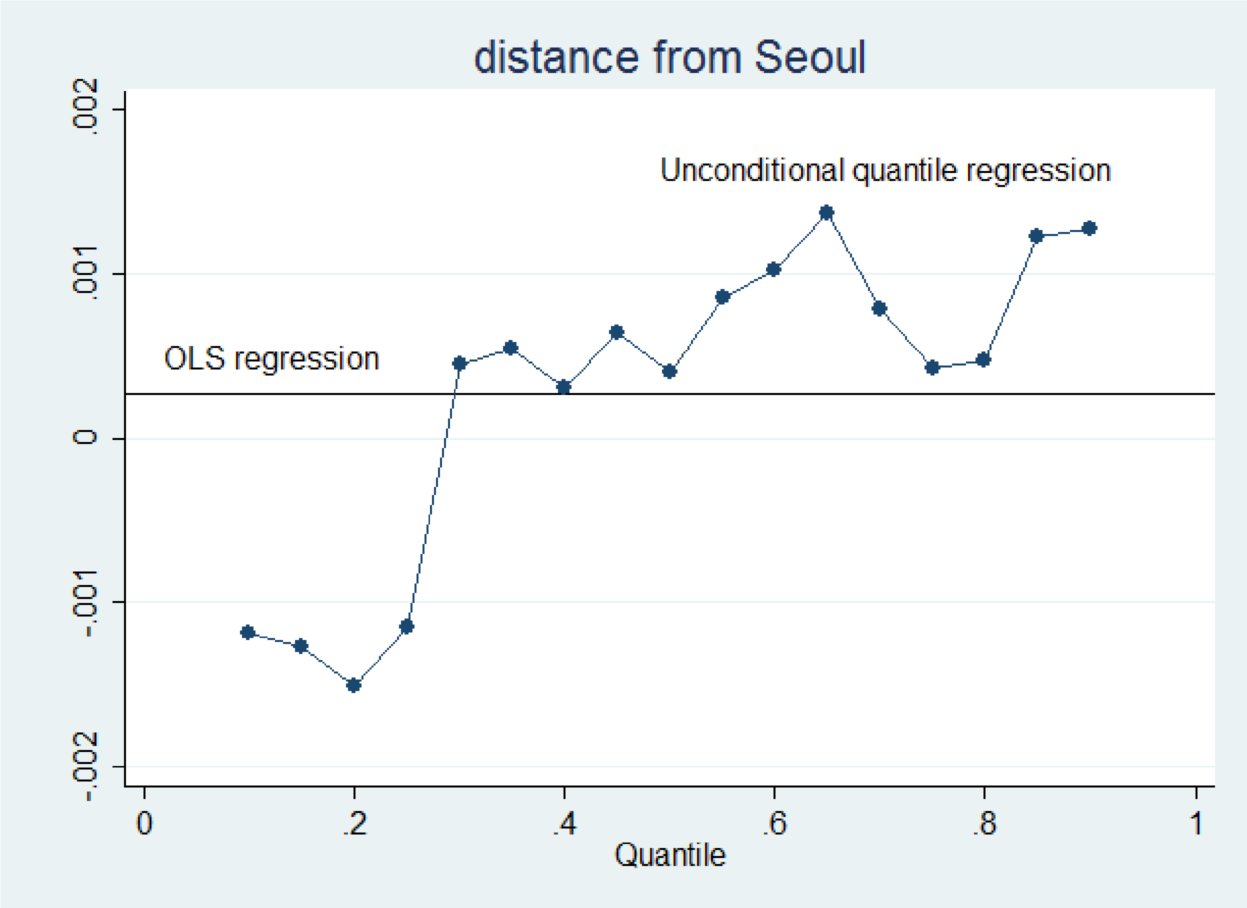


Figure 7.6 continued

7.2. Model 2: Farm Income and Off-Farm Income

Model 2 considered the impact of farm income and off-farm income but did not include government subsidies when assessing the farmland values. The result, shown in Table 7.2, is similar to model 1. The effects of farm income and off-farm income are relatively lower than those obtained in model 1. Since farm income and off-farm income have positive and significant effects on farmland values, I can conclude that both of these income variables contribute positively to farmland values. A 100% increase in off-farm income increases farmland values by 15% in the OLS model. However, the impact ranges from about 10% in the 10^{th} quantile, 14% in the median quantile, and 23% in the 90^{th} quantile regression model. The effect of off-farm income rises with

Table 7.2. Models of log total farmland value per hectare via OLS and unconditional quantile regression (Model 2)

Variables	OLS	10th quantile	25th quantile	50th quantile	75th quantile	90th quantile
Log(farm income)[21]	0.091***	0.0874***	0.0542***	0.0789***	0.119***	0.113***
	(0.0055)	(0.00710)	(0.00582)	(0.00672)	(0.00926)	(0.0140)
Log(off-farm income)[22]	0.159***	0.0965***	0.0998***	0.136***	0.185***	0.228***
	(0.0049)	(0.00659)	(0.00529)	(0.00588)	(0.00795)	(0.0115)
Debt to asset ratio	-0.431***	-0.199*	-0.189**	-0.455***	-0.635***	-0.499***
	(0.0436)	(0.0813)	(0.0637)	(0.0586)	(0.0736)	(0.0865)
Fruit & vegetable farms	-0.053**	-0.180***	-0.108***	0.0300	-0.0507	0.0583
	(0.0202)	(0.0321)	(0.0267)	(0.0284)	(0.0342)	(0.0422)
Special crops & flower farms	-0.0430	-0.310***	-0.185***	-0.0213	0.0368	0.413***
	(0.0400)	(0.0639)	(0.0492)	(0.0534)	(0.0610)	(0.0909)
Livestock farms	-0.201***	-0.191***	-0.106**	-0.0795	-0.232***	-0.393***
	(0.0290)	(0.0508)	(0.0405)	(0.0444)	(0.0527)	(0.0585)
Other types farms	-0.102***	-0.208***	-0.0832**	-0.00817	-0.0273	-0.0482
	(0.0247)	(0.0355)	(0.0295)	(0.0333)	(0.0434)	(0.0570)
Population density	0.0003***	0.0001***	0.00014***	0.00023***	0.00033***	0.00062***
	(0.00002)	(0.00002)	(0.00002)	(0.00003)	(0.00004)	(0.00006)
Distance from Seoul	0.00008	-0.0013**	-0.0013***	0.000269	0.000222	0.00102
	(0.0002)	(0.0004)	(0.0003)	(0.0003)	(0.0004)	(0.00057)
Gangwon-do region	-0.874***	-0.175***	-0.179***	-0.970***	-1.813***	-1.447***
	(0.0433)	(0.0478)	(0.0432)	(0.0578)	(0.0826)	(0.125)
Chungcheong-do region	-0.774***	0.0112	-0.00685	-0.802***	-1.752***	-1.512***
	(0.0379)	(0.0374)	(0.0356)	(0.0483)	(0.0746)	(0.117)
Kyeongsang-do region	-0.957***	-0.236**	-0.312***	-1.032***	-1.632***	-1.396***
	(0.0551)	(0.0805)	(0.0676)	(0.0707)	(0.0984)	(0.150)

Robust standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

[21] Unit of farm income is 1 million won per hectare.
[22] Unit of off-farm income is 1 million won per hectare.

(Table 7.2 continued)

Variables	OLS	10th quantile	25th quantile	50th quantile	75th quantile	90th quantile
Jeolla-do region	-1.410*** (0.0628)	-0.250** (0.0855)	-0.758*** (0.0776)	-1.706*** (0.0812)	-2.264*** (0.111)	-1.816*** (0.168)
Jeju-do region	-0.549*** (0.108)	0.627*** (0.166)	0.610*** (0.141)	-0.622*** (0.144)	-1.175*** (0.190)	-1.608*** (0.269)
Year=2009	-0.0354 (0.0235)	-0.0248 (0.0349)	-0.0295 (0.0285)	-0.0365 (0.0327)	-0.0222 (0.0418)	-0.0618 (0.0536)
Year=2010	-0.0476* (0.0232)	-0.0189 (0.0350)	-0.0334 (0.0285)	-0.0705* (0.0326)	-0.0499 (0.0414)	-0.0463 (0.0537)
Year=2011	-0.0458 (0.0237)	-0.0539 (0.0356)	-0.0455 (0.0288)	-0.0725* (0.0327)	-0.0348 (0.0420)	-0.0370 (0.0542)
Year=2012	0.0239 (0.0232)	0.0584 (0.0335)	0.0177 (0.0283)	-0.00322 (0.0326)	0.0392 (0.0421)	0.00729 (0.0545)
Intercept	5.453*** (0.0399)	3.965*** (0.0422)	4.537*** (0.0390)	5.457*** (0.0502)	6.755*** (0.0788)	6.934*** (0.123)
N	12642	12642	12642	12642	12642	12642
adj. R2	0.434	0.085	0.210	0.277	0.302	0.228

Robust standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

quantile. Similar to Model 1, debt-to-asset ratio has a negatively significant effect on farmland values for all quantiles.

Most types of specialized farms have lower farmland values compared to crop producers (base group). Farmland values of livestock farmers decreases by 20% and 39% in the OLS model and 90th quantile model, respectively. Population density has a positive and significant effect on farmland value. In year dummy variable, year 2012 is not significant; from 2009 to 2011 farmland values are less than the farmland values of 2008.

Figure 7.7 shows the coefficient estimates from the OLS and the unconditional quantile model. The shapes of the graphs are similar to those obtained in figure 7.6. I can check that the unconditional quantile model illustrates how the coefficients increase or decrease across quantiles, while the OLS coefficients are steady. The quantile coefficients of farm income and off-farm income increase in higher quantiles; in the case of farm income, it increases until the 75th quantile after which it shows a drop before increasing again at the 90th quantile.

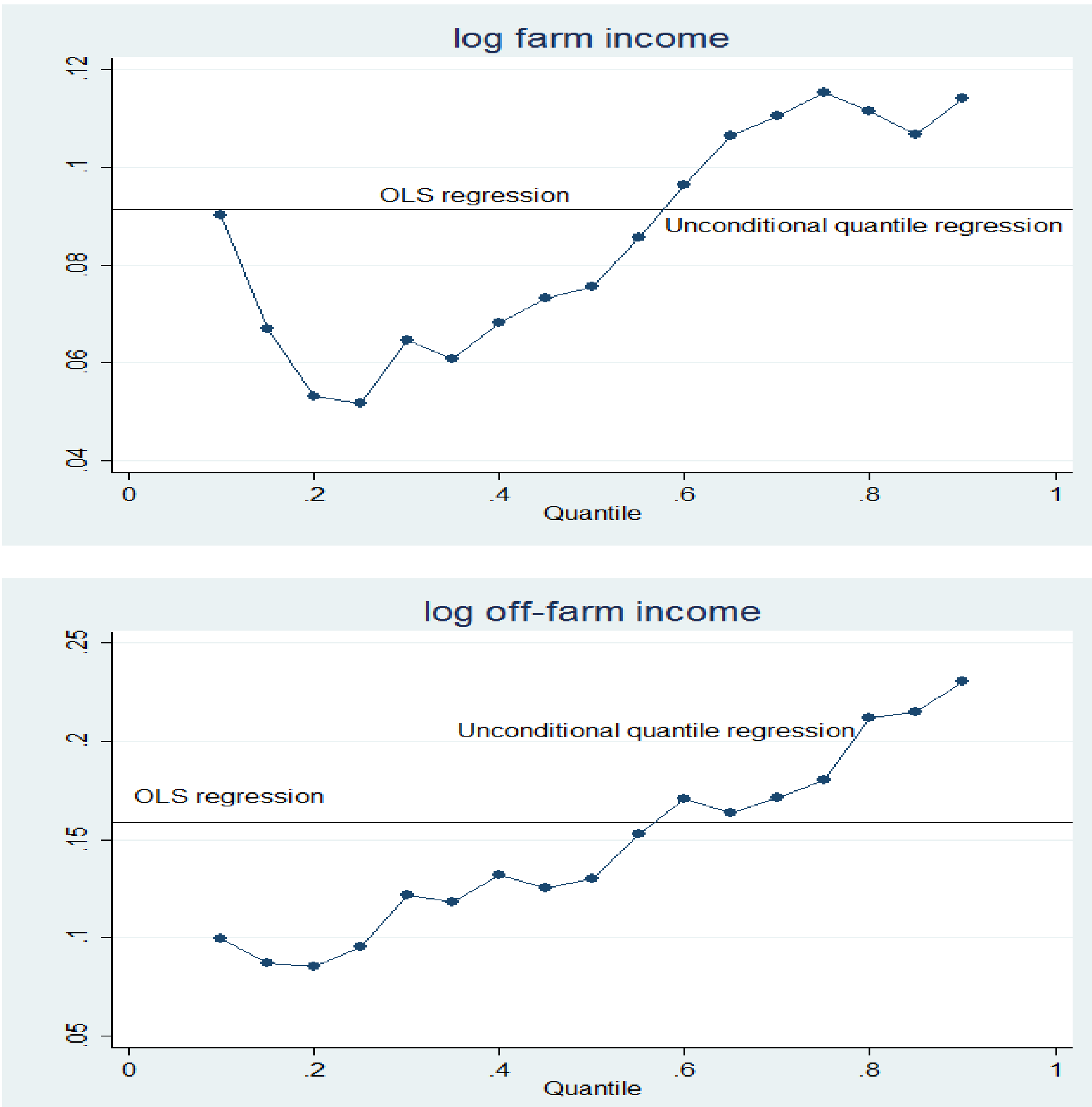
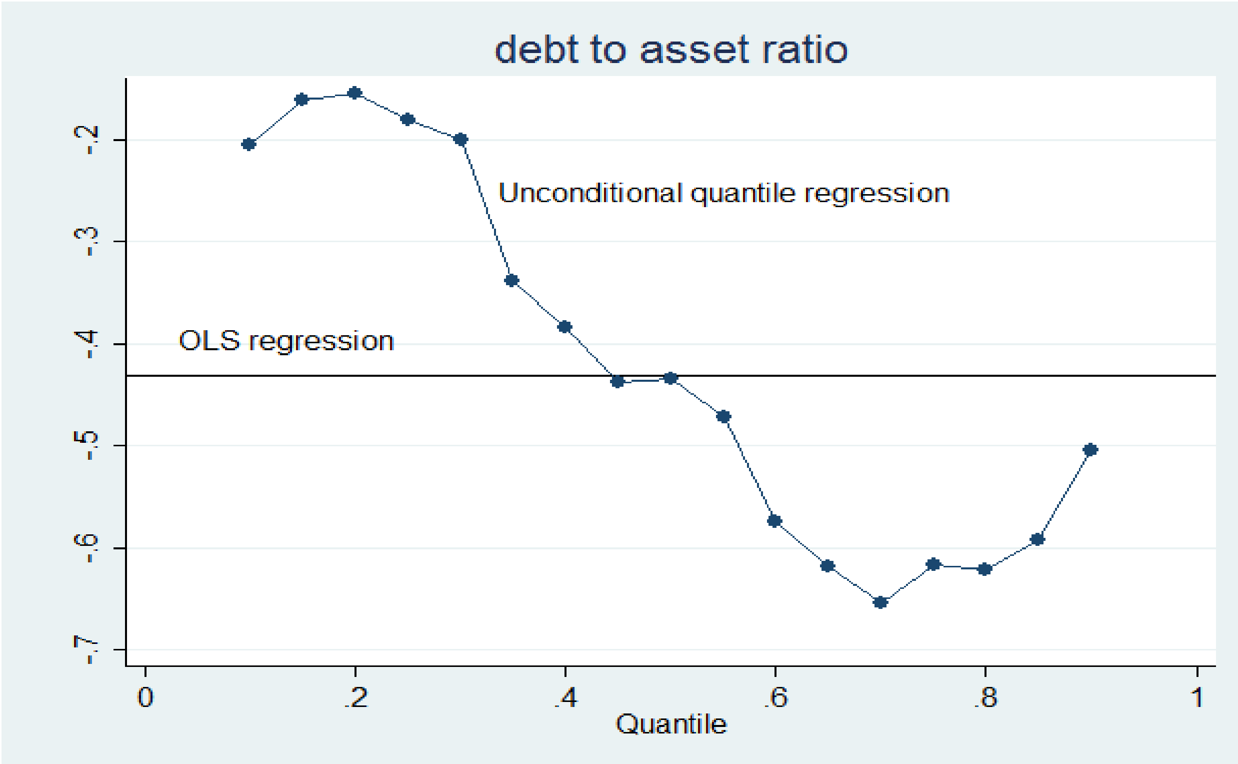


Figure 7.7. OLS and unconditional quantile regression coefficients for each regressor (Model 2)



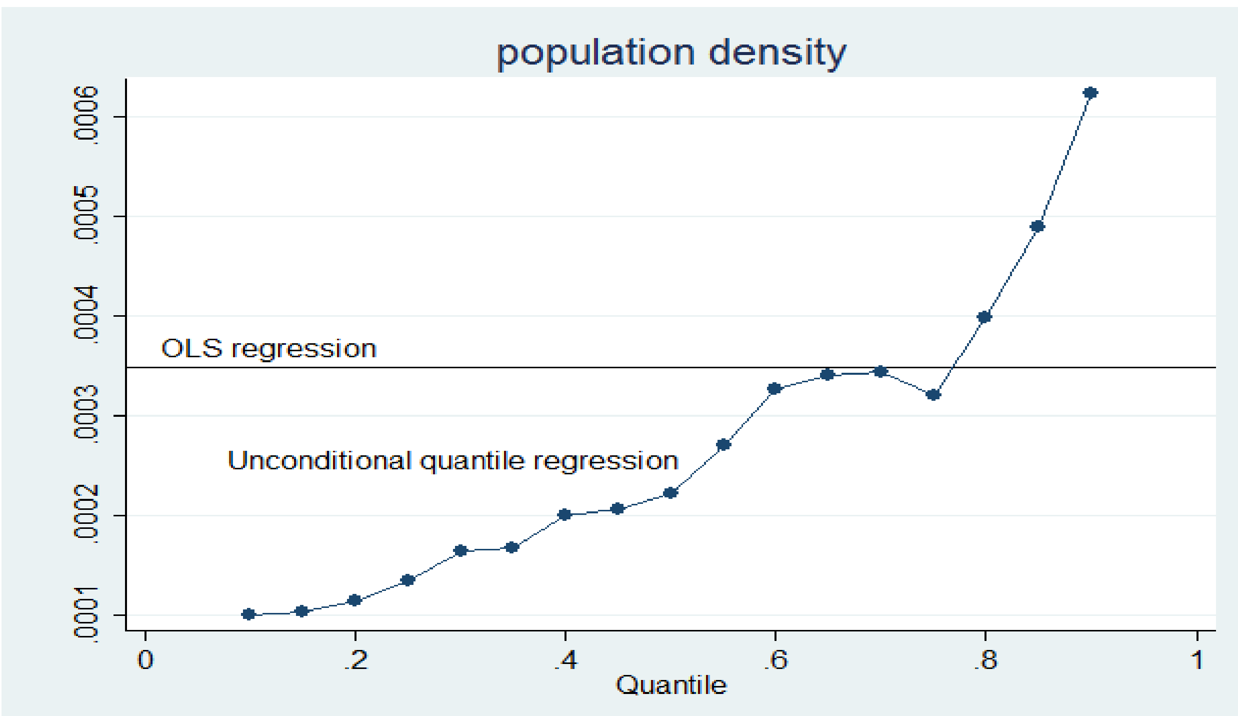


Figure 7.7 continued

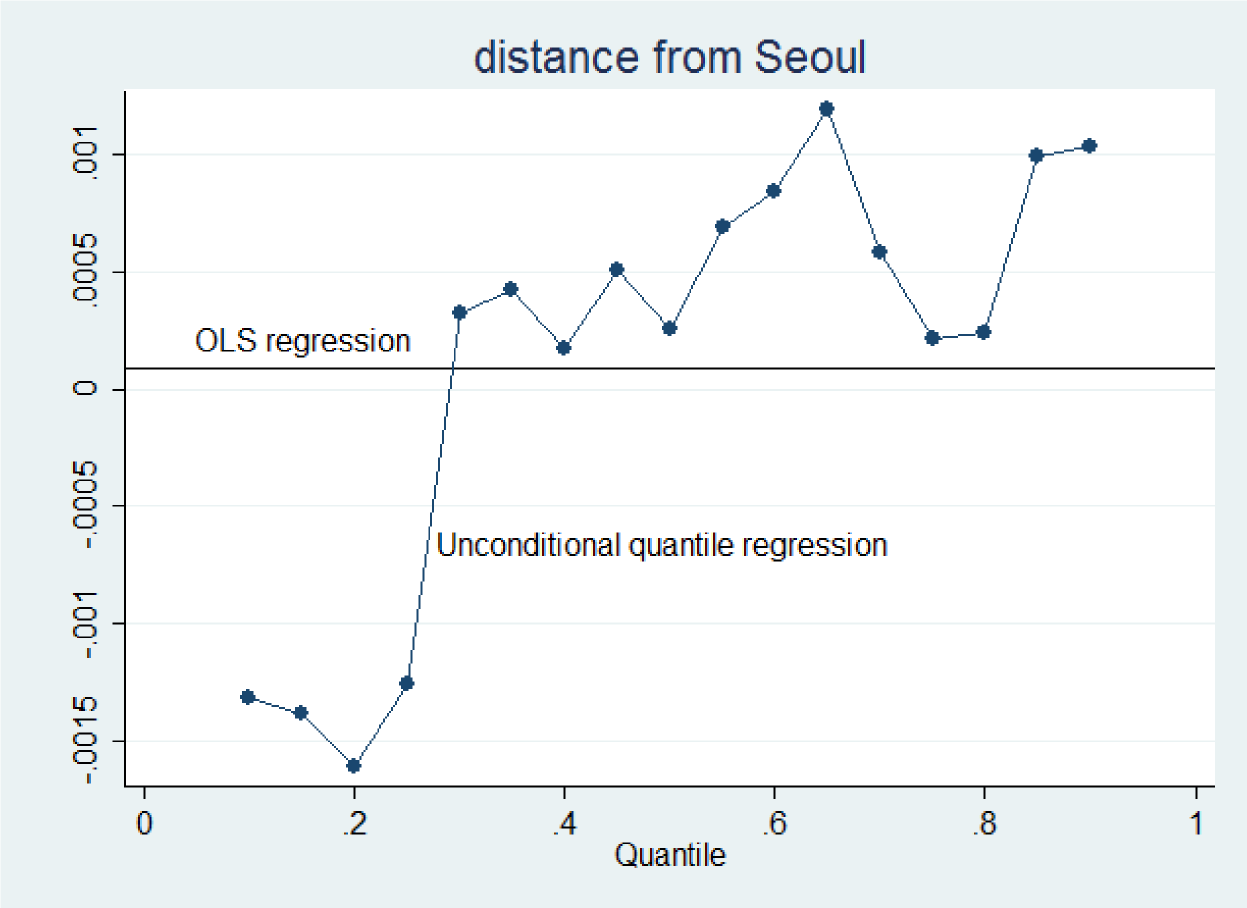


Figure 7.7 continued

7.3. Model 3: Farm Income, Off-Farm Income, and Government Subsidies

To develop Models 1 and 2, Model 3 estimates the impact of income from farm work and off-farm work, and government subsidies on farmland value. The estimated results are presented in Table 7.3. All income variables – farm income, off-farm income, and government subsidies – are positive and have a statistically significant effect on farmland value in the OLS and all quantiles. In the median quantile, results show that a 100% increase in farm income increases farmland value by about 6.6%. The results are consistent with Devadoss and Manchu (2007) and Livanis et al. (2006) who found that net farm income had a positive and significant effect on farmland value. In the median quantile, a 100% increase in off-farm income increases farmland value by about 12.4%. However, it is interesting to note that a 100% increase in government subsidy payments only increases farmland value by about 5.6% - about 1% lower than the impact of farming income.

These income variables have an even greater impact at the higher quantiles. For example, a 100% increase in farm income increases farmland value by about 9% in the 90th quantile. Similarly, a 100% increase in government subsidies increases farmland value by 10% in the 75th quantile and about 9% in the 90th quantile. However, in the case of off-farm income, a 100% increase in off-farm income increases farmland value significantly more: by 17% in the 75th quantile and 21% in the 90th quantile. This suggests that the unconditional quantile distribution of farmland value is enhanced by farm income, off-farm income, and government subsidies. In accordance with off-farm income and government subsidies, findings here are consistent with the literature on the capitalization of off-farm income and government subsidies to farmland values (Barnard et al., 1997; Sherrick and Barry, 2003; Goodwin et al., 2003; and Mishra and Moss, 2013). Specifically, Mishra and Moss (2013) pointed out that indirect and direct government payments can influence farm household income resources and change the farmland values. Off-farm income might be a proxy for other job opportunities. If farmers have high off-farm income, it follows that they have more off-farm opportunities and may live near urban areas which allows them to easily obtain off-farm work. On the other hand, higher farm household income due to off-farm work can lead farmers to invest in farm productivity or farm assets, such as farmland.

As a proxy for solvency, the debt-to-asset ratio was included in the model. Higher debt-to-asset ratio (normally over 70%) denotes high-risk farmers and low ability to pay the debt. The debt-to-asset ratio is negative and significant in all quantiles. This result is consistent with Devadoss and Manchu (2007) who found that the debt-to-asset ratio had a negative and significant

Table 7.3. Models of log total farmland value per hectare via OLS and unconditional quantile regression (Model 3)

Variables	OLS	10th quantile	25th quantile	50th quantile	75th quantile	90th quantile
Log(farm income)[23]	0.0732*** (0.00545)	0.0715*** (0.00708)	0.0435*** (0.00593)	0.0659*** (0.00698)	0.0963*** (0.00950)	0.0920*** (0.0142)
Log(off-farm income)[24]	0.142*** (0.00498)	0.0818*** (0.00676)	0.0899*** (0.00548)	0.124*** (0.00610)	0.165*** (0.00814)	0.209*** (0.0116)
Log(government subsidies)[25]	0.0773*** (0.00603)	0.0685*** (0.00753)	0.0460*** (0.00611)	0.0561*** (0.00743)	0.0955*** (0.0105)	0.0895*** (0.0151)
Debt to asset ratio	-0.415*** (0.0427)	-0.185* (0.0811)	-0.179** (0.0634)	-0.443*** (0.0584)	-0.615*** (0.0722)	-0.481*** (0.0861)
Fruit & vegetable farms	-0.0311 (0.0199)	-0.161*** (0.0319)	-0.0949*** (0.0267)	0.0456 (0.0284)	-0.0242 (0.0341)	0.0830* (0.0420)
Special crops & flower farms	-0.00203 (0.0394)	-0.273*** (0.0636)	-0.160** (0.0490)	0.00847 (0.0533)	0.0874 (0.0609)	0.460*** (0.0907)
Livestock farms	-0.152*** (0.0287)	-0.148** (0.0508)	-0.0769 (0.0405)	-0.0440 (0.0445)	-0.171** (0.0530)	-0.337*** (0.0586)
Other types farms	-0.0465 (0.0247)	-0.159*** (0.0358)	-0.0501 (0.0299)	0.0322 (0.0337)	0.0414 (0.0439)	0.0162 (0.0571)
Population density	0.0003*** (0.00002)	0.0001*** (0.00002)	0.00014*** (0.00002)	0.0002*** (0.00004)	0.00033*** (0.00004)	0.00062*** (0.00006)
Distance from Seoul	0.000156 (0.00024)	-0.00121** (0.00041)	-0.0013*** (0.00034)	0.000319 (0.000318)	0.000307 (0.000397)	0.00110 (0.000566)
Gangwon-do region	-0.899*** (0.0430)	-0.197*** (0.0481)	-0.193*** (0.0434)	-0.988*** (0.0579)	-1.843*** (0.0823)	-1.475*** (0.124)
Chungcheong-do region	-0.810*** (0.0378)	-0.0199 (0.0379)	-0.0278 (0.0359)	-0.827*** (0.0485)	-1.796*** (0.0745)	-1.552*** (0.117)

Robust standard errors in parentheses.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

[23] Unit of farm income is 1 million won per hectare.
[24] Unit of off-farm income is 1 million won per hectare.
[25] Unit of government subsidies is 1 million won per hectare.

(Table 7.3. continued)

Variables	OLS	10th quantile	25th quantile	50th quantile	75th quantile	90th quantile
Kyeongsang-do region	-1.006*** (0.0547)	-0.279*** (0.0810)	-0.341*** (0.0678)	-1.067*** (0.0708)	-1.693*** (0.0980)	-1.452*** (0.150)
Jeolla-do region	-1.450*** (0.0624)	-0.285*** (0.0857)	-0.782*** (0.0777)	-1.735*** (0.0813)	-2.313*** (0.110)	-1.863*** (0.167)
Jeju-do region	-0.569*** (0.107)	0.610*** (0.166)	0.598*** (0.141)	-0.636*** (0.144)	-1.199*** (0.189)	-1.630*** (0.269)
Year=2009	-0.0570* (0.0234)	-0.0438 (0.0348)	-0.0423 (0.0285)	-0.0521 (0.0327)	-0.0488 (0.0417)	-0.0867 (0.0536)
Year=2010	-0.0711** (0.0231)	-0.0397 (0.0349)	-0.0473 (0.0286)	-0.0875** (0.0326)	-0.0789 (0.0415)	-0.0734 (0.0539)
Year=2011	-0.0752** (0.0236)	-0.0799* (0.0356)	-0.0630* (0.0289)	-0.0939** (0.0327)	-0.0711 (0.0419)	-0.0710 (0.0543)
Year=2012	-0.00959 (0.0232)	0.0287 (0.0334)	-0.00224 (0.0283)	-0.0275 (0.0327)	-0.00223 (0.0421)	-0.0315 (0.0548)
Intercept	5.430*** (0.0397)	3.945*** (0.0425)	4.523*** (0.0392)	5.441*** (0.0504)	6.727*** (0.0790)	6.907*** (0.123)
N	12642	12642	12642	12642	12642	12642
adj. R^2	0.443	0.090	0.213	0.280	0.308	0.231

Robust standard errors in parentheses.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

effect on farmland value. They pointed out that if farmers have high debt-to-asset ratio, then they are more likely to lose farmland, and debt is negatively related to farmland values. However, in this study I investigate the impact of debt-to-asset ratio on the entire distribution of farmland values. Results show that a 1% increase in debt-to-asset ratio decreases farmland value by about

18% in the 25th quantile and 62% in the 75th quantile. Low solvency may lead farmers to purchase less farmland and borrow farmland for farm work instead.

Farm specialization variables were also included in the model as proxies of farm characteristics. The effects of farm specialized products on farmland values are diverse depending on the quantile. For example, in the lower quantiles - the 10th or 25th percentiles - fruit and vegetable, special crops, and other types of farm groups have significantly lower farmland values than the farmers specializing in crops (base group). However, in the higher quantile, 75th or 90th percentile, fruit and vegetable, special crops, and other types of farm groups have a positive effect on farmland value compared with the crop product groups. In Table 7.3, farmers specializing in livestock have lower farmland value compared to crop farmers. Specifically, livestock farms have lower farmland value, by about 15% in the 10th quantile and about 34% in the 90th quantile compared to crop product farms. These findings are consistent with the literature (Ready and Abdalla, 2005; Huang et al., 2006). Since livestock need spacious places for pasture, the unit price for pasture might be cheaper than for cropland.

Factors such as urbanization and population density could also influence farmland values. Population density represents urban pressure; higher population density means more people per hectare. Population density has a positive and significant effect on farmland values in South Korea. For example, a 1% increase of population density increases farmland values by 0.03% in the OLS model and about 0.06% in the 90th quantile. This result is consistent with Goodwin et al. (2003) who found a positive relationship between population density and farmland values. High population density means there will be a greater demand for living in that area; therefore the farmland value in a high population density area will be higher than in an isolated area.

As a proxy of accessibility, distance from the city can be used. In the model, as the distance from Seoul gets longer, farmland values decrease significantly at the 10th and 25th quantile. This result is consistent with Mishra and Moss (2013), who found that when a farm is located close to a metro area, farmland values rose significantly, and Livanis et al. (2006), who estimated and found a significant relationship between distance to urban centers (accessibility index) and farmland values.

Other regional factors that may affect farmland values such as demand for recreation or industrial complexes may affect farmland value, as well as the included six regional dummy variables in the model. The base regional dummy is the capital region. Results in Table 7.1 show that most regions have low farmland values compared to the capital region (base area) at all quantiles—except quantile 10^{th} and 25^{th} in the Chungcheong-do region. This result shows that compared to the capital region, farmland values are lower in other regions. Livanis et al. (2006) pointed out that most agriculture-based areas had lower farmland values. Similarly, Mishra and Moss (2013) found regional differences in farmland values. Year dummies are included to capture time trend effects on farmland values. Year 2008 was used as a base group. Mostly, farmland values during 2009 to 2012 are lower than farmland values in 2008 in the OLS model but the 2012 year dummy is not statistically significant. This result means that the decrease of farmland values in recent years may be due to demand for non-farm land usage such as housing or industrial complexes.

Since unconditional quantile regression uses a Recentered Influence Function with robust standard errors, the Wald test is not applicable. As an alternative, I show a graphical display to compare coefficients among the two models: OLS with robust standard errors and the unconditional quantile regression. The differences of coefficients among the models are represented in Figure 7.8. The X-axis is the quantile from 0 to 1 (or 100), the Y-axis is the corresponding coefficients, the horizontal solid line represents the OLS coefficient estimates, and the dotted line is for the unconditional quantile regression coefficient estimates. As we observe in the graphs (Figure 7.6), the distinction between the coefficients of the two estimates are considerable. The OLS model shows the one-point estimate according to the conditional mean distribution. However, unconditional quantile regression shows the different coefficient points based on each quantile. It provides significantly different estimates and additional information of the distribution.

The log of off-farm income under the median quantile is slightly lower than the OLS estimate; meanwhile, when off-farm income is over the median quantile, it is higher than the OLS values. This means the low farmland value group earns lower off-farm income than the higher farmland value group, showing a positive correlation between off-farm income and farmland value. Similarly, the coefficient of government subsidy payments has a greater difference based on the 65th quantile.

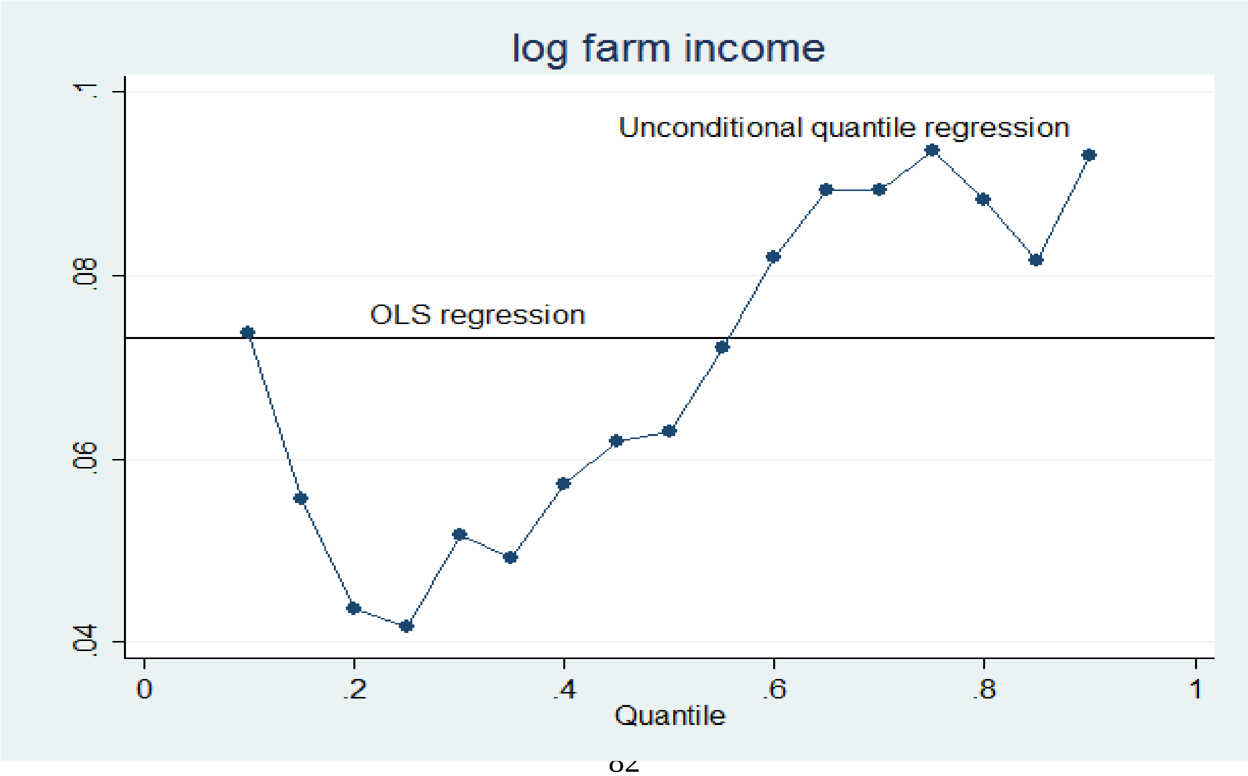
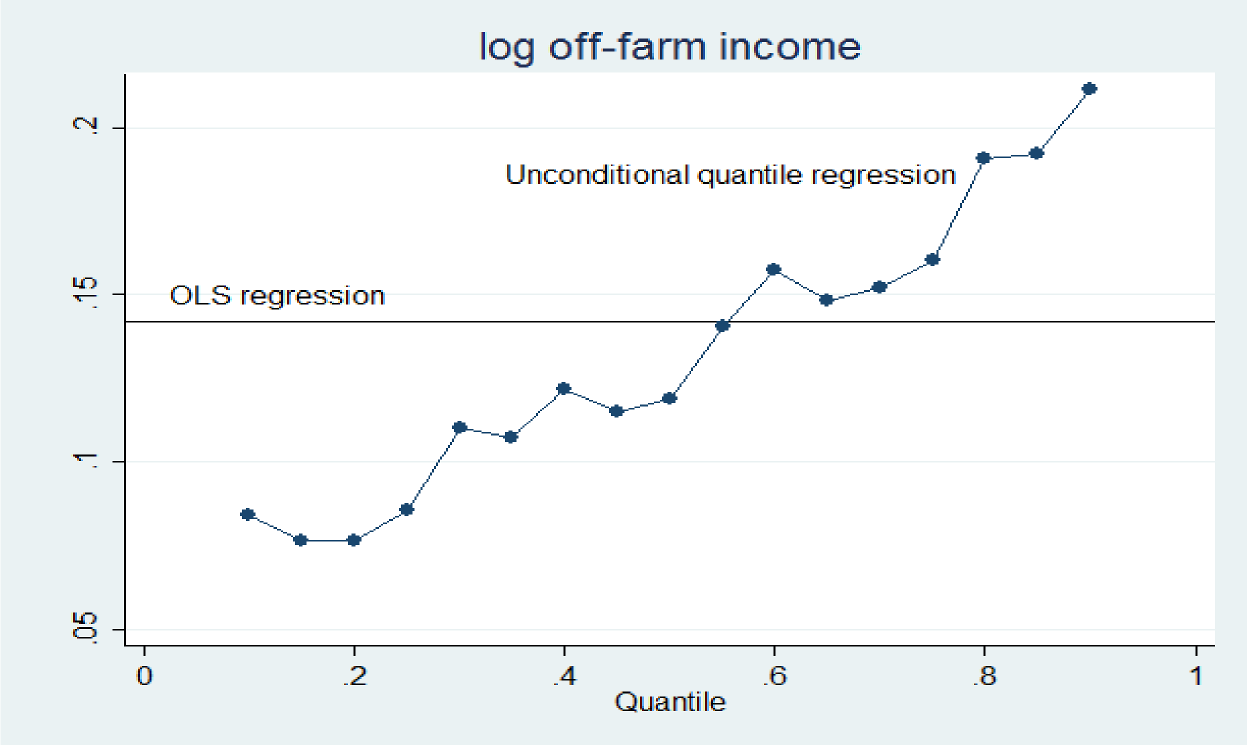


Figure 7.8. OLS and unconditional quantile regression coefficients for each regressor (Model 3)



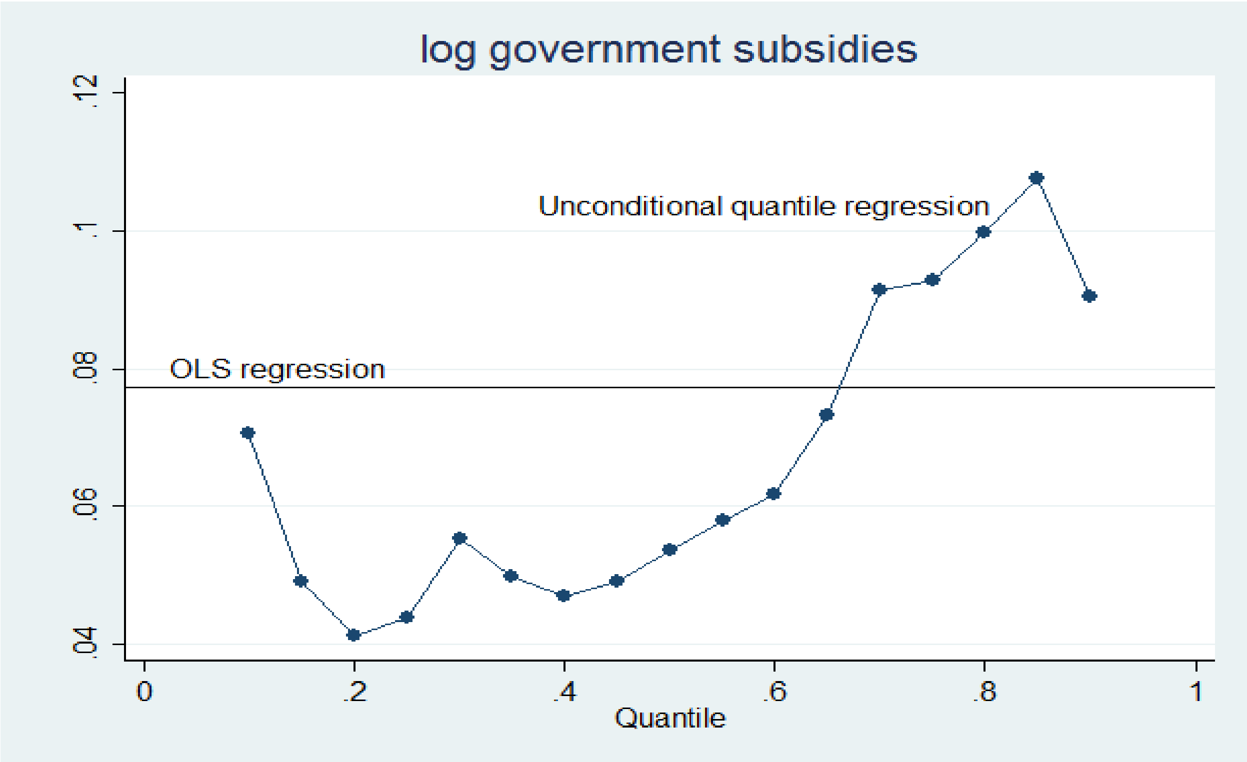
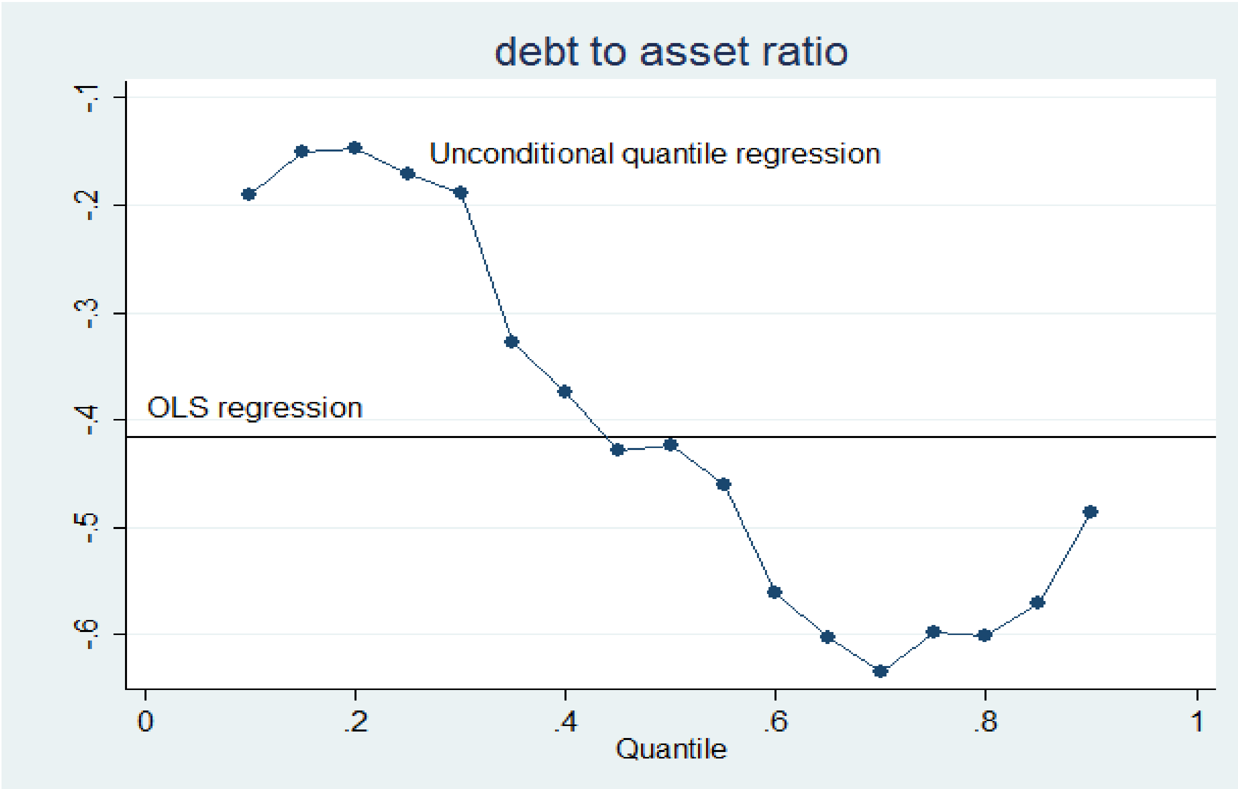


Figure 7.8 continued



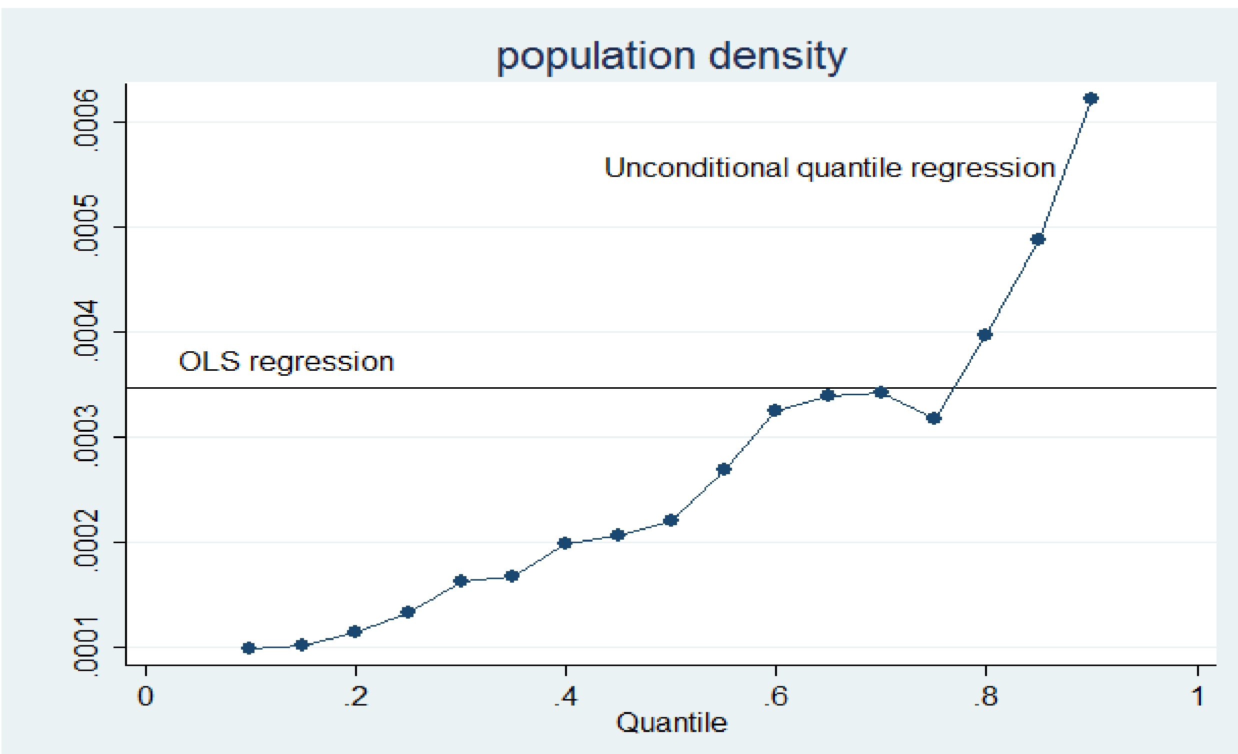


Figure 7.8 continued

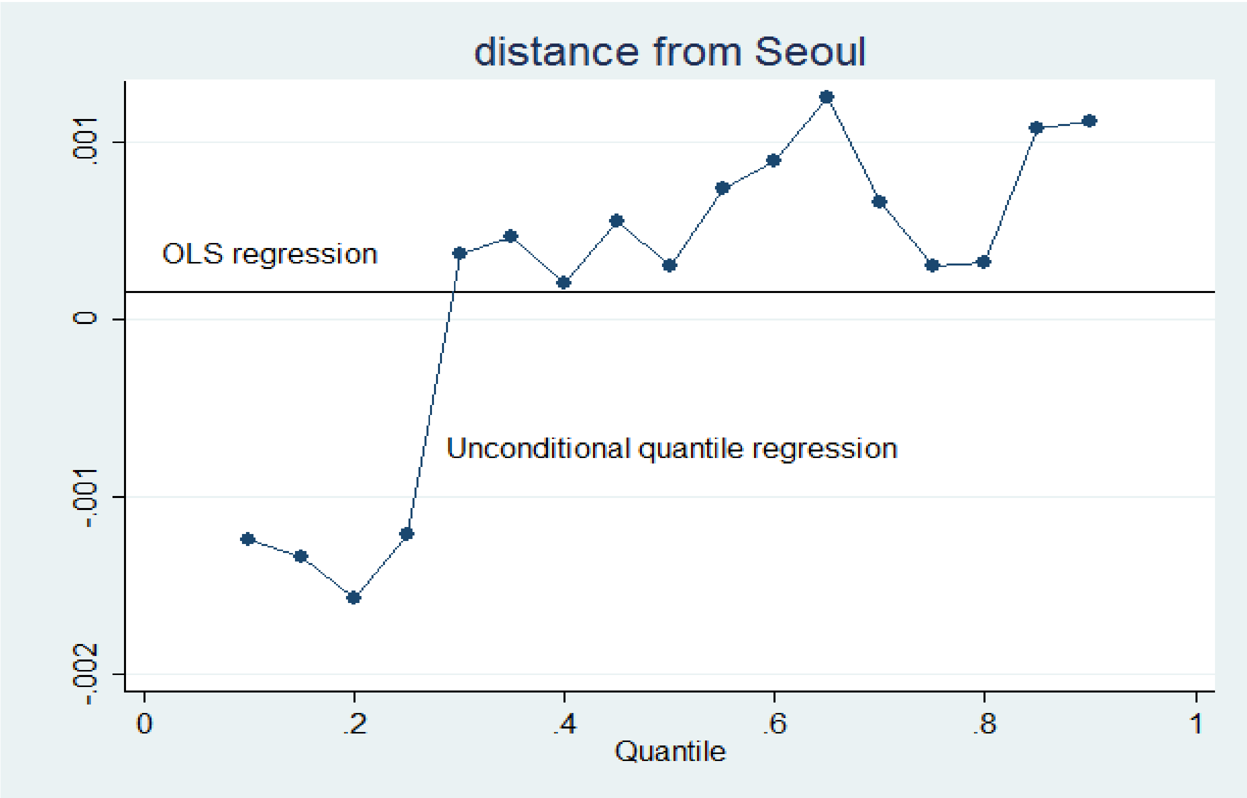


Figure 7.8 continued

CHAPTER 8: SUMMARY AND CONCLUSION

The goal of this dissertation was to study the impact of off-farm income and government subsidies on farmland values in South Korea. South Korea was mainly an agricultural country until 1970s. However, after industrialization, the Gross Domestic Product (GDP) of the agricultural sector was only 6% of the total GDP in 2013. To support the weakened agricultural sector, the South Korean government subsidized farm households and the farming industry through payments. Compared to other Organization for Economic Cooperation and Development (OECD) countries, South Korea is now known for providing high agricultural subsidies.[26] Although South Korean farmers rely heavily on government subsidies, off-farm work also plays an important role in increasing farm household income and the economic well-being of farm families. In fact, the share of off-farm income in the total farm household income is well over 50% and has been gradually increasing.

Clearly, off-farm income and government subsidy payments are the main sources of income for farm households, as they provide farm households with income security. Increased income from off-farm work or government subsidies can be capitalized in farm assets such as farmland. Farmland is the main farm asset, consisting of 80% of the total farm household assets. A plethora of literature has investigated the impact of off-farm income and government subsidies on farmland values. However, these studies are mainly concentrated in North America and West European countries. None have analyzed the issue in the context of South Korea.

[26] In 2013, the producer support estimate (PSE) of South Korea was 52.5%, and the average PSE of OECD countries was 18.2%.
(http://www.oecd.org/tad/agricultural- policies/producerandconsumersupportestimatesdatabase.htm)

Quantile regression is useful in dealing with outlier problems and to understand the distribution of the variable of interest (Cameron and Trivedi, 2010). Quantile regression uses conditional quantile functions and adopts the percentiles or quantiles of observations as a dependent variable instead of one point estimates. The method was developed by Koenker and Bassett (1978), and can be separated into conditional quantile and unconditional quantile regression. The conditional quantile model is easy to apply and commonly used; however, the estimated results are easily changed, in accordance with adding control variables in the model. To avoid this problem, the unconditional quantile method was introduced, and is used to examine variation on the marginal (unconditional) quantile distribution of the outcome variable according to covariate changes (Firpo, Fortin, and Lemieux, 2009). Since unconditional quantile regression is not influenced by the distinct variables, it is more generally interpreted. Therefore, this study used the unconditional quantile regression method to investigate the proposed objective.

Using the unconditional quantile regression, farm income, off-farm income, government subsidies, farm characteristics, and regional dummy variables were employed to assess their effects on farmland values. I found that off-farm income and government payments have positive and significant effects on farmland values; this effect is higher in the upper quantiles - the 75th and 90th quantile. For example, a 100% increase in off-farm income increased farmland values by 21% in the 90^{th} quantile, and a 100% increase in government subsidies increased farmland values by 10% in the 75^{th} quantile. This implies that the increased income from off-farm work and government subsidies have contributed to higher farmland values. When comparing off-farm income and government subsidies, off-farm income had a greater impact on improving farmland values. Increasing the off-farm income portion of farmland assets can contribute to higher farmland values. Government subsidy payments are also important for increasing farm household income. However, under free trade agreements, high government payments are discouraged and could result in penalties to the South Korean government.

In addition, other factors were considered in explaining farmland values. Higher debt-to-asset ratio (normally over 70%) denotes riskier farmers and lower ability to pay debt. The debt-to-asset ratio is negative and significant in all quantiles. For example, a 1% increase in debt-to-asset ratio decreases farmland values by 62% in the 75^{th} quantile.

Farm specialization variables were also included in the model as a proxy of farm characteristics. For example, in the lower quantile - 10th or 25th percentile - fruit and vegetable, special crops, and other types of farm groups have significantly lower farmland values than the farmers specializing in crops (base group). Farmers who specialize in livestock have lower farmland values compared to crop farmers. Specifically, livestock farms have lower farmland values by about 15% in the 10th quantile and about 34% in the 90th quantile compared to crop product farms. Factors such as urbanization and population density could also influence the farmland values. The population density, represents urban pressure, has a positive and significant effect on farmland values in South Korea. As a proxy of accessibility, distance from the city can be used. In the model, as the distance from Seoul increases, farmland values decrease significantly at the 10th and 25th quantile.

After analysis, a graph displayed a comparison of the coefficients among the two models: OLS with robust standard error and unconditional quantile regression. In the graph, the differences of coefficients among the model were represented, and the distinction between the coefficients of two estimates are considerable. The OLS model shows the one point estimate, according to conditional mean distribution. However, unconditional quantile regression shows the different coefficients' points, based on each quantile. Therefore, unconditional quantile regression provides significant estimates and abundant information of distribution.

This dissertation is, to my knowledge, the first study to estimate the impact of off-farm income and government payments of South Korean farm households. Recall, the agriculture in South Korea is heavily subsidized and consists of small farms, and entry into farming is highly restrictive. Results from this study can assist policymakers in many countries as they design agricultural policies to encourage growth in the non-farm economy. This study will be of use particularly in places like South Korea where there are severe limitations such as high cost of labor or lack of farmland both of which diminish the capacity of the overall agricultural sector. The higher price of farmland in South Korea increases production costs; however, over the long-term, it will have positive effects for farmers as they gain increased farm assets. With this in mind, the role of off-farm income could play an important role in improving farm assets and farm income; thus, the policy should be designed to encourage off-farm work for long-term farm household support programs.

REFERENCES

Abrevaya, J., & Dahl, C. M. (2008). The effects of birth inputs on birthweight: evidence from quantile estimation on panel data. *Journal of Business and Economic Statistics, 26,* 379–397.

Ahearn, M., El-Osta, H., & Dewbre, J. (2006). The impact of coupled and decoupled government subsidies on off-farm labor participation of U.S. farm operators. *American Journal of Agricultural Economics, 88(2),* 393-408.

Alston, J.M. (1986). Analysis of Growth of U.S. Farmland Prices. *American Journal of Agricultural Economics 68,* 1-9.

Awasthi, M. K. (2014). Socioeconomic determinants of farmland value in India. *Land Use Policy*, *39*, 78-83.

Barnard, C.H., Whittaker, G., Westenbarger, D., & Ahearn, M. (1997). Evidence of capitalization of direct government payments into U.S. cropland values. *American Journal of Agricultural Economics, 79(5),* 1642-1650.

Burt, O.R. (1986). Econometric Modelling of the Capitalization Formula for Farmland Prices. *American Journal of Agricultural Economics 68,* 10-26.

Cameron, A. C., & Trivedi, P. K. (2010). *Microeconometrics using STATA*. 2nd Edition. College Station, TX: Stata Press.

Canay, I. A. (2011). A simple approach to quantile regression for panel data. *Econometrics Journal, 14,* 368–386.

Chavas, J.P. and A. Thomas. (1999). A Dynamic Model of Land Prices. *American Journal of Agricultural Economics 81*, 772-84.

Chicoine, D.L. (1981). Farmland values at the urban fringe: an analysis of sale prices. *Land Economics, 57(3),* 353-362.

Devadoss, S. & Manchu, V. (2007). A comprehensive analysis of farmland value determination: A county-level analysis. *Applied Economics, 39(18),* 2323–2330.

El-Osta, H., Mishra, A., & Morehart, M. (2008). Off-farm labor allocation decisions of married farm couples and the role of government payments. *Review of Agricultural Economics, 30(2),* 1-22.

Falk, B. (1991). Formally Testing the Present Value Model of Farmland Prices. *American Journal of Agricultural Economics 73,* 1-10.

Firpo, S., Fortin, N. M., & Lemieux, T. (2009). Unconditional quantile regressions. *Econometrica, 77(3),* 953-973.

Frölich, M. & Melly, B. (2010). Estimation of quantile treatment effects with Stata. *The Stata Journal, 3,* 423-457.

Gardner, B.L. (1987). *The Economics of Agricultural Policies.* NY: Macmillan.

Goodwin, B. K., & Mishra, A. K. (2003). Acreage effects of decoupled programs at the extensive margin. Presented at AAEA Annual meeting, July 27-30, Montreal, Canada.

Goodwin, B. K. & Mishra, A. K., (2006). Are 'decoupled' farm program payments really decoupled? An empirical evaluation. *American Journal of Agricultural Economics, 88(1)*, 73-89.

Goodwin, B. K., Mishra, A. K., and F. Ortalo-Magné (2003). "What's wrong with our models of agricultural land values?", *American Journal of Agricultural Economics, Vol. 85(3),* 744-752.

Greene, W. H. (2011). *Econometric analysis, 7/E*. NY: Prentice Hall.

Hong, S. Y., Minasny, B., Zhang, Y. S., Kim, Y.H., & Jung, K.H. (2011). Digital soil mapping using kegacy soil data in Korea. 2010 19th World Congress of Soil Science, Soil Solutions for a Changing World, 1 – 6 August 2010, Brisbane, Australia. Published on DVD.

Hopkins, J. and M.J. Morehart. (2000). An Empirical Analysis of the Farm Problem: Comparability in Rates of Return. Selected Paper for Challenging the Agricultural Economics Paradigm. A Symposium Honoring the Career of Luther Tweeten. Columbus, Ohio.

Huang, H., Miller, G. Y., Sherrick, B. J., and Gómez, M. I. (2006). Factors influencing Illinois farmland values. *American Journal of Agricultural Economic, 88(2),* 458-470.

Kim, H. and Lee, Y. (2003). Agricultural policy reform and structural adjustment: Historical evidence from Korean experience. Policy Reform and Adjustment Workshop, Imperial College London, Wye Campus from International Agricultural Policy Reform and Adjustment Project (IAPRAP).

Koenker, R. (2005). *Quantile Regression*. Cambridge: UP.

Koenker, Roger and gilbert Bassett. (1978). Regression Quantiles. *Econometrica. 46(1),* 33-50.

Koenker, R. and K. Hallock. (2001). Quantile Regression, *Journal of Economic Perspectives, 15,* 143-156.

Korean Statistics Department. (2014). 2013 Farm household economy survey report. (KREI Weekly agriculture & rural village trend. 2013.11.25. vol.46). Korea: Korean Statistics Department.

Kost, W.E. (1968). Rates of Return for Farm Real Estate and Common Stocks. *American Journal of Agricultural Economics 50,* 213-244.

Lee, T., Lim, J., Ahn, D., et. al. (2011). The Research on Interim Evaluation of the Agricultural Policies of Current Korea Administration and Reform Project. Agricultural Economics Association (Written in Korean).

Lence, S.H. and D.J. Miller. (1999). Transaction Costs and the Present Value Model of Farmland: Iowa, 1900-1994. *American Journal of Agricultural Economics 81*, 257-72.

Livanis, G., C. Moss, Breneman, V., & Nehring, R. (2006). Urban sprawl and farmland prices. *American Journal of Agricultural Economics, 88(4)*, 915–929.

Melichar, E. (1979). Capital Gains versus Current Income in the Farming Sector. *American Journal of Agricultural Economics 61*, 1086-1106.

Miranowski, J.A. and Hammes, B.D. (1984). Implicit prices of soil characteristics of farmland in Iowa. *American Journal of Agricultural Economics, 66,* 745-749.

Mishra, A. K., & Goodwin, B. K. (1997). Farm income variability and the supply of off-farm labor. *American Journal of Agricultural Economics, 79(3),* 880-887.

Mishra, A. K., & Moss, C. B. (2013). Modeling the effect of off-farm income on farmland values: A quantile regression approach. *Economic Modelling, 32,* 361-368.

Moss, C.B. (1997). Returns, Interest Rates, and Inflation: How They Explain Changes in Farmland Values. *American Journal of Agricultural Economics 79,* 1311-18.

Moss, C. B., K. Erickson, and L. Perruso. (1999). Spatial Information in Farmland Values: An Entropy Approach. Paper presented at the American Agricultural Economics Annual Meetings, Nashville, TN.

Moss, C. B., Shonkwiler, J.S., & Schmitz, A. (2003). The certainty equivalence of farmland values: 1910 to 2000. In C. B. Moss & A. Schmitz, eds. *Government policy and farmland markets: The maintenance of farmer wealth*. Iowa State: UP.

Offutt, S. (2003). The significance of the value of farmland. In C. B. Moss & A. Schmitz, eds. *Government policy and farmland markets: The maintenance of farmer wealth*. Iowa State: UP.

Oh, N., & Kim, U. (2001). Off-farm income policy and future policy direction. *Agricultural Economics, 24(2).* (Written in Korean).

Palmquist, R. & Danielson, L. (1989). A hedonic study of the effects of erosion control and drainage on farmland values. *American Journal of Agricultural Economics, 71,* 55-62.

Park, S. J., Park, J. K., Song, J.H., Chae, G. S., & Moon, H. P. (2011). A study on reform of agricultural subsidy. *Korea Rural Economic Institute*, P140.

Phipps, T. T. (1984). Land Prices and Farm-Based Returns. *American Journal of Agricultural Economics 66*, 422-429.

Powell, D. (2013). A new framework for estimation of quantile treatment effects: Nonseparable disturbance in the presence of covariates. Working paper, *LAND Labor & Population,*WR824-1.

Powell, D. (2014). Did the Economic Stimulus Payments of 2008 reduce labor supply? Evidence from quantile panel data estimation. *Working Paper, LAND Labor & Population*.

Ready, R.C., C.W. Abdalla. (2005) The amenity and disamenity impacts of agriculture: estimates from a Hedonic Pricing Model. *American Journal of Agricultural Economics 87,* 314-326.

Schmitz, A. (1995). Boom/Bust Cycles and Ricardian Rents. *American Journal of Agricultural Economics 77,* 1110-25.

Schmitz, A., and C.B. Moss. (1996). Aggregate Evidence of Boom/Bust Cycle in Domestic Agriculture. University of Florida, Food and Resource Economics Department, Applied Economics Working Paper AEWP 96-1.

Schmitz, A. & and Just, R. E. (2003). The economics and politics of farmland values. In C. B. Moss & A. Schmitz, eds. *Government policy and farmland markets: The maintenance of farmer wealth*. Iowa State: UP.

Shalit, H., and A. Schmitz. (1982). Farmland Accumulation and Prices. *American Journal of Agricultural Economics 81,* 710-19.

Sherick, B. J. & Barry, P. J. (2003). Farmland markets: Historical perspectives and contemporary issues. In C. B. Moss & A. Schmitz, eds. *Government policy and farmland markets: The maintenance of farmer wealth*. Iowa State: UP.

Tegene, A. and F.R. Kuchler. (1991). A Description of Farmland Investor Expectations. *Journal of Real Estate Finance and Economics 4,* 283-96.

U.S. Department of Agriculture (USDA). (2001). Economic Research Service (ERS). Agricultural outlook in 2001 report. Washington D.C.: GPO.

U.S. Department of Agriculture (USDA). (2005). Balance sheet information http://www.ers.usda.gov/Data/farmbalancesheet/fbsdmu.htm.

Weersink, A., Clark, S., Turvey, C.G., & Sarker, R. (1999). The effect of agricultural policy on farmland values. *Land Economics, 75,* 425-439.

Xu, Feng, Ron C. Mittelhammer, and Pual W. Barkely. (1993). Measuring the contributions of sit characteristics to the value of agricultural land. *Land Economics, 69,* 356-369.

APPENDIX

Appendix 1. Arable land and arable land utilization by regions

Regions	Type	Utilized arable land(ha)[27]	Rice (%)	Barley (%)	Mixed grains (%)	Pulses (%)	Root & tuber crops (%)	Vegetable & fruit trees (%)	Special & medicinal, and other crops(%)
Total	Total	1,711,436	48.1	1.9	1.6	5.6	2.8	21.7	11.2
	Rice paddy	963,876	85.4	2.9	0.2	1.2	0.3	3.8	6.3
	Field	747,560	0.9	0.6	3.5	11.0	5.9	44.5	17.4
Seoul	Total	629	30.9	-	0.4	4.1	4.3	12.7	3.6
	Rice paddy	186	83.2	-	-	1.3	1.0	-	-
	Field	443	0.2	-	0.6	5.7	6.3	19.7	5.1
Busan	Total	6,415	47.0	-	1.4	1.1	2.6	27.0	2.3
	Rice paddy	3,859	72.3	-	0.5	0.4	0.1	11.9	0.4
	Field	2,557	2.4	-	2.8	2.4	7.0	53.4	5.3
Daegue	Total	8,825	34.5	4.4	0.7	3.3	3.0	27.9	5.0
	Rice paddy	4,499	67.0	8.7	0.1	1.2	1.4	12.8	2.5
	Field	4,326	2.4	0.3	1.3	5.3	4.4	42.9	7.4
Incheon	Total	20,042	56.9	0.7	0.3	2.6	5.5	12.1	4.4
	Rice paddy	13,586	85.9	0.9	-	0.3	0.4	-	1.3
	Field	6,456	0.8	0.3	0.8	7.1	15.2	33.9	10.6

Source: Korean statistics (http://www.kosis.kr).

[27] Utilization rate might be greater than 100 because cultivated area includes multiple seasoned farming.

(Appendix 1. continued)

Regions	Type	Utilized arable land(ha)[28]	Rice (%)	Barley (%)	Mixed grains (%)	Pulses (%)	Root & tuber crops (%)	Vegetable & fruit trees (%)	Special & medicinal, and other crops(%)
Gwangju	Total	10,628	51.2	6.2	0.8	2.7	1.8	17.1	7.5
	Rice paddy	6,958	78.9	9.2	0.3	0.5	0.3	6.1	2.4
	Field	3,671	1.4	0.7	1.6	6.6	4.3	36.9	16.9
Daejeon	Total	4,616	29.0	-	0.6	3.7	3.3	21.0	8.6
	Rice paddy	1,837	71.0	-	-	1.6	0.1	4.6	1.3
	Field	2,779	0.6	-	1.0	5.1	5.5	32.2	13.6
Ulsan	Total	11,441	48.7	0.1	0.8	2.2	1.9	21.2	9.6
	Rice paddy	6,887	81.9	-	0.1	0.5	0.2	3.8	8.9
	Field	4,554	0.2	0.1	2.0	4.7	4.4	46.7	10.8
Kyeonggi -do	Total	176,857	48.7	0.1	1.0	4.8	3.1	12.6	10.0
	Rice paddy	98,873	89.1	0.1	-	0.7	0.2	0.7	1.0
	Field	77,985	0.9	0.2	2.1	9.5	6.7	26.8	20.8
Gangwon -do	Total	110,378	30.3	0.1	7.1	8.1	6.1	22.5	14.6
	Rice paddy	41,701	81.5	0.2	0.8	2.0	0.2	1.6	3.3
	Field	68,677	0.4	0.1	10.7	11.6	9.5	34.8	21.3
Chungcheongbuk-do	Total	114,530	36.4	0.1	4.3	10.2	3.1	22.6	14.5
	Rice paddy	48,062	86.1	-	0.8	1.9	0.2	1.0	3.0
	Field	66,468	0.5	0.1	6.7	16.3	5.3	38.1	22.9

Source: Korean statistics (http://www.kosis.kr).

[28] Utilization rate might be greater than 100 because cultivated area includes multiple seasoned farming.

(Appendix 1. continued)

Regions	Type	Utilized arable land(ha)[29]	Rice (%)	Barley (%)	Mixed grains (%)	Pulses (%)	Root & tuber crops (%)	Vegetable & fruit trees (%)	Special & medicinal, and other crops(%)
Chungcheonnam-do	Total	234,945	64.7	0.1	0.3	3.9	2.5	10.3	8.0
	Rice paddy	165,120	90.1	0.1	-	0.5	0.1	0.6	1.4
	Field	69,825	1.8	0.1	1.0	12.2	8.5	34.4	24.2
Jeollabuk-do	Total	204,592	61.5	6.2	0.6	3.5	2.4	12.2	15.2
	Rice paddy	141,873	88.5	8.6	0.1	1.3	0.3	1.8	12.1
	Field	62,719	1.6	0.9	1.8	8.4	7.2	35.4	22.1
Jeollanam-do	Total	308,220	55.2	3.5	1.1	5.8	2.3	23.1	12.9
	Rice paddy	191,893	88.5	4.4	0.1	0.7	0.2	3.2	10.5
	Field	116,327	1.6	1.9	2.6	14.0	5.9	55.2	16.8
Kyeonsangbuk-do	Total	279,484	38.5	0.4	0.9	6.2	2.2	30.8	8.6
	Rice paddy	140,500	77.1	0.6	0.2	2.4	0.6	7.2	4.3
	Field	138,984	0.5	0.1	1.6	10.1	3.7	53.9	13.0
Kyeongsangnam-do	Total	156,978	48.6	3.5	0.7	4.3	2.2	26.8	10.7
	Rice paddy	98,010	79.2	5.6	0.2	1.8	1.0	13.6	10.4
	Field	58,968	0.5	0.3	1.4	8.1	4.0	47.6	11.0
Jeju-do	Total	62,856	0.5	1.7	6.7	9.9	3.2	63.1	10.7
	Rice paddy	32	33.3	-	-	-	-	-	-
	Field	62,823	0.5	1.7	6.7	9.9	3.2	63.2	10.7

Source: Korean statistics (http://www.kosis.kr).

[29] Utilization rate might be greater than 100 because cultivated area includes multiple seasoned farming.

VITA

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