ESSAYS ON LAND PROPERTY RIGHTS IN CAMBODIA: EMPIRICAL ANALYSIS

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ABSTRACT

This dissertation consists of four chapters on land rights in Cambodia. The first chapter focuses on historical background of land rights in Cambodia. *De jure* private property rights in land were first established in 1863. The civil wars of the 1970s led to an abolition of land property rights and it was again reintroduced in 1989 in which households could register their plots through sporadic land registration. The combination of a poorly functioning land registry system and rising demand for arable land led to a sharp increase in conflicts over land rights in the 1990s. To address these problems, the Cambodian government carried out a series of land policy reforms in the 1990s and introduced a systematic land registration in 2002 to speed up land registration in the country. The second chapter empirically estimates the effect of land property rights on investment in land by farm households in Cambodia using the 2003-2004 Cambodia Socio-Economic Survey (CSES). In this chapter, I use matching regression techniques, in particular Propensity Score Matching (PSM), to account for selection effects in household participation in land titling program. The empirical analysis indicates a positive link between *de jure* land rights and land investment. The third chapter estimates the effect of *de jure* land rights on household consumption. Instrumental variable techniques are used to account for endogeneity of *de jure* land rights. The results show that the choice to obtain *de jure* land rights results in a statistically significant increase in household consumption. The fourth chapter explores the relationship between *de jure* land rights and child health in households of land owners in Cambodia. The 2003-2004 CSES which is used to estimate this effect contains information of 8,745 children ages

below 6 years old. The findings show that children of titled parcels have higher height-

for-age z-scores than children of untitled parcels.

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This chapter describes the historical background of land rights in Cambodia from the French colonial period until the present. Cambodia has changed its political regime many times since gaining independence from the French in 1953. There have been at least five different property rights regimes counting from the colonial period until the present, leading to contemporary confusion over land rights. The modern concept of land holding did not exist until the arrival of the French in 1863. A system of land registration was established by the French and continued after the country gained independence from France in 1953. The civil wars of the 1960s and 1970s and the emergence of the communist Khmer Rouge as the governing authority for certain parts of the country from the late 1960s until the late 1990s and for the entire country from 1975 to 1979 generally involved a collectivization of land and abolition of individual property rights. The People's Republic of Kampuchea (PRK), which succeeded the Khmer Rouge following Vietnam's invasion of Cambodia in 1978, retained collectivization, while reintroducing some limited private rights to land but initially not land ownership. This relaxed form of collectivization slowly gave way in the 1980s to *de facto* private property rights, which became formalized in a 1989 reform in which households could register possession for agricultural land and ownership for their residential plots through sporadic land registration. The combination of a poorly functioning land registry system and rising demand for arable land in an expanding economy led to a sharp increase in conflicts over

land rights in the 1990s. In an attempt to address these problems, the Cambodian government carried out a series of land policy reforms in the 1990s, culminating in the adoption of a new land law in 2001 and the implementation of systematic land registration (SLR) operated under a western-donor-assisted land management and administration project (LMAP) starting in 2002 and still continuing. The government's long-term goal is to register all Cambodian lands, and to enforce recording of their transfer on its official registry in order to maintain records of land holders for tax collection purposes and to facilitate land market transactions.

Chapter Two: Land rights and investment in land

This chapter empirically estimates the effect of land rights on land investment by farm households in both urban and rural areas in Cambodia after the reform in 1989. The mix of farm households having different land rights raises the possibility of estimating the effects of land reform on investments made by farm households in both titled and un-titled farm lands. The 2003-2004 Cambodia Socio-Economic Survey (CSES) includes information on household land investment and the legal status of a household's farmlands, thereby facilitating analysis of this relationship. In this chapter, I use matching regression techniques, in particular Propensity Score Matching (PSM), to account for selection effects in household participation in Cambodia's program to convert *de facto* land claims into formal *de jure* land rights supported by a national land registry. The empirical analysis indicates a positive link between *de jure* land rights and land investment. Investment on titled farms is higher than on untitled farms. The findings of

this study provide additional support for there being a link between formal land rights and positive agricultural outcomes in low-income environments.

Chapter Three: Property rights in land and household consumption

This Chapter empirically estimates the impact of *de jure* land rights on household well-being, which is measured by household consumption. Previous microeconomic studies have posited that *de jure* land rights reform in developing countries had the potential to reduce poverty and enhance economic growth. *De jure* enforcement and titling of arable lands are often posited as factors that facilitate low-income households climbing out of poverty by allowing land holdings to serve as collateral for loans to improve farm productivity and to smooth consumption expenditures of farm households. This Chapter utilizes data from the 2003-2004 CSES to explore the link between *de jure* land rights and household consumption. The finding from this study provides new evidence on the impact of formalizing land rights in low-income countries, a topic which has not been widely studied yet. The Chapter's empirical analysis uses three different measures of *de jure* land rights: the households that possess land plots with land titles, land titles or application receipts, and just application receipts. Instrumental variable techniques are used to account for endogeneity of *de jure* land rights. The empirical estimations show that the choice to obtain *de jure* land rights results in a statistically significant increase in household consumption in regression estimates that do not account for endogeneity of *de jure* rights. The impact becomes larger when the regression includes instruments for *de jure* land rights.

Chapter Four: The impact of property rights in land on child health

This chapter explores the relationship between *de jure* land rights and child health in households of land owners in urban and rural areas in Cambodia. There are currently few studies that focus on how the establishment of land rights affects children's health. Galiani and Schargrodsky (2003, 2004) argued that land titles could have positive indirect impacts on child health because they lead to more investment in housing and household structures. Vogl (2007) asserted that the positive effect of land rights in urban areas of Peru on child nutrition might come from increases in labor force participation, housing investment, and credit access. This study maintains that the effect of land rights on child health could take place via other channels, such as the increase in household consumption, land investment, and housing investment. This study estimates this relationship for a sample of households drawn from the 2003-2004 Cambodia Socio-Economic Survey (CSES) that includes information on 8,745 children ages 0-5. Weight-for-height and height-for-age are used as measures for children's health. Three different measures of *de jure* land rights are utilized in this analysis: the household that possesses land plot with land title, land title or application receipt, and just an application receipt. The analysis uses instrumental variable regression techniques to account for the selection effects in a household's decision to participate in a land titling program to convert *de facto* land claims into formal *de jure* land rights. The results from this analysis show that children of titled parcels have higher height-for-age *z*-scores than children of untitled parcels but there are no statistically significant differences in weight-for-height *z*-scores outcomes in a regression with instrumentation of land rights.

CHAPTER ONE

LAND RIGHTS IN CAMBODIA

1.1 Introduction

Cambodia has changed its political regime many times since gaining independence from the French in 1953. There have been at least five different property rights regimes counting from the colonial period until the present, leading to contemporary confusion over land rights. The modern concept of land holding did not exist until the arrival of the French in 1863. With colonization came a modern bureaucracy that established and administered a system of land registration allowing an individual to claim property rights to a land parcel, a right that was formerly the exclusive domain of the king (So, 2009; Hartman, 2006; Chan & Sarthi, 2002; Sik, 2000).

A system of land registration was established by the French and continued after the country gained independence from France in 1953. The civil wars of the 1960s and 1970s and the emergence of the communist Khmer Rouge as the governing authority for certain parts of the country from the late 1960s until the late 1990s and for the entire country from 1975 to 1979 generally involved a collectivization of land and abolition of individual property rights. The People's Republic of Kampuchea (PRK), which succeeded the Khmer Rouge following Vietnam's invasion of Cambodia, retained collectivization, while reintroducing some private rights to land. Households were allowed to farm on either collective land or individually held plots within the collective (So, 2009; Chan, Tep, & Sarthi, 2001; Sik, 2000). This relaxed form of collectivization slowly gave way in the 1980s to *de facto* private property rights, which became

formalized in a 1989 reform in which households could register their plots through sporadic land registration. The transition from collective land holding to household claims on land through occupation (*de facto rights)* to *de jure* property rights in 1989 with a weak cadastral managerial system led to problems of tenure security for uneducated and poor households who were not integrated into the new land registration system (So, 2009). Registration of land ownership was costly and inaccessible to most cultivators with *de facto* rights. As a result, only a small proportion of households who applied for land ownership title in 1989 and the 1990s actually received land titles. The majority of landholders initiated the land registration process by filing an application but did not follow through with land registration. They obtained only application receipts from cadastral officers (So, 2009; Chan & Sarthi, 2002).

The combination of general lawlessness, a poorly functioning land registry system and rising demand for arable land in an expanding economy led to a sharp increase in conflicts over land rights in the 1990s. In an attempt to address these problems, the Cambodian government carried out a series of land policy reforms, culminating in the adoption of a new land law in 2001 and the implementation of systematic land registration (SLR) operated under a land management and administration project (LMAP) starting in 2002 (World Bank, 2002). Under a 2001 land law, a land holder can obtain title through either a revised sporadic land registration (known as non-mandatory registration) or systematic land registration (SLR, also known as mandatory land registration). The government's long-term goal is to register all Cambodian lands, and to enforce their transfer through its registry in order to maintain records of land holders for tax collection purposes and to facilitate land market transactions (So, 2009).

1.2 The French colonial period (1863-1953)

Prior to the French colonial period, all land belonged to the king. The king allowed his people to cultivate his land. Practically, each plot of land belonged to the person who tilled it. Since the population was still small, people could move freely from one place to another and assume *de facto* ownership of unoccupied land (Chan & Sarthi, 2002; Sik, 2000; Greve, 1993).[1] Hartman (2006) concludes that pre-1863 land rights were essentially usufruct rights where land holders had rights to use land and pass it to heirs as long as they continued to keep it in production. With low population densities and growth, there was no need to regulate land rights. Thus, there were no cadastral documents that recorded information on land ownership. Rights were established by local acceptance rather than formal systems. Governing authorities also did not rely upon precise specification of land rights as taxes were imposed on harvests rather than on the quantity or value of the land (So, 2009; Thion, 1993).

De jure private property rights to land were first introduced in 1863 when the country became a French colony. The French government imposed a formal system of private property rights in order to tighten its control over the country, to collect taxes, to advance and protect French business interests, and to sell unoccupied lands for large-scale plantation projects (So, 2009; Thion, 1993). Lands were categorized as "crown land, public land, reserved land, and alienable land". Ordinary people were only entitled to hold alienable land.[2] Vacant lands could be settled but settlers were restricted to claim what they could use (Cooper, 2002, p.15).

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[1] Chandler (1993) estimated that the population of Cambodia was less than one million people in the middle of the nineteenth century.
[2] Alienability was not previously a feature of Cambodian land rights.

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To proceed with land registration, the government created land governance bodies to administer land registration and to oversee the production and maintenance of a land book, i.e., a land database. The Department of Cadastre, which was later changed to Department of Cadastre and Topography in 1908, was established in 1896. The government also began to form a commune committee in 1908 to facilitate the process of creating a land book. In establishing the land book, the commune chief took an important role in the process vis-à-vis the people in his commune by certifying the land owner and identifying the location of the land (Lim, 1997).[3]

After the implementation of the land registration, there were few changes between 1884 and 1920. The land registration system did not work particularly well during this time due to resistance to registration by the elite and village peasants and to weak land governance institutions. The Cambodian elite simply disagreed with this new land law. The elimination of slavery and establishment of individual land property rights outraged the elites whose interests depended on traditional arrangements of labor exploitation and taxation of harvests. They also felt insecure because their positions were changed from exploiting the people to being paid civil servants of the French colonial regime. Further, the new land laws changed the basis of taxation from the harvest to the quantity of their land, and village peasants realized few if any public benefits from their tax payments. The amount of tax paid was estimated to be around 30 percent of the value of the peasant's annual crop; French administrators made little investment in infrastructure or social development with the revenues (So, 2009; Chandler, 1993).

Despite some resistance, the implementation of land registration continued with the adoption of the civil code in 1920 and the Fixed Asset Declaration (FAD) in 1925.

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[3] Lim Voan was the director of the national land title department during the 1990s.

The civil code of 1920 recognized both possession and ownership land rights. A land holder could file for a possession land right through fixed asset registration. The commune authority was obligated to send the fixed asset registration to the district land office and leave a copy for landholders. This land holders' copy of fixed asset registration was recognized as a possession right. The formal ownership title could be issued to a land holder only after the FAD was registered in the land book at the district land office. The registration of FAD in the land book required a land survey and a legalization process involving identification of the land owner (So, 2009; Lim, 1997).[4]

There were different procedures in transferring land with possession rights and ownership rights. The transfer of land with possession rights occurred at the commune office, whereas the transfer of land with ownership rights required a written property transfer form and was registered at the district land office (So, 2009). The possession status given under the 1920 civil code was equivalent to ownership in terms of rights that except the possession status was forfeited when the land was left unused for a number of years. This did not include the case where lands were left fallow (Cooper, 2002).

By 1930 most rice growing plots were registered. The majority of the land was split into plots of smaller than 5 hectares, while large land holdings associated with plantation projects had also been created. Meanwhile, many people continued to hold their lands according to the customary land holding system. People who sold their lands moved into the forest (the common land) and established new land plots (Sik, 2000; Greve, 1993). This customary land holding was also recognized by the 1920 civil code. A

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[4] The sub-national structure of the Cambodian government runs from village, commune, district, and to province level.

land holder who peacefully occupied unregistered land for five consecutive years became eligible to apply for ownership rights (So, 2009).

1.3 Post colonial period (1953-1975)

The legacy of a mixture of customary and formal private property rights in land was continued by the Cambodian governments who assumed power after independence in 1953. Despite initial resistance, the elites began to accept the system of titled private property as they perceived that it was a form of investment and a store of wealth (So, 2009; Williams, 1999). Land registration continued, with land holders able to pursue a claim to either possession rights or ownership rights. At the same time, claiming land ownership rights through occupation also continued. The coexistence of modern and traditional land holdings created land conflicts when the government was unable to protect vulnerable groups who had not titled their lands. Powerful elites and military officials seized the opportunity to reap benefits from undocumented land holders by issuing themselves land ownership rights on lands held by peasants under customary rights. These actions culminated in a peasants' revolt in 1967. The revolt was thereafter suppressed by government forces. Many people who were involved in this revolt sought refuge in the forests, where the communist rebels also hid (So, 2009; Thion, 1993).

The period from 1953 to 1970 is marked as the beginning of increasing land inequality and land concentration in Cambodia. Starting from 1953, wealthy households slowly accumulated more fertile rice fields (So, 2009). The statistics from 1962 indicated that 53.74 percent of peasants held land smaller than 5 hectares, 24.82 percent held land between 5 and 10 hectares, and 21.45 percent held land larger than 10 hectares (Lim,

1997). By 1970, the number of land-owning peasants had shrunk as the number of landlessness increased to about 20 percent. The growing inequality was partly due to political instability and a weak land governing institution in which people with political connections and more resources seized this opportunity and took control of fertile land (So, 2009; Kiernan & Boua, 1982).

Economic hardship together with administrative corruption and the failure of the state to protect village peasants from powerful persons created an unfavorable situation for the government led by Prince Sihanouk. This situation led to the collapse of his government in 1970. The republican government led by General Lon Nol from 1970 to 1975 still acknowledged private land property rights but new land registration was impeded by internal political chaos. In the early 1970s, Cambodia became a war zone contested by armed rebels, the Khmer Rouge Force (KRF), and the American-sponsored republican government (So, 2009). Land registration was not completed when the KRF took control in 1975. Only 10 percent of the land was registered in the land book, whereas the rest of the land was held under FAD (Lim, 1997).[5]

1.4 Land property rights during the Khmer Rouge regime (1975-1979)

Private property rights were abandoned when the KRF took full control of the country in 1975. The new regime, named "Democratic Kampouchea", was led by Pol Pot who had a vision, influenced by Mao's ideas, to build a collectivized, agriculturally-based economy. The Khmer Rouge leader wanted to use agriculture as a means to build the country. To achieve his utopian vision, an all-encompassing land collectivization

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[5] There are no precise data on the number of plots registered each year from the start of land registration in 1863 to its end in 1975. The figure provided in the text is a rough estimate by the officer who worked for the cadastral office before the full Khmer Rouge takeover in 1975.

system was implemented. The KRF evacuated hundreds of thousands of people from every city and town to carry out back-breaking labor in the countryside without providing adequate food to sustain people's lives and energy. People were forced to work on rural public works projects, such as building dams or irrigation systems to achieve the government's goal of increasing rice productivity (So, 2009; Twining, 1989). As part of its collectivization of agriculture, the KRF eliminated virtually all forms of property rights and supporting institutions. They destroyed all cadastral records, including cadastral maps and land ownership titles (Sik, 2000).

The KRF could not achieve its vision due to poor management, lack of inputs to nourish cultivated land, and no motivation from the Cambodian people to work hard in the new economic environment. Consequently, dams and irrigation systems were poorly built and the goal to greatly increase agricultural productivity was never accomplished. The failure of this endeavor led Khmer Rouge cadres to search for and purge the "enemies of the revolution" (So, 2009; Becker, 1998). Over a 44-month period, approximately 1.7 million Cambodian people perished from disease, starvation, and execution (So, 2009).

1.5 Land property rights during the People's Republic of Kampuchea (1979-1989)

The Khmer Rouge regime was toppled by Vietnam's invasion of Cambodia in 1978. A new government, the People's Republic of Kampuchea (PRK), was immediately established. It was led by former KR, controlled by Vietnam and was communist in character. This government initially depended heavily on support from Vietnamese soldiers and aid from the eastern communist bloc to suppress the remaining KRF and

non-communist forces that did not recognize the legitimacy of the PRK government (So, 2009; Frings, 1993).

In early 1979 after the new government took power, most of country's rice fields were left fallow because there were not enough inputs and agricultural equipment to farm them and much of their infrastructure had been destroyed or needed a great deal of repair. In late 1979, PRK officials together with their Vietnamese advisors decided to retain the collectivization system in a relaxed form. The government expected that the collectivization system would allow the state to equally distribute resources and to feed its cadres and soldiers in the long run. The government further hoped that getting people to work in the fields would allow rice production to resume, help resolve the country's food crisis, and save the economy (Gottesman, 2003).

From 1979 to 1989, all land belonged to the state. Households were allowed a small piece of land for residential purposes, but could not obtain any legal documents documenting their possession and rights. The rights to residential land during the PRK regime were essentially *de facto* land rights in which a household established use rights through occupation (Sik, 2000; Chan & Sarthi, 2002). Cultivated land was collectively managed by a solidarity group. A plot of land could be farmed collectively or privately within the collective. Each solidarity group was composed of 10 to 15 families (So, 2009).[6] Solidarity groups were classified into three different types: (1) land was collectively held by the group and cultivated by group members; output was shared by group members; (2) land was held by the group but the group was divided into a sub-group of 3 to 5 families; each subgroup managed the production process in which

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[6] The number of families in a solidarity group varied according to the population in each region.

produce was divided by subgroup member; and (3) the group's land was divided into plots that were allocated to an individual family and privately farmed (Lim, 1997).

During the 1980s, the collectivization system slowly failed for a number of reasons. First, the government lacked human resources to support and promote the collective system. Second, people did not have motivation to work because output was distributed to some group members who did not work. Further, materials to support cultivation were not distributed equally. Seeds, fertilizers, fuels, and other agricultural equipment were mostly made available only to model solidarity groups. Third, for fear of a political backlash the government did not take strict actions against group members who were able to work but did not participate. The experience from the extreme collectivization system imposed during the Khmer Rouge regime made people suspicious of the PRK's leadership motives, and they objected to actions intended to restore the system (So, 2009; Frings, 1993). Slowly, on a *de facto* basis, a private property system began to creep back in during the 1980s, in which people "sold" or exchanged their land to others with simple unwritten verbal agreements or using simple documents that were authenticated by village or commune chiefs as was done in transferring possession rights in pre-Khmer Rouge years (So, 2009).

1.6 Land property rights from 1989 till the present

In 1989, the government implemented a land reform program that established *de jure* private rights to residential and arable land. Politics and rural conditions were primary reasons behind the program. The PRK government faced political challenges following the withdrawal of Vietnamese troops in 1989 and a subsequent reduction of aid

from the Soviet Bloc, as it had to confront the remaining Khmer Rouge forces with fewer resources. To deal with the Khmer Rouge armed resistance, the PRK had to broaden conscription, a measure with the potential to provoke popular resentment. The land privatization program was intended to compensate the people for the unfavorable military draft policy. At the same time, the government realized that land collectivization could not produce enough output to feed the population. The lack of private land property rights discouraged investment in existing farms and clearance of new land for cultivation. Although agriculture production increased in the late 1980s, the government projected that Cambodian famers could not produce enough to meet the needs of Cambodia's then-rapidly increasing population (So, 2009). Thus, the policy of moving toward private property rights was adopted both to stabilize the country's politics and to increase agricultural productivity to meet the demand for food by the growing population.

The 1989 land privatization program had its legal roots in constitutional amendments, in sub-decree number 25 on providing house ownership to the Cambodian population, and instruction number 3 on implementation of land use and management policy, all adopted in 1989.[7] A new land law was adopted in 1992 (So, 2009).[8] Land ownership rights established before 1979 were not recognized by any of these measures.

Instruction number 3 granted transferable ownership rights for residential land which did not exceed 2000 square meters and possession rights for cultivated land which did not exceed 5 hectares. A farmer could claim a possession right to cultivated land as long as the farmer had used the land one year before the date of declaration of the

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[7] Council of Ministers, Instruction No. 03 SNN on Implementation of land use and management policy, 03 June 1989.
Council of Ministers, Sub-Decree ANK 25 on Providing house ownership to the Cambodian population, 22 April 1989.
[8] National Assembly, Land Law, 10 August 1992.

instruction. In addition, returnees from abroad and refugee camps were eligible for residential and cultivated land according to the availability of land. The rest of the collective land was redistributed to households based on family size and availability of land (Sik, 2000).

Following the land privatization in 1989, issues related to land distribution and land registration arose. According to the instruction, land was reallocated according to the size of the family and availability of land within the village. Application of this rule would result in variations in land holdings across villages due to differences in land availability and population, but families of a given size within a particular village were supposed to receive equal allocations. In practice, other factors influenced official allocations of land, as authorities kept good farmland for themselves, their relatives, and friends. Moreover, the sporadic land registration—a voluntary land registration system whereby land holders could register their holding and receive a title—began operations in 1989 and was widely viewed as ineffective and a mechanism for validating the large land holdings that had been acquired by powerful groups and individuals (So, 2009).

The main issue behind the ineffectiveness of the sporadic land registration program was the unwillingness of the government to register land without officials being paid fees and bribes so large that no one but the upper middle class and the wealthy could afford registration. Also the cadastral department was poorly equipped and did not have enough staff to handle the influx of applications for land titles (So, 2009). Another important issue was the sporadic land registration program's complicated procedures. An application for land title must complete a number of steps before land title can be issued; some can be completed at the communal level, while others require action by officials at

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the district level (Chan et al., 2001). Figure 1.1 provides a flow diagram of the titling process. Each stage of an application process requires an approval from the cadastral officer in charge. This multi-step bureaucratic procedure delays the application process as it provides numerous opportunities for the responsible officer to freeze an application and ask for a bribe to proceed (So, 2009; Frings, 1993).

During the first two years in which households could initiate the titling process (1989-1990), millions of Cambodian started the process of registering their land holdings. In 1990 local governments issued receipts for applications covering 3.7 million plots; applications tailed off in 1991, as the total number of receipts issued grew to over 4 million (So, 2009).[9] Due to the reasons articulated above, only a small percentage of households completed the registration process and received a title for their lands. Through 1997, less than 15 percent of households starting the registration process had received a land title. Most of the titled plots were in or near the capital city of Phnom Penh. Other households with application receipts began to view receipts as a weak form of land title, as the receipt was an official document that noted their claim while not providing specifications of its extent or boundaries and not being part of an official registry (Chan et al., 2001; Sik, 2000).

The rapid expansion of the Cambodian economy in the 1990s along with high rates of population growth put enormous pressure on both official and unofficial systems of land holdings. Economic growth was on average 7 percent annually in the years 1994-2004 (WB, 2006). Cambodia's population had also been surging, increasing from about 6

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[9] The application receipt is a little piece of paper given by cadastral officers when a household first applies for a land titling certificate or possession certificate. The application is first processed at the commune chief office. The receipt contains a permanent address of the applicant, the registration number of the receipt, date of application, name of land holder, size of land, category of land, and a signature from a cadastral officer.

million people in the early 1980s to more than 11 million people in 1998 (Chan & Sarthi, 2002). Table 1.1 illustrates that population growth in the 1990s averaged 2.9 percent. Together these two factors pushed up the price of residential and farm land in Cambodia. The price of residential land in urban areas rose from $10/m^2 in 1995 to more than $20/m^2 in 2000. The price of cultivated land also rose sharply, from $0.07/m^2 in 1995 to $0.19/m^2 in 2000 (Chan & Sarthi, 2002). Tables 1.2 and 1.3 provide lists of prices of residential and cultivated land in both rural and urban areas. The price of land varies according to the location and size of land.[10]

The rise in land values led land speculators to buy up lands in both rural and urban areas. It also induced, in combination with ineffective land registries and lands held only by initial application receipts or without documents, an increased number of land-related conflicts in the juridical and other institutions. Between 1992 and 1993, the United Nations Transitional Authority in Cambodia (UNTAC) received many complaints related to boundary issues and land grabs by civilians and soldiers (So, 2009; Ledgerwood, 1998). The appeals court received 1,325 land dispute cases between 1995 to mid-1999; in 2001 alone, the court received 1,310 cases (Cooper, 2002). The 2003-2004 Cambodia Socio-Economic Survey (CSES) revealed that approximately 2 percent of land plots were engaged in litigation and a 2005 USAID report indicated that slightly more than 1 percent of the population was engaged in land conflicts (So, 2009).

Further, various documents indicate that land holdings became more concentrated after the 1989-1992 land reforms. A small survey in three villages conducted in 1996 showed that the top 10 percent of households occupied 34 percent of village land, whereas the bottom 40 percent held just 9 percent (So, 2009; CDRI, 1997). A report from

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[10] The price of land in the tourist regions is mostly high in comparison to other areas.

Oxfam GB in 2007 from a survey of 433 villages revealed even greater concentration: 12 percent of households owned 72 percent of village lands while 67 percent of households accounted for less than 8 percent (So, 2009).

The Cambodian government adopted land policies in 2001 designed to both lessen the frequency of land disputes and reduce land concentration. In its "Statement on Land Policy", the government set out its policy on land management, administration, and distribution. It called for the creation of a land inventory, enhancing the capacity to resolve land disputes, registering all land under SLR or under a revision of the 1989-2001 system of sporadic land registration, and strengthening land tenure security. The SLR—mandatory land registration—was to be accomplished under the auspices of the Land Management and Administration Project (LMAP), an endeavor that drew technical support from various donors and was primarily funded by a loan from the World Bank. The project's goal was to complete the land registration within its set 15-year life span, 2002-2017 (WB, 2002).

The legal basis for the SLR was the land law adopted in 2001 by the national assembly of Cambodia and various sub-decrees. The 2001 land law was written to remedy some flaws in the 1992 land law. It requires the utilization of a "cadastral index map" for all plots in order to clarify their boundaries. Private ownership is allowed for both residential and cultivated land. It allows people who already occupied land peacefully before the adoption of the law to complete a five-year possession term in order to claim ownership rights to their land. Following the effective date of the 2001 land law new occupation of a plot of land by clearing it or settling down on it with this leading to a possession right and then ownership was prohibited. The law does, however, have

provisions for social land concessions in which the government allocates empty state land to landless families for building a house or cultivation (So, 2009).

The SLR is an important part of the current land policy. The program is designed to register all land parcels in Cambodia, to put all land ownership under government's supervision through creation of cadastral index maps, and to maintain cadastral land records. Figure 1.2 sets out the various steps by which a land holder can title holdings under the SLR. SLR is a mandatory land registration program in which all plots in a selected location are registered together; normally an SLR location is a commune and most/all lands in that commune are registered. The teams from the cadastral office, which are composed of registration specialists and land surveyors, are sent to the selected location to gather information about land owners, to perform land surveys, and register land into the cadastral system (So, 2009).

In addition to SLR, land can still be registered through a revised sporadic land registration. A sub-decree embodying a revised version of the program was issued in May 2002.[11] Some of the procedures listed in Figure 1.1 were removed. Step two in Figure 1.1, the formation of a subcommittee, was taken out. If there is a land conflict or a counter claim, then the application process is halted at the district cadastral office until the issue has been settled. If no problems occur, then an application receipt is issued to the applicant and the date of land survey and demarcation is set. When the land survey and demarcation are completed, the district cadastral officer signs a form documenting the land holder's identity and the land's boundary. This form is then disclosed to the public for 30 days. The land is then registered by the district cadastral staff into a sporadic land registration map, and the application together with all land documents are

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[11] Sub-decree 48 ANK on sporadic land registration, 31 May 2002.

forwarded to the provincial or city cadastral office where information on the land claim is recorded into the land registry. Finally, the application is sent to the General Department of Cadastre and Geography (GDCG) for issuance of title.[12] This revised version of the titling procedures is not much different from the previous one.

According to the Decision issued in 2006, the time to issue a land title under SLR is longer than under sporadic land registration. It takes 5 to 7 months for title to be issued under SLR and 2 to 3 months under sporadic land registration. The fee for issuance of a land title under SLR in rural areas was set at $0.25/1000 m^2 for agricultural land, whereas the fee for issuance of a land title under sporadic land titling registration in all provinces and municipalities was approximately $2.5.[13] The fee charged under sporadic land registration is not clearly defined. It does not clearly distinguish the different amounts charged on land of various sizes. This flaw makes it difficult to actually calculate the fee paid for a title issued under sporadic land registration.

During its first phase (2002 to 2007), the LMAP operated in 11 of Cambodia's 24 provinces, surveyed more than one million land plots, and issued titles for more than 800,000 land plots (So, 2009). Table 1.4 provides information on agricultural land plots in Cambodia with registered titles in 2003-2004 and 2009.[14] It indicates that about 21 percent of arable land was held with titles in 2004, but only about 11 percent in 2009. The remainder was either held with various types of documents or no documents. Some of the differences in the two surveys may be due to confusion between receipt and title, as some households who reported in the 2004 survey may have treated their receipts as

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[12] Ibid.
[13] Decision on cadastral service standards, 21 December 2006.
[14] The data in Table 1.4 are from CSES 2003-2004 and 2009.

titles. The 2009 survey may be more accurate because households were asked to show their documents during the survey interview.

1.7 Sustainability of the cadastral database

Since 2002, the World Bank and other donors to Cambodia have devoted significant amount of resources to LMAP to register land systematically and develop land rights institutions. The goal of this effort is to increase tenure security, which can have a positive impact on overall well-being and poverty alleviation in the country. Owners, whose names are recorded in the land registry, receive *de jure* rights that the government has promised to enforce. However, the majority of the people (a smaller percentage in urban areas and a larger percentage in rural areas) do not register a transfer when transfer of land ownership. This results in the central land registry becoming outdated and negatively impacts the effort to develop an effective system of *de jure* land rights in Cambodia (So, 2009).

There are several issues that make households opt out of formal land transfers. First, complicated procedures and a high transfer fee discourage households from registering land transfers. A formal land transfer starts from the district cadastral office which reports a land transfer to the Ministry of Land Management, Urban Planning and Construction (MLMUPC). After the transfer form is completed and signed by the district chief, a tax amounting to 4 percent of the sale's value must be paid at the provincial tax department. The provincial department of the MLMUPC must verify the transaction agreement and forward the transfer form together with the tax receipt to GDCG for final approval of the transaction (Chan & Sarthi, 2002). Several bureaucratic stages must be

completed to finalize the transfer and it is impossible to move from one stage to another without paying unofficial fees (So, 2009). Moreover, households also revealed that high transfer taxes, which account for 4 percent of the sale's value, discourage them from making official land transfers. A formal land transfer eats up almost 30 percent of land value whereas the informal transfer is much cheaper and less time consuming (So, 2009).

The second issue stems from a weak judicial system enforcing *de jure* rights. People have no trust in the judicial system providing them justice when a land dispute erupts (Chan & Sarthi, 2002). Many poor people turn instead to local officials or politicians to solve the issue (So, 2009). The third issue is related to a routine practice which is widely accepted by the people and government officers. People often go to the commune office to conduct their transfer and believe that the written agreement with a signature and stamp from a commune chief is enough to certify their transaction. This is the most common form of land transfer implemented and a commune chief does not regularly report land transactions to the district office (Chan & Sarthi, 2002). This form of land transfer was also implemented in the period before the Khmer Rouge regime in which the land registered under FAD was transferred at the commune office.

Due to the reasons articulated above, it is very difficult to shift to a formal registration system since government protection of land tenure is weak. This attenuates incentives to participate in the formal registration system. At the same time, the informal system also provides people with some forms of tenure security. Some people reason that land registration is unnecessary because the price of land is low and no one would file a claim on their land as they continue to utilize it (Chan & Sarthi, 2002). The coexistence of the two systems greatly impacts current government efforts to build a sustainable

cadastral system since titled land gets transferred through the informal system as untitled land. The outdated cadastral system can be a source of land conflicts and can severely impact land tax collections and land transaction market (So, 2009).

1.8 Conclusion

The coexistence of *de facto* and *de jure* land holding systems in Cambodia created land tenure insecurity for households who were not integrated into the *de jure* land holding system (especially poor and less-educated persons) in the 1960s and again, in the 1990s and 2000s. In both instances, the national government started a land titling program that was not widely utilized, at least in part due to weak government institutions registering land and enforcing *de jure* rights. In both cases, land grabs occurred. After gaining independence from the French in 1953, the government continued the land registration program that was imposed by the French in 1863, but failed to take appropriate measure to protect undocumented land holders. Land grabs by government and military officers who registered ownership claims on undocumented land culminated in a peasants' revolt in 1967. On the eve of the 1970s political turmoil, the number of peasants who owned land had shrunk as landlessness increased to about 20 percent. The issue reemerged in 1989 when the PRK government reintroduced private property rights in land after their abolition during the Khmer Rouge regime. The combination of economic expansion and rapid population growth in the 1990s increased land tenure insecurity for peasants without registered titles.

The incumbent government set out its policy on land management, administration, and distribution to lessen land conflicts and land concentration in 2001. The

government's goal was to register all land plots in the country under SLR or sporadic land registration. Land registration increased during this period, but the system has worked poorly because few owners of titled land have registered transfers of their titles through the formal system. In other words, the LMAP was successful in building an initial registry of land holding but not in updating the registry as the land has been transferred. This negates the ultimate goal of cadastral sustainability. Most households holding titled lands opt out of the cadastral office's formal system of transfers due to bureaucratic procedures and corruption inside the cadastral office. In the absence of a working land registry, an existing norm/ practice has been continued: Households go to the commune office to transfer lands. Without additional efforts by the government to enforce land transfer through cadastral offices, the central database becomes outdated and fails to serve the functions for which it was established.

Table 1.1

Cambodia: Population and real GDP

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Population	10.03	10.38	10.72	11.06	11.38	11.69	11.98	12.25	12.51	12.76	12.99	13.22	13.43	13.65	13.86	14.09	14.32	14.56	14.80
Population growth (%)	3.5	3.4	3.3	3.1	2.9	2.7	2.5	2.3	2.1	2	1.8	1.7	1.6	1.6	1.6	1.6	1.6	1.6	1.7
GDP per capita (current US$)	...	...	...	...	...	300.1	287.5	254.7	281.1	286.4	306.3	324.1	346.8	390.9	453.3	515.8	602.6	710.2	705.7
Real GDP growth (%)		9.1	6.4	5.4	5.6	5	11.9	8.8	8	6.7	8.5	10.3	13.3	10.8	10.2	6.7	-1.9		

Source: The World Bank, retrieved from http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?cid=GPD_30

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Table 1.2

Average price of residential land in urban areas

Location of land	('000 Riels/m^2)							
	1995	1996	1997	1998	1999	2000	2001	% Change (95-01)
Sihanoukville	75	76	68	95	105	96	197	162.66
Kompong Cham	25	25	130	148	128	120	97	288.00
Battambang	27	42	60	83	108	163	126	366.66
Prey Veng	..	134	27	90	63	58	..	..
Banteay Meanchey	30	27	28	52	71	127	154	413.33
Siem Reap	19	47	34	46	69	96	84	342.10
Kandal	19	31	77	55	58	71	..	..
Kratie	17	36	40	58	42	98	..	..
Pursat	..	73	11	8	136	19	..	..
Svay Rieng	20	23	22	60	46	51	80	300.00
Kampot	13	21	17	41	32	54	68	423.07
Koh Kong	23	15	64	29	29	31	27	17.39
Ratanakkiri	..	..	44	23	11	8	14	..
Kompong Thom	29	13	18	33	9	24	10	-65.51
Kampong Chhnang	22	13	7	20	19	23	17	-22.72
Takeo	..	6	11	11	10	18	13	..
Kompong Speu	6	18	6	14	9	13	10	66.66
Kep	12	3	3	4	3	2	1	91.66

Table 1.3

Average price of agricultural land in rural areas

Location of land	('000 Riels/m^2)							
	1995	1996	1997	1998	1999	2000	2001	% Change (95-01)
Siem Reap	655	2,075	720	35,087	2,866	2,848	289	-55.87
Kampot	525	224	301	2,641	673	1,169	1,593	203.42
Kandal	119	168	659	2,564	1,941	500	..	..
Kompong Speu	386	470	3,396	686	501	35	..	..
Takeo	..	323	227	148	297	4,100	242	..
Banteay Meanchey	..	252	679	503	1,971	1,536	346	..
Koh Kong	262	192	898	1,442	1,380	976	977	272.90
Svay Rieng	..	..	316	..	609	650	750	..
Kompong Cham	185	51	195	154	1,751	533	..	..
Battambang	57	73	196	601	617	..	65	14.03
Pursat	..	318	..	..	98	..	..	..
Kratie	..	34	..	34	..	..	434	..
Kampong Chhnang	372	137	65	115	48	166	81	-72.22
Prey Veng	..	..	..	118	..	..	..	..
Kompong Thom	..	116	..	27	44	41	8	..
Ratanakiri	..	..	..	27	..	..	..	..
Average	170	224	6.7	1,251	1,172	743	239	40.58

Note: Residential and agricultural land price. Adapted from "Land transactions in Cambodia: An analysis of transfer and transaction records," by Chan and Sarthi, 2002, CDRI, p. 28-31.

Table 1.4

Legal status of agricultural land in 2004 and 2009

Type of documents	2004 CSES	2009 CSES
Land tile certificate	43.53%	22.17%
Application receipt	49.60%	23.45%
Land investigation paper	2.85%	0.37%
Paper from local authority	0%	37.37%
Rental contract	0.82%	0.80%
Other	3.20%	15.84%

Note: The CSES 2004 indicates that about 52.65 percent of cultivated land was held with various types of documents, whereas CSES 2009 shows that 50.93 percent of cultivated lands was held with various types of documents.
Source: All data are from CSES (2003-2004) and (2009).

Appendix 1.A

Figure 1.1

Procedures for sporadic land registration

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a) An applicant has to make application to his/her commune chief in a standard form. Completed application forms are certified by the commune chief and forwarded to Office of Land Management, Urban Planning, Construction and Land (OLMUPCL) at the district. The owner receives a receipt for his/her application.

b) A sub-committee is formed consisting of the commune chief as its chair, the village chief (of the applicant's village), one or two officials of the staff of the OLMUPCL (district cadastral office) and one older person from the community whose knowledge and authority in the village is respected.

c) The sub-committee, in consultation with the applicant, fixes a date for site inspection. Owners of neighboring lands to the applicant's land parcel are also called to ensure correct and mutually acceptable boundary demarcation during the measurement process.

d) Prior to the visit, an announcement is made by the district chief about the intent of the applicant to title his/her land. A notice period of 10 to 15 days is allowed for any party to raise objections or contest the claim. A notice to this effect is displayed on or near the site (for example, in the village concerned, or at the relevant commune office or district office).

e) During the visit, the applicant must erect signposts at appropriate places in order to demarcate his/her land and also identify the shape of the land. Neighbors can raise objections, if they have any, at this stage. The land survey is completed upon satisfactory completion of the boundary demarcation. A standard form is then filled in and duly authenticated by neighbors and others on the sub-committee. The background of the applicant, his/her family details and the mode of land acquisition (for example, through inheritance or purchase), are noted. Any plantations or construction on the land are also recorded. In the event that one or more of the neighbors is a state authority, their representative(s) are called for the boundary inspection.

f) In the event of a dispute concerning the applicant's claim, the processing of the claim is halted until the dispute is resolved. Otherwise, the form is signed by the commune chief in his/her capacity of chairperson, and forwarded to the district OLMUPCL Cadastral Office with a recommendation to issue a certificate. The relevant documents are then forwarded to the district chief.

g) In the case of agricultural land, the district chief can approve issue of the certificate if s/he is satisfied. S/he can call for clearance from other concerned parties if s/he deems it necessary, for example, from forestry or fisheries departments. In the case of residential land, the chief of the district cadastral office recommends the matter to the district chief for verification, who in turn refers the case to Department of Land Management, Urban Planning, Construction and Cadastre (DLMUPCC) at the provincial level. This department then submits the papers to the provincial governor for final approval for issuing a certificate.

Note: Procedures for land registration. Adapted from "Land tenure in Cambodia: A data update," by Chan et al., 2001, CDRI, p. 27-38.

Figure 1.2

Procedures for sporadic land registration

1. PREPARATION

The Provincial/Municipal Governor

The Ministry of Land Management, Urban Planning and construction

The Provincial/Municipal Governor

> Declaration of Adjudication Area

> Appointment of the Officers
> 1. Field Manager
> 2. Demarcation Officers, Survey
> 3. Officers and Adjudication Officer

> Opening Meeting

2. FIELD WORK

Demarcation Officer

> Demarcation
> Demarcating the boundaries of parcels

Adjudication Officer

> Adjudication
> clarifying the rights related to parcels

Survey Officer

> Surveying
> Preparation of the Cadastral Index Map

Field Manager

> Adjudication Record
> 1. Cadastral Index Map
> 2. List of Owners
> 3. Parcel Forms

3. SIGNATURE INSP. COMMISSION

The Administrative Commission

> Public Display of the Record

Undisputed Parcels

> Confirmation

Agreement

Disputed Parcels

> Settlement

> Technical Inspection of the Adjudication Record by the Provincial/Municipal Office of Land Management, Urban Planning, Construction and Cadastre

> Signature of the Governor
> Signature of the Ministry

> Undisputed Land

> Disputed Land

> The Decision of the Court

> The Validity of adjudication Record
> 1. Registration
> 2. Title Certificates

Note: Procedures for land registration. Adapted from "Land tenure in Cambodia: A data update," by Chan et al., 2001, CDRI, p. 27-38.

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CHAPTER TWO

LAND RIGHTS AND INVESTMENT IN LAND

2.1 Introduction

The acceleration of economic growth and an increase in population density in the 1990s augmented land tenure insecurity in Cambodia, especially for poor and less educated groups. The 1989 land reform and the subsequent introduction of a sporadic land titling registration program have, however, been unable to resolve land tenure insecurity in the country. Registration of land ownership proved to be costly and inaccessible to most cultivators with *de facto* rights. Consequently, only a small percentage of people applying for ownership or formal possession of their land received formal possession or ownership documents (So, 2009; World Bank, 2002; Chan, Tep, & Sarthi, 2001). The combination of a poorly functioning land registry system and rising demand for arable and commercial land in an expanding economy induced sharp increases in conflicts over land rights. The rise of conflicts affected the lives of many Cambodians and became a major issue that threatened people's livelihoods and raised the possibility of pushing already impoverished farmers deeper into poverty (So, 2009).

In an attempt to address these problems, a range of land policy reforms were carried out in the 1990s, culminating in the adoption of a new land law in 2001 and the implementation of systematic land registration (SLR) under a Land Management and Administration Project (LMAP) starting in 2002. This land reform effort was aimed at improving security of tenure, a component of land rights that reformers expected would lead to increased access to credit markets, incentives to make larger investments in the

land, and to improvements in agricultural productivity. A World Bank report (2002) argued that poor and vulnerable groups would gain the most from the reforms, and that the reforms would reduce poverty.

Empirical studies of the effect of *de jure* land rights on land investment have not always supported the effects articulated in economic theories of *de jure* property rights. Abdulai, Owusu, and Goetz (2011), Goldstein and Udry (2008), Do and Lyer (2006), Jacoby, Li, and Rozelle (2002), Alston, Libecap, and Mueller (1999), and Besley, (1995) found a positive link between land rights and land investment, while Jacoby and Minten (2007), Braselle, Gaspart, and Platteau (2002), Place and Migot-Adholla (1998), Place and Hazell (1993), Migot-Adholla, Hazell, Blarel, and Place (1991) did not. Other studies maintained that their inconclusive results were due to the small sample sizes utilized in most published empirical studies (Deininger & Jin, 2006) and the failure of most studies to adequately account for endogeneity of land rights (Brasselle et al., 2002). Small sample sizes reduce the precision of estimates and tend to bias estimated coefficients towards zero (Deininger & Jin, 2006; Deaton, 1997). Endogeneity of household choices to register *de facto* claims and obtain *de jure* land titles is accepted as a critical issue in this literature, as households who have made larger capital investments in their lands have a larger incentive to complete the bureaucratic process for obtaining a title from the government land registry to protect their earlier investments.

Cambodia has the potential to be a good case study of the impacts of *de jure* land rights on land investment by farm households because its land titling program has been operated long enough to make an assessment and, more importantly, the program has been implemented during a time of political stability and economic growth. This long

political stability facilitated program implementation unlike an earlier land titling program that was interrupted by civil war. The smooth implementation of a land titling program is very important for an agrarian economy like Cambodia where the majority of the rural population depends heavily on cultivation to survive. Most importantly, household survey data that incorporate information on household land titles are available for Cambodia. The 2003-2004 Cambodia Socio-Economic Survey (CSES) includes information on household land investment and the legal status of a household's farmlands, thereby facilitating analysis of this relationship. In this chapter, I use matching regression techniques, in particular Propensity Score Matching (PSM), to account for selection effects in household participation in Cambodia's program to convert *de facto* land claims into formal *de jure* land rights supported by a national land registry. This PSM method is very useful when matching treated and untreated observations involving many covariates, as it yields a weighting scheme that provides an unbiased estimate of the treatment effect (Dehejia & Wahba, 2002).

The empirical analysis in this study provides a result supporting the theory of land rights: Investment on titled farms is higher than untitled farms. The findings of this study also provide support for the link between land rights and agricultural outcomes in low-income environments amidst the inconclusive results on this relationship offered by earlier studies.

2.2 Literature review

Secure and transferable land rights have been documented in the economics literature as a key to economic growth (Field, 2007; Deininger & Jin, 2006; Carter &

Olinto, 2003; De Soto, 2000; Jacoby et al., 2002; Besley, 1995; Binswanger, Deininger, & Feder, 1995; Pinckney & Kimuyu, 1994). Three linkages between land rights and economic growth stand out. First, secure land rights enhance investment incentives. This is a traditional view that highlights the gains resulting from freedom from expropriation (Besley, 1995; Alchian & Demsetz, 1973; Demsetz, 1967). Households are more willing to undertake investment if they expect to reap benefits from their investments (Besley, 1995; Brasselle et al., 2002). Second, a clear proof of legal ownership of the land rights allows legitimate land owners to access lower interest rates in credit markets, thereby raising returns on investment projects, as lenders become confident that their investment is secured (Feder & Nishio, 1998). Third, clear land rights facilitate secured transfers of land from inefficient to efficient users. They allow land to be owned by those who value it the most and also assure buyers that their lands will not be confiscated in the future (Jacoby & Minten, 2007).

Securing land rights through registration of land titles and enhancing rights to transfer and their social benefits have been widely discussed in the past two decades because empirical findings on this linkage have been inconclusive. Studies from most Asian countries provide evidence supporting the theory of a positive relationship between land property rights and agricultural outcomes. A prominent study of Thailand indicated that land titles have positive and significant effects on land improvements and access to credit markets (Feder, Onchan, Chanlamwong, & Hongladarom, 1988). In Vietnam, improvement in land rights, such as rights to exchange, transfer, lease, or mortgage, led to an increase in the share of land devoted to long-term crops and labor used in non-agricultural activities (Do & Lyer, 2006). In China, an increase in land tenure security

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induced more investment in land (Jacoby, Li, & Rozelle, 2002). A land titling program in Indonesia was found to increase investment incentives and land values (Do & Lyer, 2006; SMERU, 2002). Studies from Latin American countries also show the positive link between land title and various social benefits. Alston, Libecap, and Mueller (1999) found that titles have a positive impact on land investment and land values in some provinces in Brazil. Galiani and Schargrodsky (2004 and 2010) found that titles have positive impacts on child health, housing investment and house structures in Argentina, whereas Field (2007) emphasized that formal land titles increased participation in formal labor markets in the urban squats of Peru.

The studies from Africa have drawn researchers' attention due to their inconclusive results on the effect of land rights. Some studies provide results supportive of models of the farm sector that yield private and social benefits from establishing *de jure* land rights, whereas others do not. Besley (1995) and Abdulai et al. (2011) found that land rights in Ghana enhance land investment. Another study of Ghana by Goldstein and Udry (2008) found that tenure insecurity decreases investment in land fertility as households who have weak networks of social and political power tend to have their land confiscated when it is left fallow. In Ethiopia, Deininger and Jin (2006) illustrated that improvement in rights to transfer has a positive effect on terrace building and tree planting. In Zambia, Smith (2004) confirmed that land tenure security increases fixed investment and productivity. Hayes, Roth, and Zepeda (1997) found that land tenure security in Gambia enhanced long-term investment which, in turn, improved agricultural outputs. Other studies including Jacoby and Minten (2007), Braselle et al. (2002), Place and Migot-Adholla (1998), Place and Hazell (1993), Migot-Adholla et al. (1991) found

weak effects of land rights on agricultural outcomes. Fenske (2011) utilized nine data sets from West Africa and reassessed some of the previous empirical studies and found that land tenure is important for fallow and tree planting but less important for manure and chemical fertilizer. This result implies that land rights are essential for long-term but not short term land investment.

The view that *de jure* land rights bring about tenure security and agricultural outcomes can be summarized into two factors, which conceptually affect the process of adoption and implementation of a land titling program and the ability of the program to provide the expected outcomes. They are (1) the capacity of land governance institutions and (2) cultural diversity and/or context-specific conditions.

2.2.1. *Capacity of land governance institutions*

Land governance institutions are complementary factors to *de jure* land rights that establish land tenure security and thereby promote investment in land. The capacity of land governance institutions includes the ability of the state to facilitate land registration and to enforce the land owner's rights. Without the above facilitation and protection from the state, land titles hold little value or utility. Facilitation of land registration requires that land institutions simplify the registration process and that the cost of registering a land transfer with the national land registry does not discourage title holders from registering a land transfer. Facilitation of the initial registry of *de facto* claims and the subsequent registry of transfers of *de jure* land rights means that the land registry will have up-to-date information on the geographic extent of land claims (often from a survey of the claim required for initial registration); on restrictions on the land rights, e.g., an easement for bringing sheep from neighboring farms to market; on previous land owners,

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the current land owner, and liens on the land. This information allows land markets to function efficiently in placing values on land. Also, for a system of *de jure* land rights to function properly, there must be a well-functioning legal system capable of adjudicating conflicts over rights and enforcing its decisions (So, 2009). In its absence, households will need to allocate additional resources to guard or fence their properties (Feder & Feeny, 1991).

The achievements of the land titling program in Thailand highlight the strength of Thailand's Department of Land and the government's political will to enhance land tenure security. The role and responsibility of Thailand's Land Department was clearly defined to ensure that the land titling program was properly implemented (Rattanabirabongse, Burns, & Nettle, 1998). Institutional capacity has been a major issue for some African countries that have introduced land titling programs (Jacoby & Minten, 2007; Jansen & Roquas, 1998; Platteau, 1996; Attwood, 1990). The major drawback of Kenya's land titling program has been the inability of the land governance institution to update records of land transfers (Pinckney & Kimuyu, 1994). Experience from Honduras reveals that its land titling program has had limited effects because the government cannot provide protection for *de jure* rights holders in a rural community against outside entities. This inability leads to more land conflicts, with *de jure* rights holders seeking the help of political leaders rather than courts to enforce their rights (Jansen & Roqas, 1998). Atwood (1990) also highlighted issues related to high transfer costs which discourage households from participating in land titling programs and make them rely on customary or informal land transfers.

2.2.2 *Cultural diversity and context-specific conditions*

Conventionally, land titling programs are enacted to increase land tenure security, enhance agricultural productivity by facilitating transfers of land to more productive managers, increase access of land owners to formal credit institutions, and provide opportunities for land owners to use new technology and to invest more in their farms. However, land titling programs do not always produce these results. One reason may be that researchers tend to overlook the cultural heritage of each country. As Plateau (1996) suggested, many problems accompanying a developing country's land titling program stem from a failure to take into account sequences of evolution in land rights. He views the evolution from customary land rights enforced at the village level to *de jure* individual land rights enforced at the provincial or national level to be due to population pressure, change in technologies, and increases in commercialization of agriculture.

As arable land becomes more scarce in a country with a growing population, people demand rules or institutions compatible with factor endowments and technologies. A land titling program may be more appropriate in such conditions, as the higher value of the land warrants a more careful specification and more rigorous enforcement of the package of rights and responsibilities adhering to the land (Platteau, 1996). Some studies have shown that introducing a land titling program, especially in African countries where indigenous land rights are still prevalent, may create uncertainty and possibly conflicts rather than increase land tenure (Jacoby & Minten, 2007; Platteau, 1996; Atwood, 1990). In some African countries, the technology package necessary to make larger investments in land is unavailable, as their agricultural sector is not yet commercialized. Platteau

(1996) concluded that land registration in Africa should only be considered when informal institutions and practices cannot provide tenure security.

2.2.3   Issues in the empirical studies

Inconclusive effects of land rights on agricultural outcomes in empirical studies may be partly due to flaws in these studies. First, measures of land investment vary considerably. Land investment in most studies is measured with discrete variables such as building fences, digging wells, constructing drainage systems, terracing, irrigating, mulching, applying manure, conserving soil, and planting trees. Some types of investments may not be initiated until land tenure security is high and the quality of land is sufficiently high to warrant such investments. Deininger and Jin (2006) warned that the use of such variables as the "application of manure" to measure land investment does not provide a clear indication of how the outcomes relating to such small activities translate into a larger intervention. On the other hand, land investments that are either commonly or rarely made pose several problems. Fenske (2011) maintained that "excluding them can, for example, hide insecurity so severe that it has completely discouraged a particular investment. Lack of identifying variation in the dependent variable raises the standard errors, pushing results towards insignificance" (p. 142).

Second, *de jure* land rights are rarely exogenously imposed. Households with more education, wealth, and political connections are more likely to participate in land titling programs. In some countries, land investments facilitated improvements in tenure security for households with fragile *de facto* land rights (Atwood, 1990). A study of Burkina Faso land holders confirmed that land investment served to increase land tenure

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security rather than the other way around (Brasselle et al., 2001). A similar pattern was found in Uganda where coffee planting was undertaken to enhance tenure security (Place & Otsuka, 2002). Despite the causal relationships identified between land rights and investment, some empirical studies of this relationship did not control for endogeneity of land rights.[1]

Third, the issue of soil quality in land investment regression analysis has never been widely discussed. Conceptually, soil quality is related to the shape and relief of the plot, the drainage capacity of the soil, and the geographical area of the plot in relation to irrigation systems or water resources. Even within relatively small geographic areas, there can be large variations in soil quality (Benjamin, 1995). Previous studies reported a small effect of soil quality on land investment (Jacoby & Minten, 2007; Place & Otsuka, 2002; Hayes et al., 1997; Gavian & Fafchamps, 1996; Besley, 1995). A dummy variable measuring soil quality was used in almost every econometric study but for the Feder et al. (1988) study of land titling in Thailand. It used a soil quality index incorporating information on type of soil, slope of the land, upland or lowland location, access to irrigation, availability of all-weather roads to village and market, and travel time to nearest market and village. The soil quality index was found to have a positive and statistically significant impact on land investment (Feder et al., 1988).

Fourth, the finding of a weak relationship between land rights and land investment in some studies was based on empirical analyses using small samples. A small sample size may not provide sufficient variation in land rights to allow precise estimates of this relationship, and there is a tendency for coefficient estimates to be biased toward

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[1] Brasselle et al. (2001) discussed numerous empirical studies which did not control for endogeneity of land rights.

zero (Deininger & Jin, 2006; Deaton, 1997). Besley (1995) also examined this issue in his seminal study, arguing that the statistically insignificant link between land investment and land rights in Anloga (Ghana) could be due to the small sample size utilized in regression estimates.

2.3 Prospects for enhancing land tenure security in Cambodia

2.3.1   Agriculture

Agriculture is the most important economic sector in Cambodia. This sector contributes almost one-third of GDP and employs more than 50 percent of the total labor force in the formal economy. From 2000 to 2008, the GDP of the agricultural sector grew 5.6 percent annually (Yu & Diao, 2011). The steady growth for almost one decade came from agro-industries owned by a small group of wealthy people; small farmers did not gain much from this growth (So, 2009; Kenjiro, 2005). Cambodia's outputs per hectare of common crops, such as rice, maize, and cassava are the lowest in the region. The average rice yield in 2003 was about 2.15 tons per hectare, whereas in 2003 Vietnam, Thailand, and Lao reached 4.6, 2.45, and 3.31 tons per hectare respectively (World Bank, 2006). Cambodia's output per hectare in 2003 just slightly results (about 2 tons) from the 1960s and early 1970s (Sarthi & Chan, 2002).

The low productivity of this sector can be partly attributed to a lack of land tenure security, low investment and limited access to credit institutions (World Bank, 2002). According to CSES (2003-2004), from 1979 to 2004 approximately 15 percent of agricultural land parcels were invested in (see table 2.2). Loans from formal credit institutions were low (only 3.6 percent of households received them), as most households

instead approached money lenders and non-governmental organizations. The average interest rate paid by households was about 4.4 percent per month. Borrowing for agricultural purposes accounted for about 24 percent of household loans, and the rest of the borrowed funds supplemented household consumption, medical spending, or other purposes (see table 2.3). Cultivated land per household did not grow fast enough to feed Cambodia's growing population. The population of Cambodia grew from 6 million in the early 1980s, to more than 11 million in 1998, and 13.4 million in 2008 (Chan & Sharti, 2002; Census of Cambodia, 2008). Each household occupied only 1.29 hectares in 2004 (CSES, 2003-2004).

2.3.2 Land investment in Cambodia (1979 to 2004)

This section uses CSES data from 2003-2004 to compare investment in land during the 1979-1988 period when land was under state control, and the 1989-2004 period when land parcels were privatized and *de facto* and *de jure* land rights systems coexisted. The separation of our sample into two periods allows observations of investment patterns in land parcels during periods when land parcels were owned by the state and collectively held and when land parcels were privately owned.

Table 2.1 provides the total number of each type of land investment made from 1979 to 2004. There are eight types of land investment: digging a well, digging a ditch, terracing, drainage construction, soil reclamation, growing an orchard, planting a perennial tree, and other investment. The CSES series for land investments began in 1979 when land had not yet been privatized. Column 10 of Table 2.1 provides the total number of investments in all categories. Households made a total of 323 investments in their

cultivated lands in 1979, 136 in 1980, 58 in 1981, and 101 in 1982. Land investment in 1979 was higher than in all other years. From 1983 to 1999, the total number of land investments decreased before reversing course beginning in 2000. In both periods (1979-1988 and 1989-2004), investments were made on about 15 percent of cultivated farms. Investments in digging ditches, planting trees, and establishing orchards were the most frequent. Investments in terracing were negligible after 1979.[2]

In the first period (1979 to 1988), cultivated land was collectively held by the solidarity group. Investment was nonetheless quite substantial in 1979 in comparison with other years in this period. Investment after land privatization never reached the 1979 pre-privatization peak of 323 per year. Two arguments for the large investment in land when it has not yet been privatized are considered here. First, households might have invested more because they perceived that they were the legitimate owners of the land and that making investments in the land would solidify their claims. Second, land investment was indispensable due to increases in the demand for food after the Khmer Rouge Regime (KRR) was driven out of Phnom Penh and the towns and from a certain part of the countryside in 1979. The KR soldiers destroyed whatever food stocks they could not take with them as they retreated, and because farmers had not been allowed to retain their own food under the KRR (So, 2009). Consequently, in 1979 there was a severe shortage of food that threatened rural households' livelihoods. Thus, after the end of the KRR, households made considerable investments in land regardless of their tenure situation to foster their immediate survival.

In the second period (1989 to 2004), rights to land were individualized formally, based on a series of laws that enacted from 1989. People claimed rights to land either

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[2] Figure 2.1 shows investment patterns from 1979 to 2004.

with some form of documents (e.g., land titles, application receipts, and land investigation documents) or without any documents (a *de facto* land claim). The increase in the total number of land parcels investment in this period, from 54 in 1989 to 137 in 2000, to 118 in 2001, 119 in 2002, and 137 in 2003 could have been due to an increase in land tenure security or the belief that investment would increase land tenure security. As discussed in Chapter One, prior to the adoption of the 2001 land law, households were eligible to claim rights on the plots they had held peacefully for five consecutive years. Thus it remains unclear whether the increase in investment during the second period was because of an increase in tenure security or because of the belief that investment in a land parcel strengthens the land tenure of occupants with *de facto* rights.

2.4 A model of tenure security and investment

Feder et al. (1988), Besley (1995), Deininger and Jin (2006) developed theoretical models to assess the impact of tenure security on choices of farmers. The Feder et al. (1988) model derives relationships between land rights and the price of land, land investment, and access to credit markets. Besley (1995) develops three theoretical models to explain the link between land property rights and investment decisions. He posits that having secured land rights would increase investment in land in three scenarios: land rights reduce the risk of expropriation; land rights allow land to be used as collateral in investment markets; land rights facilitate sale or rent to households with a higher value of the land. Deininger and Jin (2006) used a two-period household model to explain the effect of tenure security on investment. They suggested that tenure security will have a positive impact on investment by inducing a productivity increase if land tenure is

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exogenously given. This result does not hold, however, when farmers invest to enhance land tenure security.

The three models are similar in positing that land tenure security encourages land investment. However, the model developed by Deininger and Jin (2006) fits the Cambodia *de jure* property rights' context, as discussed in Chapter One. The model provided below is taken from Deininger and Jin (2006). A Cobb-Douglas production function is used to simplify discussion. Households are assumed to be endowed with the same amount of land and to maximize their utility over two periods:

$$Max\ U(C_1, C_2) = lnC_1 + \beta lnC_2$$

s.t.

$$(1 + r)[(K_1)^\alpha (L_1^P)^{1-\alpha} + L_1^O w_1 - C_1]$$

$$+ [\tau(S_2(S_1, L_1^I))(K_1 + g(L_1^I))^\alpha (L_2^P)^{1-\alpha} + L_2^O w_2 - C_2] = 0$$

$$L_1^I + L_1^O + L_1^P = L_1 \text{ and } L_2^O + L_2^P = L_2$$

where:

C_1 and C_2= Consumption in periods 1 and 2

L_1 and L_2= Labor in periods 1 and 2

L_1^P, L_1^I, and L_1^O= Labor used for agricultural production, land related investment, and off-farm work with wage w.

K_1= Capital in period 1

Y_1 = Output in period 1 which is generated according to $(K_1)^\alpha (L_1^P)^{1-\alpha}$

K_2= $K_1 + g(L_1^I)$, $g(L_1^I)$ is an increasing function of L_1^I

Y_2= Output generated in period 2 according to $(K_1 + g(L_1^I))^\alpha (L_2^P)^{1-\alpha}$

$\beta \in [0,1]$= Discount rate of Cambodian farmers

$\tau \in [0,1]=$ Probability that land can be seized in period 2

S_1 and $S_2=$ Land tenure security in periods 1 and 2.

Let $\tau[S_2(S_1,L_1^I)]$ "be a function of land tenure security in the second period", which is a function of tenure security and land improvement in the first period and assume that $\partial\tau/\partial S_2 > 0$, $\partial^2\tau/\partial^2 S_2 < 0$, $\partial S_2/\partial S_1 > 0$, $\partial^2 S_2/\partial^2 S_1 < 0$, $\partial S_2/\partial L_1^I > 0$, $\partial^2 S_2/\partial^2 L_1^I < 0$, and $\partial^2 S_2/\partial S_1 \partial L_1^I < 0$ (Deininger & Jin, 2006, p. 1270). Assuming separability between household consumption and production, the household utility maximization problem above can be written as:

$$\underset{L_1^I,L_1^P,L_1^O,L_2^P,\ L_2^O}{Max}(1+r)[(K_1)^\alpha(L_1^P)^{1-\alpha} + L_1^O w_1]$$

$$+\beta[\tau(S_2(S_1,L_1^I))(K_1 + g(L_1^I))^\alpha(L_2^P)^{1-\alpha} + L_2^O w_2]$$

s.t.

$$L_1^I + L_1^O + L_1^P = L_1 \text{ and } L_2^O + L_2^P = L_2$$

The first-order conditions are:

$$\frac{\partial L}{\partial L_1^I} = -(1+r)(1-\alpha)(K_1)^\alpha(L_1 - L_1^I - L_1^O)^{-\alpha}$$

$$+\beta\left[\tau'(S_2(S_1,L_1^I))S_2{}'(S_1,L_1^I)(K_1 + g(L_1^I))^\alpha(L_2^P)^{1-\alpha}\right]$$

$$+\beta[\alpha\tau(S_2(S_1,L_1^I))(K_1 + g(L_1^I))^{\alpha-1}(L_2^P)^{1-\alpha}g'(L_1^I) = 0 \qquad (1)$$

$$\frac{\partial L}{\partial L_1^O} = (1-\alpha)(K_1)^\alpha(L_1 - L_1^I - L_1^O)^{-\alpha} = w_1 \qquad (2)$$

$$\frac{\partial L}{\partial L_2^O} = (1-\alpha)(K_1 + g(L_1^I))^\alpha(L_2^P)^{-\alpha} = w_2 \qquad (3)$$

Equations (2) and (3) imply that the marginal product of labor is equal to the off-farm wage, whereas equation (1) implies that the marginal cost of investment effort in period one is equal to the discounted value of the marginal benefit of the increase in

tenure security in the second period and the marginal benefit of the additional investment chosen in period two.

2.4.1 *Case 1: Land tenure security is exogenous*

If land tenure security is exogenous, the second term in equation (1) drops out. Equation (1) then can be written as:

$$\frac{\partial L}{\partial L_1^I} = -(1+r)(1-\alpha)(K_1)^{\alpha}(L_1 - L_1^I - L_1^O)^{-\alpha}$$

$$+\beta[\alpha\tau(S_2(S_1, L_1^I))(K_1 + g(L_1^I))^{\alpha-1}(L_2^P)^{1-\alpha}g'(L_1^I) = 0 \qquad (4)$$

If tenure security is exogenous, $S_2(S_1, L_1^I)$ can be replaced with S_1. Equation (1) then becomes:

$$\frac{\partial L}{\partial L_1^I} = -(1+r)(1-\alpha)(K_1)^{\alpha}(L_1 - L_1^I - L_1^O)^{-\alpha}$$

$$+\beta[\alpha\tau(S_1)(K_1 + g(L_1^I))^{\alpha-1}(L_2^P)^{1-\alpha}g'(L_1^I) = 0 \qquad (5)$$

Substituting equations (2) and (3) into equation (5):

$$\frac{\partial L}{\partial L_1^I} = -(1+r)(1-\alpha)w_1 + \beta[\alpha\tau(S_1)w_2g'(L_1^I)] = 0 \qquad (6)$$

Totally differentiating (6) with respect to L_1^I and S_1:

$$\beta[\alpha\tau(S_1)w_2g''(L_1^I)]\partial L_1^I + \beta[\alpha\tau'(S_1)w_2g'(L_1^I)]\partial S_1 = 0 \qquad (7)$$

$$\frac{\partial L_1^I}{\partial S_1} = -\frac{\tau'(S_1)g'(L_1^I)}{\tau(S_1)g''(L_1^I)} > 0 \qquad (8)$$

The last result indicates that land tenure security has a positive impact on land investment. This is the standard case in the literature: Tenure security enhances land investment which increases land productivity.

2.4.2 Case 2: Land tenure is endogenous

If a household invests to enhance land tenure security, then the third term of equation (1) drops out:

$$\frac{\partial L}{\partial L_1^I} = -(1+r)(1-\alpha)(K_1)^\alpha (L_1 - L_1^I - L_1^O)^{-\alpha}$$

$$+\beta\left[\tau'\left(S_2(S_1, L_1^I)\right)S_2{}'(S_1, L_1^I)(K_1 + g(L_1^I))^\alpha (L_2^P)^{1-\alpha}\right] = 0$$

$$\frac{\partial L}{\partial L_1^I} = -(1+r)w_1 + \beta\left[\tau'\left(S_2(S_1, L_1^I)\right)S_2{}'(S_1, L_1^I)\right]\left[\frac{w_2}{(1-\alpha)(L_2^P)}\right] = 0 \quad (9)$$

Totally differentiating (9) with respect to L_1^I and S_1:

$$= \left\{\left[\tau''(S_2)\left(\frac{\partial S_2}{\partial S_1}\partial S_1 + \frac{\partial S_2}{\partial L_1^I}\partial L_1^I\right)\right]S_2{}'(S_1, L_1^I)\left[\frac{w_2}{(1-\alpha)(L_2^P)}\right]\right\}$$

$$+\left\{\tau'\left(S_2(S_1, L_1^I)\right)\left[\frac{w_2}{(1-\alpha)(L_2^P)}\right]\left[\frac{\partial^2 S_2}{\partial L_1^I \partial S_1}\partial S_1 + \frac{\partial^2 S_2}{\partial^2 L_1^I}\partial L_1^I\right]\right\} = 0$$

$$\frac{\partial L}{\partial L_1^I} = -\frac{\left[\tau''(S_2)\frac{\partial S_2}{\partial S_1}S_2{}'(S_1, L_1^I)\right]+\left[\tau'\left(S_2(S_1, L_1^I)\right)\right]\frac{\partial^2 S_2}{\partial L_1^I \partial S_1}}{\tau''(S_2)\frac{\partial S_2}{\partial L_1^I}S_2{}'(S_1, L_1^I)+\tau'\left(S_2(S_1, L_1^I)\right)\frac{\partial^2 S_2}{\partial^2 L_1^I}} < 0 \qquad (10)$$

In this case, land rights are endogenous, as households invest to enhance land tenure security. Investments to enhance security are mostly short-term investments and some of these investments, such as posting or fencing, are not made to increase productivity but rather to secure land rights.

2.5 Empirical analysis

2.5.1 Data

The empirical analysis is based on a Cambodia Socio-Economic Survey (CSES) conducted in 2003-2004 by the National Institute of Statistics (NIS) of the Ministry of Planning (MOP). The survey was funded by the United Nations Development Program, Swedish International Development Agency, and the World Bank. NIS is an experienced

institution that administers most of the national surveys in Cambodia. The first survey was carried out in 1994 and CSES 2003-2004 is the fifth survey. It covers 100 percent of the sample population, which compares well to the other four surveys which left some geographic areas uncovered due to poor security in some areas. The goal of CSES is to collect information on various socio-economic aspects of households to track down the extent of household poverty.

It is a nationally representative survey of 15,000 households in 24 provinces and 900 villages conducted from November 2003 to January 2005. The sampling frame of the survey was based on Cambodia's general population census. Selected households were contacted to fill out the first part of the questionnaire covering household composition. Households were then obligated to fill out a diary of expenditure and income. Visits to and interviews of the households continued until all sections of the questionnaire were completed. The survey is available at individual, household, and village levels. The individual and household datasets contain information on employment, education, consumption and income, child health, housing construction, and farmland. The village dataset contains general information on population, agricultural land, development projects, schooling, presence of a hospital, common property resources, and occurrence of natural disasters.

2.5.2 Farm characteristics

The survey asked households to report the number of farmlands and type of documents connected with each farmland. The types of documents are land title, land investigation document, application receipt, rental contract, and other specific documents.

Generally, households with land titles are protected under the law and are entitled to transfer rights. Holders with other documents such as an application receipt or a land investigation document have to go through several steps (reviewed in Chapter One) to obtain a title. To some extent, people face a higher risk of being expropriated if their lands are registered by others; those who hold no documents are in even greater danger.

Table 2.2 provides the mean and standard deviation for plots by type of document, mode of land acquisition, land investment, and land type. General information regarding plot characteristics shows that the majority of plots are held without formal documents, are non-irrigated plots with only a few land investments, and are a type of wetland. Table 2.2 indicates that among plots reported held with some type of document, 21 percent are held with land titles, 24 percent with application receipts, 3 percent with various other documents, and 52 percent without any documents.[3] Most households either obtained land from the government (45 percent) or inherited land from their families (32 percent). Only 12 percent of land was purchased. Approximately 2 percent of plots were involved in litigation. The length of occupation of each plot was about 18 years on average. 77 percent of plots are wetlands and 75 percent are non-irrigated plots. Together this implies that cultivation in Cambodia remains rainfed, and outputs depend heavily on weather conditions. Information on type of plot also tells the story about soil quality. Land investment such as digging a well or a ditch, construction of drainage systems, and planting trees has been conducted only at minimal levels. Only 15 percent of the plots have been invested in, with 5 percent invested in digging a well or a ditch, 5

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[3] As mentioned in Chapter One, the percentage of titled plots is much lower in the CSES 2009. The higher percentage of titled plots in CSES 2004 may be due to confusion between land title and application receipt, as some households have treated their application receipt as a land title certificate.

percent in drainage construction, 3 percent in growing orchards, and 2 percent in planting trees. Other types of investments have been neglected.

This Chapter's analysis uses three different measures of land rights: land titles, land titles or application receipts, and application receipts. The land rights variables used in this study are binary. As discussed in Chapter One, some households treat application receipts as land titles. Although legally they are not, some households believe they have at least some security of tenure with an application receipt. So (2009) illustrated that some villagers who have not yet completed their registrations indicate that they are not worried about expropriation as long as they stay on the land and keep it productive. For this reason, households who hold farms with land titles or application receipts could potentially have the same or similar investment behaviors. Therefore, it is important to look at the effects separately and to estimate the magnitude of the impact with different measures of land rights.

Land investment is measured by the type of long-term investment conducted by households after the 1989 reform. The survey includes three different types of land investment. Because the second and third types are relatively unimportant, I do not consider them in this study. The first type measures long-term investment in land and uses binary variables to measure household investment in more narrow categories. The variables consist of planting trees, preparing and planting orchards, digging ditches and wells, constructing drainages and terraces, and taking measures to conserve soil. For this study, the different categories of type one investments are combined due to a small number of investments in each category.

2.5.3 Household characteristics

Table 2.4 shows that on average household heads have only 4.37 years of education and do not complete primary school. The average household has 4.94 persons, more female than male members, and is headed by a male (female heads only account for 22 percent of household heads) who is 45.14 years old. The average land holding of each household is 1.29 hectares held over 1.31 plots. The average distance from a household in each village to an all-weather road is approximately 3 kilometers. Information on household income is not included in Table 2.4, as household income in developing countries has large annual variations and is very imprecisely measured because households often hide information on their real income (Deaton, 1997). Instead, table 2.4 includes information on the value of durable goods, livestock, and number of rooms in the farmer's house as measures of household wealth. These measures are also used in Besley (1995).

2.5.4 Empirical models and econometric issues

The theoretical model discussed above suggests a regression of land investment for plot j, operated by household i, on land rights, and household and plot characteristics:

$$I_{ij} = \beta S_{ij} + \alpha P_j + \varphi Z_i + \varepsilon_{ij} \qquad (11)$$

where I_{ij} represents household i investment on plot j, S_{ij} is a binary variable denoting whether household i holds land with title or application receipt, P_j indicates plot j characteristics, and Z_i denotes household i characteristics. The specification of the investment equation will be more concrete with the inclusion of available measures of household and plot characteristics. Heterogeneity across households is important in

explaining household investment decisions. Furthermore, the variations in quality and location across plots also have an impact on land investment as well as households' efforts to enhance their rights to plots (Besley, 1995). Thus, the empirical analysis of land investment in this study includes all available variables measuring plot characteristics from Table 2.2 and household characteristics from Table 2.4. Soil quality is proxied by type of land, and access to an all-weather road is used to measure location and distance of plots. Normally, the plots are not far from household residences.

Land rights could, of course, be endogenous, such that land tenure security in period two is related to tenure security and land related-investment in period one. Failure to take either measurement error in land rights into account or to model the relationship correctly tends to bias estimates of the impact of land rights on land investment (Besley, 1995). Most previous econometric studies of this relationship used instrumental variable techniques to account for endogeneity of land rights. A few recent studies used matching regression techniques to account for this selection bias (Galiani & Schargrodsky, 2010; Field & Torero, 2006; Galiani & Schargrodsky, 2004).

There are several sensible instrumental variables for land rights that are well documented by the previous microeconomic studies. These are rights to transfer the plot, litigation over the plot, length of plot occupation, and mode of land acquisition (Markussen, 2008; Besley, 1995). While these instrumental variables are available in the CSES surveys, the analysis of land investment in this study uses the PSM method instead. The data support the use of this method, and below I discuss several advantages to using the PSM technique.

2.5.5 *Propensity score matching (PSM)*

The PSM method, initially proposed by Rosenbaum and Rubin (1983), has gained popularity in evaluating employment, education, and health programs (Caliendo & Kopeini, 2008). The method has been viewed as an alternative to experimental methods in the field of employment program evaluation if certain conditions are fulfilled (Peikes, Moreno, & Orzol, 2008; Heckman, Ichimura, Smith, & Todd, 1998). PSM is different from other matching methods because it produces a single score that summaries multiple characteristics. Its main advantage is the reduction of matching dimensionality (Peikes et al., 2008).

Despite its popularity, some researchers have warned of limitations. First, using this method requires "knowledge of the experimental impact estimates" to assess whether it produces unbiased estimates. Second, it requires "data on the right variables that would accurately predict program participation" (Peikes et al., 2008, p. 222; Smith & Todd, 2005). This method is data demanding and interpretation of results based on small samples of non-participants should be cautiously made because the process of matching requires the treatment and control group members with the same propensity scores to balance with respect to distributions of covariates covering the treatment and control samples. For this property to hold, a decent sample size is needed at each value of the propensity score. Thus, empirical studies, which rely on small samples, potentially bias the results or increase sampling errors (Bryson, Dorsett, & Purdon, 2002; Zhoa, 2000). Third, PSM estimation relies on the Conditional Independence Assumption (CIA) which cannot be tested. Thus, it is hard for researchers to justify whether they include all of the variables influencing participation and outcome (Bryson et al., 2002).

This study uses PSM to account for selection effects in household participation in Cambodia's program to convert *de facto* land claims into formal *de jure* land rights supported by a national land registry. The technique has not been widely used in land title program evaluation despite its popularity in program evaluations. The CSES survey utilized in this study allows the use of this method. The CSES contains information on most of the variables required to estimate the impact except soil quality, which is not included in the survey. However, CSES includes information on types of land, and this indicator can be used as a proxy for soil quality. The use of a soil quality proxy variable is common in other studies of property rights and land investment. Further, the data also contain sufficiently large samples of treatment and control households to perform matching.

2.5.6 *Estimation of propensity scores*

Estimation of propensity scores is a crucial task. Choice of model and variable to include in the logit selection model has to be carefully made (Caliendo & Kopeini, 2008).[4] For the choice of variables to include in the model, researchers should pay attention to relevant economic theory, previous empirical findings, and information about the institutional setting. Econometricians recommend that only variables that are unaffected by treatment assignment should be included in the model as matching strategies based on CIA. However, more variables should be included in the model when there is uncertainty about model specification (Caliendo & Kopeini, 2008; Smith & Todd, 2005; Sianeis 2004). Bryson et al. (2002) pointed out that inclusion of too many variables

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[4] Here the choice of model to estimate the probability of participation is not an issue, as treatment assignment is a dichotomous variable, and using either logit or probit would yield the same results.

could aggravate the common support problem as well as increase estimated standard errors.

The variables included in the propensity score estimates in this study are selected in the context of the empirical literature discussed in section 2.2. Since this analysis uses three different measures of land rights, the discussion of the results is divided into three panels. Panel A consists of estimated outcomes when a land title is used as a measure of secure land rights. Panel B provides the results when a combined measure of land title and application receipt is used. Panel C gives the outcomes when the application receipt is used. Table 2.5a, 2.6a, and 2.7a present estimated propensity scores derived from logit regressions of titled farms, a combined category, and application receipt farms.

The following analysis focuses on results from an estimation using land title as a measure of land rights. The estimated coefficient on human capital assets is positively associated with the propensity to obtain land title. One more year of education for the household head increases the chance of obtaining land title by 8.8 percent and is statistically significant at the 1 percent level. The ability to secure land title increases with age of the household head, with each additional year enhancing the propensity to obtain title by 2.74 percent (statistically significant at the 10 percent level). The results related to gender of household reflect the role of women in Cambodia as well as their contribution in securing land title. The estimated coefficient on number of female members in the household is positive. One more female member increases the propensity to obtain title by 5.13 percent and is statistically significant at the 5 percent level. Currently, in Cambodia, many young females from rural areas have migrated to the city or abroad to help relieve their rural household's burdens. Remittances from these women

might increase household consumption and upgrade living standards. This also has a positive effect on the household's propensity to obtain land title.

The estimated coefficients on the variables used to measure household wealth (value of durable goods and number of rooms in each household) are both positive. The estimated coefficient on the value of durable goods is statistically significant at the 1 percent level, but is very small. One more room in the farmer's house increases the probability of obtaining land title by 6.34 percent and is statistically significant at the 5 percent level. The estimated coefficient on the value of livestock is negative and statistically insignificant. The estimated coefficients on soil quality and access to an all-weather road are positive. Access to an all-weather road increases by 6.66 percent the probability of obtaining title and is statistically significant at the 1 percent level. The estimated coefficient on the size of land operated is not statistically significant.

The outcomes from regressions using application receipt and a combined land rights variable are mostly the same as those from the regression using land title as the measure of land rights. Two exceptions stand out. First, the estimated coefficient on the value of livestock becomes statistically significant at the 1 percent level when a combined land rights measure is used. In the study by Besley (1995), the estimated coefficient on value of livestock is also statistically significant but the impact is very small. Second, the estimated coefficient on size of land operated is negative and statistically significant at the 1 percent level when the application receipt is used as a measure of land rights. Outcomes vary across regressions for the estimated coefficients on various measures of soil quality.

Figures 2.2, 2.3, and 2.4 provide a histogram summarizing the estimated propensity scores of treatment and control groups. Visual comparison of the overlap between treatment and control groups in each bin provides one indication that the overlap is high enough to perform matching. In the next section, I discuss additional measures to tackle problems encountered with non-overlapping observations.

2.5.7 *Estimation of the effect of land rights through PSM*

Matching can be performed through nearest neighbor, radius, kernel, and stratification techniques to estimate the effect of *de jure* land rights on investment. Each method should provide the same outcome as the sample size becomes increasingly large (Bryson et al., 2002). The choice of matching techniques is crucial, however, when the sample size is small, as there is a tradeoff between bias and efficiency (Heckman, Ichimura, & Todd, 1997). Each method has its pros and cons and selection depends heavily on the nature of the data.

Nearest neighbor matching method involves matching treatment and control individuals who are closest in terms of their propensity scores. It can be performed with replacement and without replacement. Matching with replacement refers to multiple uses of untreated individuals, whereas in the latter case untreated individuals can only be matched with one treated individual. Allowing for matching with replacement increases the average quality of match and decreases bias. However, the efficiency of this method deteriorates as the distance (in estimated propensity scores) to the closest neighbor increases (Caliendo & Kopeinig, 2008).

The radius matching method allows for matches with the nearest neighbor within each caliper as well as all control individuals within the calipers. Individuals outside of the radius are dropped (Bryson et al., 2002). This method presents an opportunity to use as many control individuals within the calipers as possible and therefore allows additional information on good matches to be incorporated in the propensity score estimates. The pitfall of the radius method is that results are very sensitive to the width of the radius selected to perform the matching. The smaller the size of the radius, the more difficult it is to find a match within the range. Consequently, a large number of individuals may not pass the common support requirement (Caliendo & Kopeinig, 2008).

The stratification matching method divides the common support of propensity scores into a set of intervals. The effect is calculated by taking the mean difference in the outcomes between treatment and control individuals within each interval (Caliendo & Kopeinig, 2008; Smith & Todd, 2005). Kernel matching is a non-parametric matching method. It utilizes the weighted average of all individuals in the control group to create a counterfactual outcome. The advantage of this method is the lower variance which is achieved by using more information. One pitfall is that this method is prone to using observations that are bad matches (Caliendo & Kopeinig, 2008).

The analysis here uses more than one method to test whether the outcome is sensitive to the different methods applied. It discards all investment conducted before 1989 since its purpose is to look at the impact after the reform in 1989. Further, common support is enforced to improve the quality of matching as advised by Becker and Ichino (2002). A trimming method, used by Dehejia and Wahba (2002 and 1999), is also applied in this study. Comparison group propensity scores which lie below the minimum and

above the maximum of estimated scores in the treatment group are discarded. Trimming leads to 30 observations in the control group being excluded from the sample. The matching process in this study closely follows the guidelines set forth in Becker and Ichino (2002). When the balancing property is satisfied, then the matching process can be performed.

Checking whether the matching procedure is able to balance characteristics across treatment and comparison groups is suggested as the estimation is not conditioned on all covariates, rather on the propensity scores. The distribution of propensity scores in both groups should be similar. I focus on two measures of balance: t-test and bias. The t-test is used to check if there are significant differences in the covariate means for treatment and control groups. Table 2.5c, 2.6c, and 2.7c provide comparisons of the means of treated and control samples before and after matching. Before matching, there are differences in some covariate means but after matching the covariates are balanced in both groups.

Imbens and Wooldridge (2009) indicate that "the difference in averages by treatment status, scaled by the square root of the sum of the variances" is a better method to check for covariate balancing (Imbens & Wooldridge, 2009, p. 24). As suggested in Imbens and Rubin (2010), a rule of thumb is that the scaled mean difference should be less than 0.25. A larger number indicates that linear regression is sensitive to changes in specification. For all three measures of land rights, the normalized difference in averages for the matched and control covariates is less than 0.25. In general, the two measures of balance suggest the covariates for treated and control matched samples are balanced after matching.

Results are reported in Tables 2.5b, 2.6b, and 2.7b. First, the effect of land title on land investment is discussed. The estimated treatment effect of *de jure* land rights on land investment from propensity score matching suggests that, in line with modern theories of property rights, rights matter for land investment. Investment is about 1.5-1.7 percentage points higher for titled farms and the estimated coefficient on land rights is significant at the 5 percent level. The magnitudes of the effect vary when different matching methods are applied. However, in each method applied, the effect of land rights is positive and remains statistically significant.

When a combined measure is utilized, the results remain positive and statistically significant. Investment is about 1-1.1 percentage points higher for titled farms. The different magnitudes could be due to the number of controls used in performing matching, as some methods discard more observations in the group than other. As articulated earlier, each method has its pros and cons and depends on the nature of the data set. The outcomes from using application receipt as a measure for land rights remain positive in all matching methods applied but the estimated coefficient on land rights is not statistically significant at the 10 percent level.

The results above indicate that land tenure security is important for land investment. When land title or a combined measure of land title and application receipts is utilized, the estimated coefficient on the land rights variable is positive and statistically significant. When application receipts are used to measure property rights in land, the estimated coefficient is not statistically significant at the 10 percent level.

I check the sensitivity of the estimated results as estimation was made under the standard CIA or selection on observables assumption. It is a strong indentifying

assumption. A hidden bias may occur if individuals with the same observed covariates have different chances of receiving treatment. With this hidden bias, results are not robust (Caliendo & Kopeinig, 2008; Rosenbaum, 2002). Rosenbaum (2002) suggested using a bounding approach to address this problem since the magnitude of selection bias cannot be estimated with non-experimental data. This approach does not test the unconfoundedness assumption but provides the magnitude of the effect to which any results depend on this assumption (Becker & Caliendo, 2007, p. 72). Aakvik (2001) and Becker and Caliendo (2007) recommended using the Mantal and Haenszel test statistic if the outcome is a binary variable. According to Becker & Caliendo (2007), under the assumption of no hidden or unobserved selection bias, the odds radio is one ($\Gamma=1$). It implies that the unobserved variables have no impact on the probability of participation. If the odds radio equals two, it implies that individuals with the same observed covariates "could differ in their odds of receiving treatment by as much as a factor of two" (Becker & Caliendo, 2007, p. 73; Rosenbaum, 2002). There are two bounds in the output table: the Qmh$^+$ adjusts the MH test statistic downward for the case of positive unobserved selection and Qmh$^-$ for the case of negative unobserved selection. Under the assumption of no hidden bias ($\Gamma=1$), the Qmh test statistic is not significant at the 10 percent level for all measures of land rights. The results from this sensitivity analysis do not imply that *de jure* land rights have no effect on land investment. They only indicate that the findings are "sensitive to possible deviations from identifying unconfoundedness assumption" and it does not imply that CIA does not hold (Becker & Caliendo, 2007, p. 81).

The results reported in this chapter are smaller than those reported by other studies that found a positive link between land rights and investment. Besley (1995)

found that land rights in Ghana enhanced investment by 2.5 percent in an OLS estimation and 28 percent in an IV estimation, an effect that was statistically significant at the 5 percent level. The Abdulai et al. (2011) study reconfirmed previous findings for Ghana. They found that being an owner cultivator enhanced the propensity of investment in soil-improving measures between 11 and 49 percent. Deininger and Jin's (2006) study of Ethiopia showed that improvement in transfer rights increased investment in tree planting by 7 percent and in building terraces by 5.5 percent. Beside the studies from Africa, Alston et al.'s (1999) case study of Brazil's frontier found that title increased investment in land by 29 percentage points in the Altamira region. The empirical analysis in this study indicates that the estimated coefficient on land rights is statistically significant but very small relative to the estimates from other econometric studies of particular countries.

2.6 Conclusion

This study uses propensity score matching to empirically test the effect of *de jure* land rights on land investment after land reform in 1989. Matching results using land title and a combined measure reveal that there are positive links between *de jure* land rights and investment in land. Investment on titled farms is 1.5-1.7 percentage points higher than untitled farm. When application receipts are used as the measure of lands rights, the estimated coefficient on land rights is not statistically significant at the 10 percent level. This result indicates that land holders with application receipts do not view the rights adhering to the receipts as providing more land tenure security than a *de facto* claim. Results in this study are similar to other studies conducted in Asia, Latin America, and Africa that find a positive link between *de jure* land rights and agricultural outcomes.

However, the magnitude of the impact of land rights on land investment in this analysis is relatively small if compared to other studies of the field.

The paper also extends the discussion of issues in previous empirical studies of property rights related to measures of land investment, endogeneity of land rights, soil quality, and sample size. These issues have not been widely discussed previously and inconclusive results of studies measuring the impact of *de jure* land rights on investment may be related to these issues (Fenske, 2011; Deininger & Jin, 2006).

The findings in this study contribute to the empirical study on the relationship between *de jure* land rights and investment in low-income countries. Given the significance of investment to poverty alleviation in the long run, it is important to understand the role and the commitment of the government to implementation of its land titling programs. *De jure* rights were established in Cambodia but institutions registering and enforcing land rights did not function well. The failure of the central cadastral data registry to record land transfers and maintain an up-to-date record of land ownership is a huge problem (So, 2009). Moreover, informal land transfers continue (Chan et al., 2001). These problems clearly impede the sustainability and quality of the cadastral system and pose important obstacles for the future prosperity of Cambodia's farmers.

Table 2.1

Land investment: 1979-2004

Year	Digging well	Digging ditch	Terracing	Drainage construction	Soil reclamation	Growing orchard	Perennial trees	Others	Total
1979	23	112	1	15	21	70	67	14	323
1980	16	44	0	12	7	32	15	10	`136
1981	9	23	0	4	2	8	7	5	58
1982	16	17	0	8	10	13	16	21	101
1983	10	51	0	6	4	14	5	0	90
1984	7	7	0	1	2	15	7	3	42
1985	8	25	1	4	2	28	7	3	78
1986	7	7	0	0	2	9	6	1	32
1987	11	35	0	13	0	25	5	0	89
1988	7	4	1	1	1	10	4	0	28
1989	8	14	1	1	4	19	6	1	54
1990	19	9	1	7	5	20	8	0	69
1991	4	0	0	2	1	11	2	0	26
1992	14	5	0	0	4	2	5	2	32
1993	13	12	0	5	1	6	10	1	48
1994	10	5	0	4	3	9	8	1	40
1995	15	5	0	6	5	16	11	1	59
1996	5	19	0	0	1	15	9	2	51
1997	11	9	0	1	2	12	16	2	53
1998	20	21	0	2	7	31	14	2	97
1999	24	14	0	1	6	25	12	2	84
2000	34	19	0	5	17	35	17	10	137
2001	40	17	0	2	4	29	19	7	118
2002	34	20	2	1	7	26	16	13	119
2003	38	28	3	2	15	27	16	8	137
2004	12	2	1	1	3	13	5	5	42
Total	416	545	11	106	136	522	315	114	

Note: Each column represents a total number of land investment conducted by households on their plot from 1979 to 2004.
Source: All data are from CSES (2003-2004).

Figure 2.1

Land investment: 1979-2004
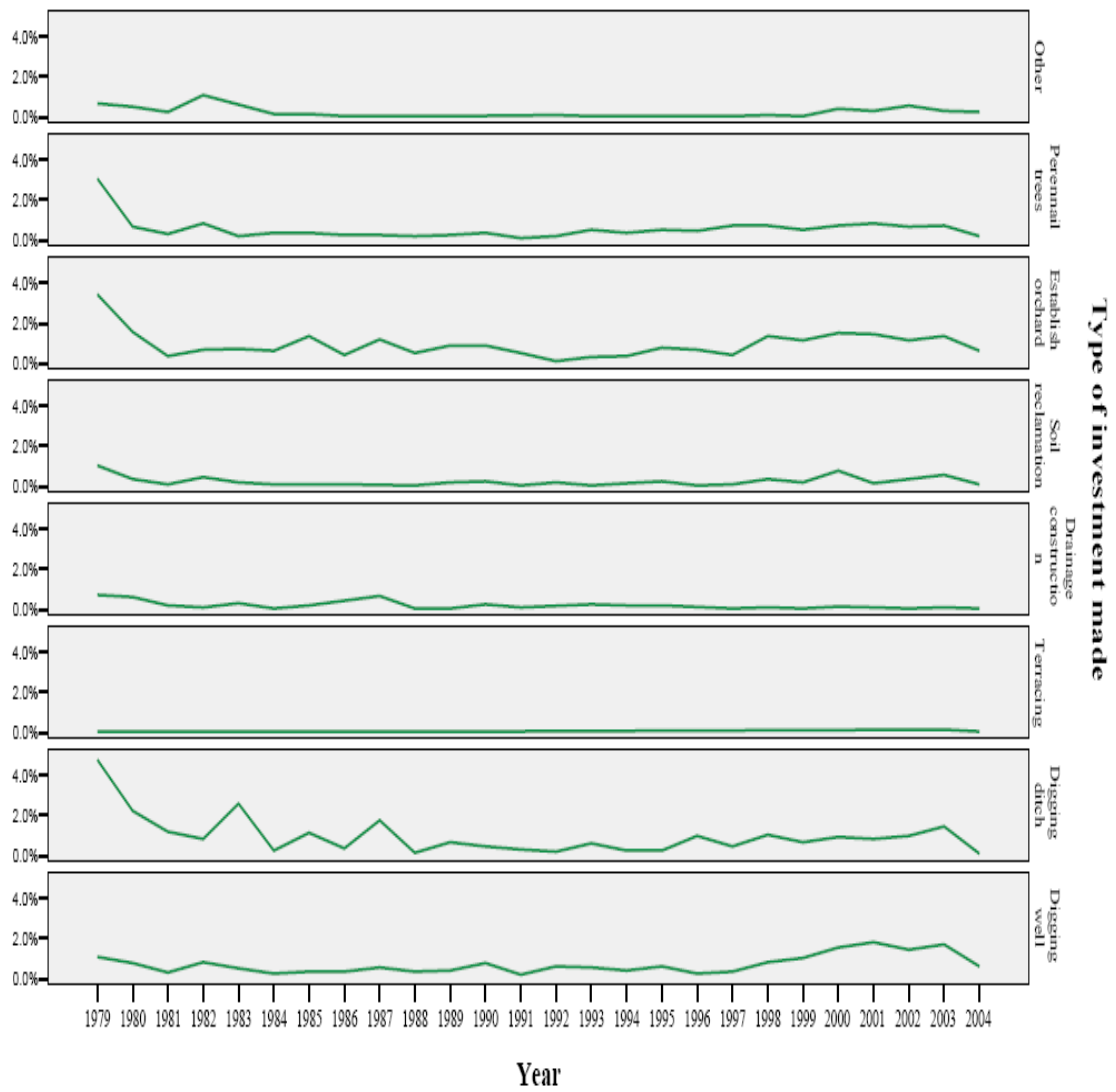
Note: Vertical axis represents a percentage of sample farms undertaking eight types of investment.
Source: All data are from CSES (2003-2004).

Table 2.2

Farm characteristics: Summary statistics

	Means	Std. Dev.
Type of document		
Land title certificate (%)	0.21	0.41
Application receipt (%)	0.24	0.43
Land investigation document (%)	0.01	0.11
Rental document (%)	0.00	0.06
Other documents (%)	0.02	0.12
Mode of acquisition		
Given by state (%)	0.45	0.50
Inherited from families (%)	0.32	0.47
Bought land (%)	0.12	0.33
Occupied for free (%)	0.06	0.24
Received from friend (%)	0.00	0.02
Rented plot (%)	0.03	0.18
Others (%)	0.00	0.08
Type of plot		
Wet land (%)	0.67	0.47
Dry land (%)	0.11	0.31
Wet and dry land (%)	0.01	0.11
Crop land (%)	0.14	0.35
Vegetable land (%)	0.02	0.14
Idle land (%)	0.02	0.14
Others type (%)	0.03	0.16
Irrigated land in dry season (%)	0.09	0.07
Irrigated land in wet season (%)	0.19	0.26
Irrigated land in dry and wet seasons (%)	0.05	0.09
Investment on plot since acquisition		
Digging well and ditch (%)	0.05	0.32
Terracing (%)	0.00	0.02
Drainage construction (%)	0.05	0.07
Soil reclamation (%)	0.00	0.08
Establish orchard (%)	0.03	0.16
Perennial trees (%)	0.02	0.13
Others (%)	0.00	0.08
Others		
Duration of tenure (Years)	18.14	8.64
Ever litigated on plot (%)	0.02	0.13
Plot can be used as collateral (%)	0.77	0.42
Number of observations	19,764	

Source: All data are from CSES (2003-2004).

Table 2.3

Household loans: Summary statistics

	Mean	Std. Dev.
Purpose of loan		
Agricultural purpose (%)	0.24	0.43
Household consumption (%)	0.32	0.47
Household medical expense (%)	0.12	0.33
Sources of loan		
Relative in Cambodia (%)	0.27	0.44
Friend (%)	0.14	0.35
Money lender (%)	0.25	0.43
Bank (%)	0.036	0.18
NGO[a] (%)	0.16	0.37
Amount average borrowed[b] (Reil)	953,324	3,706,033
Monthly interest rate (%)	0.04	0.08
Number of observations	8,024	

Note: a. NGO stands for non-governmental organization.
         b. Average amount borrowed by households in Cambodian currency.
Source: All data are from CSES (2003-2004).

Table 2.4

Household characteristics: Summary statistics

	Means	**Std. Dev.**
Education of household head (years)	4.37	4.02
Age of head (years)	45.14	13.74
Female headed (%)	0.22	0.41
Household size (number)	4.94	1.98
Male member aged 10 to 14years old (number)	0.36	0.60
Female member aged 10 to 14years old (number)	0.35	0.59
Male members aged 15 to 55 years old (number)	1.29	0.94
Female members aged 15 to 55 years old (number)	1.45	0.90
Male members aged over 55 years old (number)	0.19	0.39
Female members aged over 55 years old (number)	0.26	0.45
Value of live stock (Reil)[a]	1,437,520	2,688,887
Value of durable goods (Reil)	1,977,184	6,197,216
Number of rooms in home	1.36	0.78
Number of plots per household	1.31	1.24
Size of land operated (hectares)	1.29	0.45
Access to all-weather road (kilometer)	3.02	14.51
Number of observations	14,984	

Note: a. Average value of live stock and durable goods of household in Cambodian currency.
Source: All data are from CSES (2003-2004).

Panel A: Land title

Table 2.5a

Propensity score estimation result for titled farm regression

Covariates	Estimated coefficients	z-statistics
Education of household head	0.090	7.78
Age of head	0.030	2.92
Female headed	0.055	1.06
Member age below 10	-0.088	-0.72
Male members 10-55	0.002	0.10
Female members 10-55	0.050	2.87
Value of live stocks (*1000)	-0.005	-1.24
Value of durable goods (*1000)	0.002	4.22
Number of rooms in home	0.063	2.11
Size of land operated	0.007	1.78
Wet land	0.261	2.79
Crop land	0.984	6.11
Wet and dry land	0.093	1.00
Access to all-weather road	0.436	9.51
PseudoR^2	0.016	
Log-Likelihood	-9505.31	
Chi 2	300.73	
Number of observations	17,166	

Source: All data are from CSES (2003-2004).

Table 2.5b

Results from PSM: Land titles

		Number of cases	ATT[a]	*t*-statistic
Radius matching	Treatment	3,830	0.017	2.89
	Control	12,987		
Kernel matching	Treatment	3,949	0.015	2.75
	Control	14,815		
Stratification matching	Treatment	3,948	0.016	3.06
	Control	14,816		

Note: a. Average effect of treatment on treated (ATT)
      b. Bootstrapping applied with the results reported above.

Figure 2.2

Estimated propensity scores: Land titles
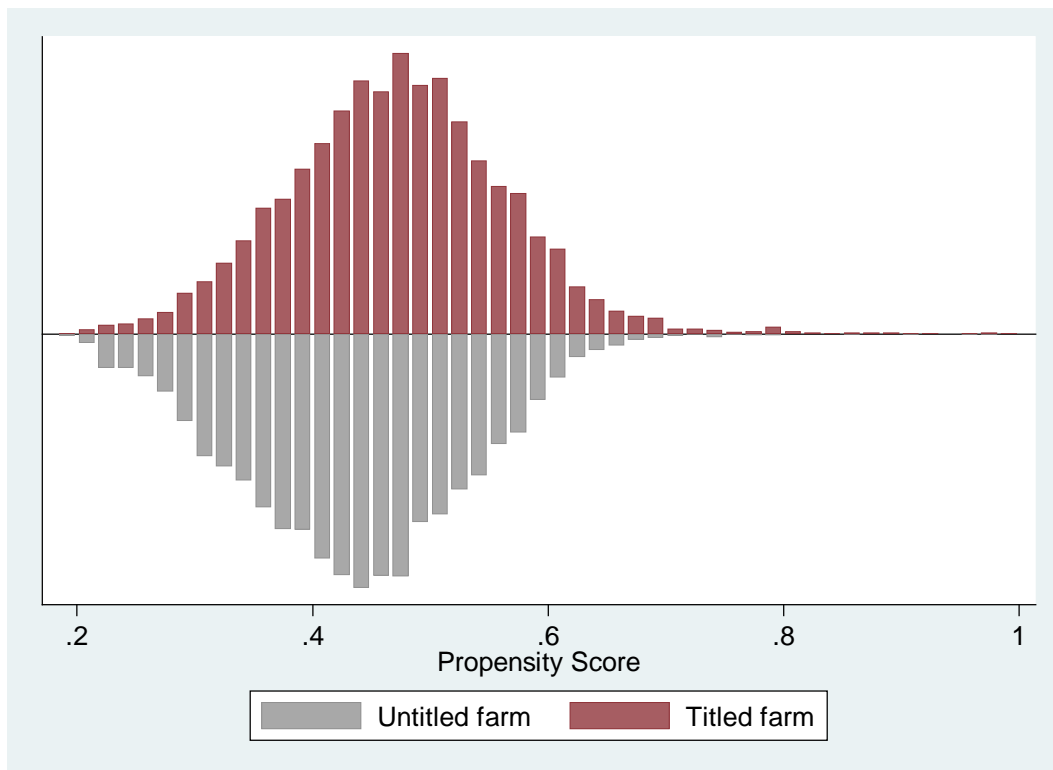
Table 2.5c

Treated vs. controls (land titles)

Variables		Treated mean	Control mean	% bias	*t*-sta.	p>/t/
Education of head	Unmatched	4.351	3.952	10.8	6.000	0.000
	Matched	4.350	4.281	1.8	0.81	0.420
Age of head	Unmatched	47.054	44.909	15.8	8.78	0.000
	Matched	47.051	46.87	1.3	0.60	0.548
Female headed	Unmatched	0.180	0.179	0.1	0.04	0.971
	Matched	0.180	0.187	-1.9	-0.82	0.411
Member below 10	Unmatched	1.171	1.249	-5.1	-2.83	0.005
	Matched	1.171	1.196	-1.6	-0.71	0.479
Male members 10-55	Unmatched	2.023	1.935	7.4	4.12	0.000
	Matched	2.023	2.007	1.4	0.61	0.544
Female members 10-55	Unmatched	2.239	2.109	11.5	6.44	0.000
	Matched	2.239	2.217	2.0	0.86	0.390
Value of live stocks	Unmatched	6.394	6.355	1.5	0.83	0.407
	Matched	6.394	6.411	-0.6	-0.28	0.778
Value of durable goods	Unmatched	6.153	5.856	17.6	9.86	0.000
	Matched	6.153	6.097	3.3	1.51	0.132
Number of rooms in home	Unmatched	1.333	1.271	9.8	5.71	0.000
	Matched	1.332	1.305	4.4	1.88	0.06
Size of land operated	Unmatched	1.966	1.693	4.3	3.11	0.002
	Matched	1.858	1.790	1.1	0.68	0.496
Wet land	Unmatched	0.706	0.689	3.7	2.04	0.041
	Matched	0.705	0.708	-0.7	-0.30	0.765
Crop land	Unmatched	0.120	0.133	-4.0	-2.22	0.026
	Matched	0.120	0.118	0.5	0.22	0.826
Wet and dry land	Unmatched	0.020	0.093	9.4	5.95	0.000
	Matched	0.020	0.018	1.8	0.71	0.478
Access to all-weather road	Unmatched	2.284	3.713	-10.6	-5.46	0.000
	Matched	2.285	2.408	-0.9	-0.52	0.602
On common support	Untreated	14,817				
	Treated	3,948				
Off common support	Untreated	0				
	Treated	1				

Panel B: Land title and application receipt

Table 2.6a

Propensity score estimation result of a combined measure regression

Covariates	Estimated coefficients	z-statistics
Education of household head	0.13	13.79
Age of head	0.013	10.64
Female headed	0.19	4.44
Member age below 10	-0.012	-1.22
Male members 10-55	0.001	0.08
Female members 10-55	0.058	4.12
Value of live stocks (*1000)	0.09	3.63
Value of durable goods (*1000)	0.001	6.73
Number of rooms in home	0.10	3.76
Size of land operated	0.003	0.92
Wet land	0.068	1.10
Crop land	0.52	3.48
Wet and dry land	-0.078	-1.07
Access to all-weather road	0.37	10.48
PseudoR^2	0.027	
Log-Likelihood	-12567.77	
Chi 2	705.20	
Number of observations	17,166	

Source: All data are from CSES (2003-2004).

Table 2.6b

Results from PSM: Combined measure

		Number of cases	ATT[a]	*t*-statistic
Radius matching	Treatment	7,879	0.010	2.04
	Control	9,165		
Kernel matching	Treatment	8,464	0.011	3.47
	Control	10,270		
Stratification matching	Treatment	8,464	0.010	2.70
	Control	10,270		

Note: a. Average effect of treatment on treated (ATT)
    b. Bootstrapping applied with the results reported above.


Figure 2.3

Estimated propensity scores: Combined measure
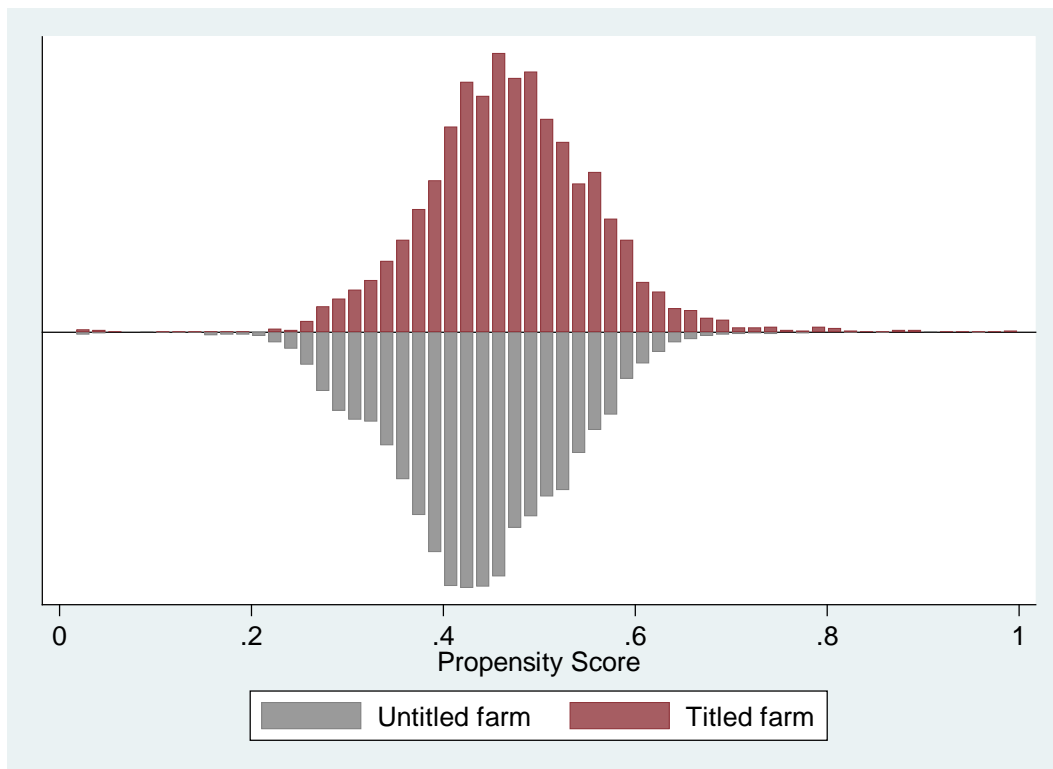
Table 2.6c

Treated vs. controls (combined measure)

Variables		Treated mean	Control mean	% bias	*t*-sta.	p>/t/
Education of head	Unmatched	4.343	3.783	15.1	10.30	0.000
	Matched	4.343	4.378	0.6	0.41	0.678
Age of head	Unmatched	46.693	44.262	17.9	12.17	0.000
	Matched	46.693	46.585	0.8	0.52	0.602
Female headed	Unmatched	0.185	0.174	2.8	1.91	0.056
	Matched	0.185	0.186	-0.2	-0.10	0.918
Member below 10	Unmatched	1.180	1.277	-6.3	-4.27	0.000
	Matched	1.180	1.190	-0.7	-0.46	0.649
Male members 10-55	Unmatched	2.004	1.912	7.7	5.28	0.000
	Matched	2.004	2.001	0.3	0.20	0.845
Female members 10-55	Unmatched	2.215	2.071	12.7	8.66	0.000
	Matched	2.215	2.206	0.6	0.38	0.700
Value of live stocks	Unmatched	6.341	6.355	-1.6	-1.08	0.27
	Matched	6.341	6.399	-2.2	-1.43	0.15
Value of durable goods	Unmatched	6.331	5.758	21.2	14.48	0.000
	Matched	6.331	6.085	1.7	1.13	0.257
Number of rooms in home	Unmatched	1.329	1.246	13.5	9.31	0.000
	Matched	1.329	1.314	2.4	1.46	0.523
Size of land operated	Unmatched	1.767	1.737	0.6	0.41	0.681
	Matched	1.767	1.811	-0.9	-0.57	0.569
Wet land	Unmatched	0.696	0.689	1.4	0.94	0.345
	Matched	0. 696	0.700	-1.0	-0.63	0.528
Crop land	Unmatched	0.125	0.135	-3.0	-2.04	0.041
	Matched	0.125	0.121	1.2	0.80	0.423
Wet and dry land	Unmatched	0.015	0.008	6.0	4.17	0.000
	Matched	0.015	0.013	1.2	0.73	0.464
Access to all-weather road	Unmatched	0.794	0.713	18.8	12.75	0.000
	Matched	0.794	0.795	-0.3	-0.20	0.841
On common support	Untreated	10,287				
	Treated	8,479				
Off common support	Untreated	0				
	Treated	0				

Panel C: Application of receipt

Table 2.7a

Propensity score estimation result of application receipt farm regression

Covariates	Estimated coefficients	z-statistics
Education of household head	0.13	11.01
Age of head	0.021	2.24
Female headed	0.225	4.20
Member age below 10	-0.012	-1.00
Male members 10-55	-0.003	-0.16
Female members 10-55	0.042	2.41
Value of live stocks (*1000)	0.04	5.51
Value of durable goods (*1000)	0.03	5.06
Number of rooms in home	0.110	3.48
Size of land operated	-0.040	-4.72
Wet land	-0.064	-0.88
Crop land	-0.138	-1.62
Wet and dry land	0.054	0.28
Access to all-weather road	0.37	10.48
PseudoR^2	0.023	
Log-Likelihood	-8003.54	
Chi 2	421.87	
Number of observations	14,810	

Source: All data are from CSES (2003-2004).

Table 2.7b

Results from PSM: Application receipts

		Number of cases	ATT[a]	*t*-statistic
Radius matching	Treatment	4,225	0.007	1.15
	Control	8,624		
Kernel matching	Treatment	4,524	0.008	1.85
	Control	10,286		
Stratification matching	Treatment	4,524	0.006	1.06
	Control	10,286		

Note: a. Average effect of treatment on treated (ATT)
      b. Bootstrapping applied with the results reported above.

Figure 2.4

Estimated propensity scores: Application receipts
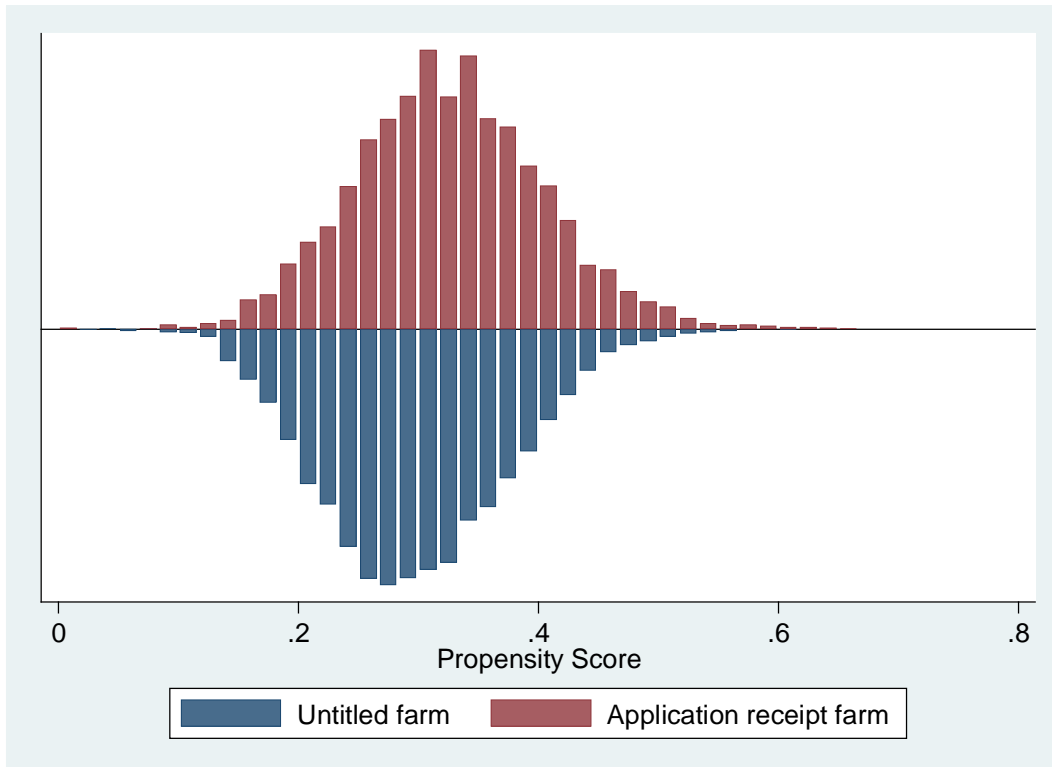
Table 2.7c

Treated vs. controls (application receipts)

Variables		Treated mean	Control mean	% bias	*t*-sta.	p>/t/
Education of head	Unmatched	4.33	3.783	14.8	8.27	0.000
	Matched	4.33	4.353	-0.6	-0.31	0.755
Age of head	Unmatched	46.375	44.261	15.5	8.68	0.000
	Matched	46.375	46.223	1.1	0.53	0.594
Female headed	Unmatched	0.190	0.175	4.1	2.33	0.020
	Matched	0.190	0.196	-1.4	-0.66	0.506
Member below 10	Unmatched	1.188	1.277	-5.7	-3.19	0.001
	Matched	1.188	1.182	0.4	0.21	0.836
Male members 10-55	Unmatched	1.987	1.912	6.2	3.54	0.000
	Matched	1.987	1.964	1.9	0.92	0.358
Female members 10-55	Unmatched	2.191	2.070	10.6	5.98	0.000
	Matched	2.191	2.181	0.8	0.40	0.693
Value of live stocks	Unmatched	2478.4	2120.4	-3.4	-1.94	0.052
	Matched	2478.4	2371.5	1.8	0.82	0.410
Value of durable goods	Unmatched	6.075	5.757	19.1	10.69	0.000
	Matched	6.075	6.055	1.2	0.58	0.561
Number of rooms in home	Unmatched	6.291	6.382	12.7	7.38	0.000
	Matched	6.291	6.243	2.0	0.90	0.367
Size of land operated	Unmatched	1.558	1.737	-5.6	-3.17	0.002
	Matched	1.558	1.652	-2.9	-1.42	0.156
Wet land	Unmatched	0.688	0.689	-0.3	0.94	0.345
	Matched	0. 688	0.686	0.3	1.70	0.089
Crop land	Unmatched	0.129	0.136	-1.7	-2.04	0.041
	Matched	0.129	0.135	-1.5	-0.59	0.554
Wet and dry land	Unmatched	0.010	0.008	1.5	4.17	0.000
	Matched	0.010	0.010	-0.7	-0.17	0.388
Access to all-weather road	Unmatched	0.775	0.713	14.2	7.84	0.000
	Matched	0.775	0.790	-3.6	-1.79	0.074
On common support	Untreated	10,286				
	Treated	4,524				
Off common support	Untreated	0				
	Treated	0				

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CHAPTER THREE

PROPERTY RIGHTS IN LAND AND HOUSEHOLD CONSUMPTION

3.1 Introduction

For some time now, the argument that *de jure* land rights would lead to a range of social benefits has led development practitioners to advocate for land reform programs oriented towards registration of private land rights. The potential social benefit of *de jure* land rights stems from better incentives for land investment, better access to credit markets, and the ability to secure land market transactions. Secured land rights allow legitimate owners of land to enjoy the fruits of investment in their land (Besley, 1995; Alchian & Demsetz, 1973; Demsetz, 1967). Similarly, clear proof of ownership of the land allows legitimate land owners to access formal credit markets to finance investment in the land due to their ability to post land as collateral (Feder & Nishio, 1998). Further, registered *de jure* land rights allow for secured transfer of land from inefficient to efficient users (Jacoby & Minten, 2007).

Previous studies have posited that *de jure* land rights reform in developing countries had the potential to reduce poverty and enhance economic growth (World Bank, 1975; Besley & Burgess, 2000; Deininger, 2003; Field, 2007). *De jure* enforcement and titling of arable lands are often posited as factors that facilitate low-income households climbing out of poverty by allowing land holdings to serve as collateral for loans to improve farm productivity and to smooth consumption of farm households (De Soto, 2000).

The increases in land investment, the greater access to capital markets, and the improvement in the functioning of land rental and sales markets can create an enabling environment for overall economic growth as well as improve the farm household's well-being. Numerous empirical studies of the impacts of establishing *de jure* land rights have found, however, that the impacts vary widely across countries. Some studies indicated a positive link between *de jure* land rights and land investment (Jacoby, Li, & Rozelle, 2002; Alston, Libecap, & Mueller, 1999; Besley, 1995), as well as access to credit markets (Field & Torero, 2006; Carter & Olinto, 2003; Feder, Onchan, Chanlamwong, & Hongladarom, 1988) while others did not (Jacoby & Minten, 2007; Migot-Adholla, Hazell, Blarel, & Place, 1991). Over the last decade, the literature studying the impact of *de jure* land property rights has greatly expanded its scope, estimating the effect of *de jure* land rights on labor supply, child health, housing, and human capital investments (Galiani & Schargrodsky, 2010; Field, 2007; Galiani & Schargrodsky, 2004). These studies have typically provided evidence in support of the theory of *de jure* property rights in land. Other studies indicated that land reform and increased access to land have positive and statistically significant impacts on poverty reduction and welfare for a broad spectrum of farm households (Besley & Burgess, 2000; Finan, Sadoulet, & de Janvry, 2005).

This Chapter examines the relationship between *de jure* land rights and household consumption by using data from the 2003-2004 Cambodia Socio-Economic Survey (CSES) to estimate this relationship. The survey data were collected during a period when the country's economy was growing relatively smoothly. From 2000 to 2005, the country did not experience a major natural disaster, drought, large economic fluctuation,

or political upheaval, all of which could have dramatically affected household livelihoods. The Chapter's empirical analysis uses three different measures of *de jure* land rights—the households that possess land plots with land titles, with land titles or application receipts, and just application receipts—to estimate the effect. To account for endogeneity of *de jure* land rights, the empirical analysis uses instrumental variable estimation techniques.

The aim of the study is to provide new evidence on the impact of formalizing land rights on household consumption in low-income countries, a topic that has not been widely studied yet. The findings should also contribute to the broader empirical literature on *de jure* land rights in Cambodia. Most studies of *de jure* land rights in Cambodia have examined various issues pertaining to the reform process including problems related to capacity of land institutions, conflicts over land rights, and land registration. Most are qualitative in nature. This study estimates the impact of formalizing land rights on a household's consumption using one regression model that does not account for endogeneity of land rights and another that does. I find that the household's choice to obtain *de jure* land rights results in a statistically significant increase in household consumption expenditures in regression estimates that do not account for endogeneity of *de jure* rights. When the regression includes instruments for *de jure* land rights, the estimated impact on household consumption becomes even larger.

3.2 Land reform and poverty reduction: A literature review

Access to land is the main source of farmers' livelihood and their assurance of household well-being. Secured access to land provides a means of subsistence through

crop production and access to credit for land investment. In many agrarian economies that experience a transition to a non-farm based economy, insecure access to land poses a major challenge to rural livelihoods and increases the severity of poverty among the rural population. Thus, ensuring that people have secure access to land is a key to poverty reduction, improvement of household well-being, and enhancement of economic growth (Deininger, 2003).

The importance of land tenure security has made land policy reform one of the key policy issues in many developing countries. Land reform encompasses a broad array of policy issues and is not an easy task. Large-scale land reforms are often entangled with political uprisings that stem, in part, from rising landlessness and inequality in land holdings. In this context, land reform programs aim to address food security and avoid social unrest by making land available to the landless and land poor families. Such reforms imply the redistribution of land from landlords and land speculators to those who physically cultivate it and to those who experience inadequate access to food (Barraclough, 1991).

The content of land reform varies across countries and is driven by specific local needs, although the basic idea of land reform is common to all countries. Land reform in Latin America has meant redistribution of land resources to rural populations or changes in the size of landholding whereas in many parts of Asia, land reform has meant making land available to the tillers (Maxwell & Wiebe, 1999). In many of the post-communist states, including Cambodia, land reform entails two stages: (1) the privatization of land holdings and (2) the improvement of the institutional mechanism that protects and registers private property rights in land. The reform that involves privatization of land

often occurred in the context of withdrawing communist ideology at the end of the cold war and was designed to increase farmers' sense of ownership, promote productivity on land, and increase conservation. Land privatization requires that a mechanism to govern private property rights be established so as to ensure security of private land holdings and to support the land market. Land tenure security reform is typically associated with this latter stage of reform: land registration and titling (So, 2009). Thus, the examination of the relationship between land reform and social well-being involves the examination of how a land registration and titling program affects tenure security, thereby generating other benefits detailed by proponents of private property rights, including increases in land investment, better access to credit markets, and secured land market transactions.

Empirical literature on the relationship between land registration and social well-being can be categorized into two groups. The first group provides empirical testing of the theory that tenure security leads to increasing long-term land investment, better access to credit, and secure land market transactions. Results from different countries are mixed. Studies from Thailand and Brazil indicate a positive relationship between land tenure security and investment in land (Alston et el., 1999; Feder et al., 1988). Some studies further emphasize that land title facilitates household access to credit markets (Field & Torero, 2006; Feder et al., 1988). Findings from Ghana and Ethiopia provide similar results: tenure security increases land investment (Goldstein & Udry, 2008; Deininger & Jin, 2006; Besley 1995). Studies in Sub-Sahara Africa do not, however, support these hypotheses (Jacoby & Minten, 2007; Braselle, Gaspart, & Platteau, 2002; Place & Migot-Adholla, 1998; Place & Hazell, 1993; Migot-Adholla et al., 1991). Further, a case study of Paraguay's land titling program indicated that small farm holders

still had difficulty accessing formal credit markets after the reform was implemented (Carter & Olinto, 2003).

The second group of literature extends the empirical testing of the implications of the theory to include the indirect impacts that land registration may have on other dimensions of social well-being. Various findings indicate that land reform programs geared towards increasing security of land tenure have been associated with increases in household labor supply, housing improvements, increases in child educational attainment and child health, and declines in household size (Galiani & Schargrodsky, 2010; Field, 2007; Galiani & Schargrodsky, 2004). Other studies found that land reform programs reduced poverty and enhanced household welfare (Besley & Burgess, 2000; Finan et al., 2004). This study further expands on the second group of literature by examining whether establishment of *de jure* land rights in Cambodia led to an increase in social well-being as measured by consumption of individual households.

3.3 Land reform and poverty reduction in Cambodia

The agenda for land reform in Cambodia is listed in the National Strategic Development Plan (NSDP) as a tool to reduce poverty and enhance economic growth (NSDP, 2009). With a series of land reforms, most households were expected to enjoy such benefits as increases in land tenure security, access to credit markets, greater land investment, and increased agricultural productivity. Poor and vulnerable groups were expected to gain the most from the reforms (World Bank, 2002). At a glance, land reform in Cambodia is in line with several elements stated in the theory as well as successful practices of land titling programs in neighboring countries. However, some researchers

have expressed concerns over the social benefits of *de jure* land rights because the number of land disputes rose after the reform started and was still in progress, although this may have been due in part to an increase in land value and economic expansion (Chan et al., 2001). Between 1992 and 1993, the United Nations Transitional Authority in Cambodia (UNTAC) received many complaints related to boundary issues and land grabs by civilians and soldiers (So, 2009; Ledgerwood, 1998). The appeals court received 1,325 land dispute cases between 1995 to mid-1999; in 2001 alone, the court received 1,310 cases (Cooper, 2002). The data from CSES 2004 indicated that approximately 2% of cultivated plots were litigated plots.

Other challenges to land reform in Cambodia are the capacity of land governance institutions, infrastructure in rural areas, and access to formal credit market. Although the land reform in 2002 aimed to strengthen institutional capacity so that the full benefit of land titling could be realized, land governance institutions continued to perform poorly. The complex bureaucratic procedure required to register land ownership transfers and the corruption associated with this registration process have pushed households away from the formal procedures for transferring registered *de jure* land titles. Instead, households have continued to use traditional processes for transferring land, as the process is easier and entails lower cost to the parties. As a result, land ownership records quickly are becoming outdated, threatening the overall effort to build a centralized land registry through the SLR and reducing the value of a *de jure* title (So, 2009; Chan et al., 2001).

Poor infrastructure in rural areas is another bottleneck to the improvement of living conditions of rural households, as it prevents farmers from distributing their products to market on time. Access to market information is very limited. The average

distance to an all-weather road is approximately 2.64 km, a taxi-stop 5.42 km, and a bus-stop 17.30 km (see table 3.1). With only a low-quality dirt road available to most farmers, these considerable distances reduce the benefit from land titling.[1] Furthermore, access to formal credit markets by farmers with titled lands has not yet lived up to expectations. Table 3.2 indicates that households with land titles and outstanding loans tend to borrow from informal sources such as friends, relatives, and money lenders rather than commercial banks. The complicated procedures imposed by commercial banks together with a limited knowledge of the formal credit system by many households discourage them from obtaining loans from formal credit institutions. Among households who borrowed from formal credit institutions, only about 24 percent used their loans for agricultural purposes. The remainder used loans for other purposes such as household consumption (32%) and medical emergencies (12%). Several qualitative studies indicate that expenditures for medical emergencies and household consumption often are associated with a household's sale of its lands and subsequently becoming landless. Lands have been sold at fire sale prices to finance emergency needs (Kenjiro, 2005; Damme, Leemput, Por, Hardeman, & Meessen, 2004; Huy, Wichmann, Beatty, Ngan, Duong, Margolis, & Vong, 2009).

In spite of the several challenges discussed above, some bright sides of the reform can be noted. A recent empirical study indicates that a *de jure* title for farm land in Cambodia is positively correlated with a farm's productivity and value (Markussen, 2008). Despite findings from various qualitative studies that land reform in Cambodia yielded mixed results, Cambodia's poverty rate continued to fall after the program was

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[1] After the civil war, infrastructure was heavily damaged throughout the country. New infrastructure investment has, however, been concentrated in urban areas.

implemented, declining from 47% in 1994 to 35% in 2004 and to 30% in 2007 (World Bank, 2008). Further, GDP growth also increased during the land reform period, rising from an average annual rate of 7% over the 1994 to 2002 period (during the implementation of the land reform program) to 8% over the 2003 to 2009 period after implementation of the land reform programs.[2] Of course, there were obviously many other factors besides land tenure security that caused Cambodia's GDP to increase and its poverty rate to decline after land reforms were implemented. This Chapter's main goal is to provide a quantitative estimate of the extent to which the property rights reform affected household well-being in Cambodia at the time of the 2004 CSES survey, roughly fourteen years after implementation of land reform began in 1989.

3.4 Empirical analysis and econometric issues

3.4.1 Empirical model

The empirical model utilized in this Chapter is based on a theoretical model developed by Finan et al. (2004) which I modify to incorporate land tenure security into their production function to fit the particular focus of this study. Finan et al. (2004) derived a specification of the household income equation from a standard agrarian household production model which yields an estimate of the effect of the size of landholding on household income. They examined the economic return to land in the context of multiple market imperfections. In their model, a household maximizes income by choosing time allocation and purchased inputs:

$$\max_{l_f, l_o, I} pf\left(l_f, I, R, H\right) - qI + wg(l_o) + r(qI - K - wg(l_o))$$

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[2] Table 1.1 in Chapter One contains information on GDP growth rates from 1994 to 2009.

s.t.

$$l_{o+}l_f \geq L, (l_o \geq 0, l_o \geq 0)$$

$$K + wg(l_o) + \theta(R) \geq Iq \qquad (1)$$

where l_f, l_o, and L denote on-farm labor, off-farm labor, and total hours of labor per year; $g(l_o)$ is the number of days worked as a function of off-farm labor supplied ($g' > 0$ and $g'' < 0$); I, q and p denote unit of input, market price of input, and market price of output; $f(l_f, I, R, H)$ is the production function where H represents the set of household characteristics that affects the return on productive assets; R represents the amount of land cultivated; K is the initial capital; $\theta(R)$ is "the capital available at an interest rate r to a household with land endowment R"; and Y denotes household income.

Forming the LaGrangian, the first-order conditions are:

$$pf_L = w(1 + r + \lambda)g'$$

$$pf_I = w(1 + r + \lambda)$$

$$\lambda[K + wg(l_o) + \theta(R) - Iq] = 0 \qquad (2)$$

Let the superscript (*) indicate the value of the choice variable that maximizes the household's income, i.e., is the solution to the household's income maximization problem above. Then the income equation can be written as:

$$Y = pf(l_f^*, I^*, R, H) - qI^*(1 + r) + w(1 + r)g(l_0^*) + rK$$

$$= \psi(p, q, r, w, L, K, R, H)$$

$$\frac{dY}{dR} = pf_R + [(pf_L - w(1 + r)g']\frac{dl_f^*}{dR} + [pf_I - q(1 + r)]\frac{dI^*}{dR}$$

$$= pf_R + \lambda g'\frac{dl_f^*}{dR} + pf_I + q\lambda\frac{dI^*}{dR} \qquad (3)$$

The income equation generated from this household production model is a function of input and output prices, the household's endowment of productive assets, and other parameters that have an impact on the return to assets. Finan et al. (2004) discussed two cases for analyzing the effect of the household's land holdings on its income. In the first case, capital markets are assumed to be perfect and "the marginal value of land is simply the value of its marginal product". In the second case, both labor and credit markets are assumed to be imperfect. As a result, increases in the size of land holdings have both a direct and an indirect impact on household income. More land increases production, gives additional flexibility in the allocation of production inputs, increases labor allocated to on-farm agriculture work, and decreases the household's unemployment rate. As the size of the household's land holding increases, "the credit constraint may either tighten or loosen depending on the relative increase in credit availability and on the demand for inputs". In addition, an increase in household landholding in a region with thin labor markets will increase the marginal value of household labor and reduce the gap between the household's shadow wage and the market wage (Finan et al., 2004, p. 31).

The household production model in Finan et al. indicates that any factor that affects the return to the productive assets of the household will affect its income. Their theoretical model focuses on the link between landholding and income and implicitly assumes that land tenure is fully secure. Lóapez and Valdés (2000) posited that poor famers in Latin America hold approximately 1-5 hectares of land and noted even a holding of five hectares might be insufficient to allow Latin American farmers to consume above the poverty line without other sources of income if their land tenure was

not fully secure. Lóapez and Valdés noted that most of the poorest farmers in the Latin American countries they studied did not have title to their lands. As a consequence, farmers cannot use their land as collateral to finance farm investment. Without land title, the market value of the farmers' lands will be lower, and this hampers the ability of households to exit poverty (Lóapez & Valdés, 2000). Cambodia also faces these particular issues. In the Cambodian context, land tenure security is one factor that affects household income. If a farm household's land is confiscated, it will lose the portion of its income generated from this factor.

I incorporate a land tenure security variable into the household production function described above, to understand how it affects household income. Let $\tau \in (0,1)$ denote the probability that land can be seized by either the government or a private party and S is a variable measuring land tenure security; the probability that land is not being expropriated is an increasing function of land tenure security; the probability of expropriation function is $\tau(S)$; it is assumed that $\tau'(S) > 0$. The household income equation (3) can be rewritten as:

$$Y = pf\big(l_f^*, I^*, R, H, \tau(S)\big) - qI^*(1+r) + w(1+r)g(l_0^*) + rK$$

$$= \psi(p,q,r,w,L,K,R,H,\tau(S))$$

$$\frac{dY}{dS} = pf_S\tau'(S) > 0 \qquad (4)$$

When $\tau(S)$ enters the production function, the income equation is a function of input and output prices, the household's endowment of productive assets, i.e., the size of land holding and land tenure security, and other parameters that have an impact on the return to assets. Equation (4) implies that household income is positively associated with land tenure security.

As its measure of household well-being, this Chapter uses household consumption rather than household income, both of which are frequently used to measure this concept in empirical studies. I use consumption because it is a more reliable measure in comparison to income in a society where the majority of households work in agriculture or are self-employed. Whereas household income suffers from large measurement errors and is subject to large annual fluctuations, consumption is more reliable because households adjust their borrowing, saving, and mutual insurance to smooth consumption over time (Ravallion, 1996; Deaton, 1997). Additionally, household consumption data sets in developing countries are less subject to measurement error than income, as households may hide information on their real income to avoid taxes (Deaton, 1997).

3.4.2 Regression Estimates

The model discussed above suggests a regression of household i consumption on land rights, household i characteristics and demographics, and household i landholding:

$$C_{iv} = \alpha_v + \alpha_1 T_{iv} + \alpha_2 Z_{iv} + \alpha_3 L_{iv} + \varepsilon_{iv} \quad (5)$$

where C_{iv} is a measure of household i consumption in village v, α_v is a village fixed effect, T_{iv} denotes household i who possesses land with land title in village v, Z_{iv} is a vector of household i characteristics and demographics, L_{iv} denotes size of land operated by each household, and ε_{iv} is an error term. The inclusion of village fixed effects captures village-specific characteristics, such as infrastructure, economic situation, variation of land rights across villages, and weather conditions.

3.4.3   Data

The paper's sample is drawn from a sample collected by the Cambodia Socio-Economic Survey (CSES) conducted in 2003-2004 by the National Institute of Statistics (NIS) of the Ministry of Planning (MOP). The goal of CSES is to collect information on various socio-economic aspects of households to track down the extent of household poverty. It is a nationally representative survey of 15,000 households in 24 provinces and 900 villages conducted from November 2003 to January 2005. The survey is available at individual, household, and village levels. The individual and household datasets contain information on employment, education, consumption and income, child health, housing construction, and farmland. The village dataset contains general information on population, agricultural land, development projects, schooling, presence of a hospital, common property resources, and occurrence of natural disasters. Since Chapter Two provides a full discussion of farm characteristics in the CSES, I focus here on household characteristics and household consumption expenditures.

3.4.4   Household consumption

The CSES 2004's consumption data are collected from two sources: monthly diaries of household expenditure and income and recall questions. These methods are commonly used in household expenditure surveys in developed and developing countries. However, the recall data collection method carries more measurement error in comparison to the diary data collection method (Gibson, 2002).

Consumption expenditure in the CSES 2003-2004 covers 14,984 households of which 12,000 were interviewed during calendar year 2004. The consumption expenditure

data can be classified into three main categories. The first category contains information on food expenditure. Households were instructed to fill out monthly diaries of household expenditure and income that listed all of last week's expenditure on any type of food purchased, produced, or received in kind.[3] After completion, the interviewers went through monthly diaries with each household and filled in missing entries. The food expenditure category also covered expenditure on tobacco and alcohol consumptions. The second category contains detailed expenditures on monthly housing rent, utilities, maintenance, and furniture. The third category has expenditures on personal care and effects, clothing, recreation, medical care, education, and transportation. The reference period for this category varies according to the type of question. The empirical analysis in this Chapter uses a measure of household consumption expenditure constructed by the National Institute of Statistics (NIS) from the 2003-2004 CSES. The method used to construct Cambodian household consumption expenditure by NIS is similar to the method illustrated in Deaton and Zaidi (2003).

Table 3.3 displays summary statistics for household characteristics such as gender of the household head, household size and migration, and consumption expenditure. The average education of a household head is just the fifth grade. This implies that most household heads can only read and write simple messages and have very limited general knowledge. Some may not have completed primary school.

A household has an average size of five members; most have male heads; and about 0.09 family members were away from home for more than two months during the five years prior to the survey date. The percentage of household heads who are self-

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[3] The NIS used current market prices to estimate the value of food received in kind or self produced by Cambodia households.

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employed (71 percent) is much higher than the percentage who are paid employees (19 percent). The higher percentage of self-employed households can be explained by the fact that farmers, especially in the rural areas, cultivate their own farms.

The average land holding of each CSES household is 1.29 hectares held over 1.31 plots. The average distance from a household in each village to an all-weather road is approximately 3 kilometers. The data further show that 29 percent of households have no cultivated land. This is a relatively high figure relative to other poor developing countries. Sixteen percent of Cambodian households report that they have experienced food shortages. Average household consumption is about US$129 per month, with food expenditure accounting for more than 50 percent of the total.

3.4.5   OLS Regression Results

The discussion in this section focuses on results from Ordinary Least Squares (OLS) estimates of equation (5) in which *de jure* land rights enter directly as a binary variable. I use total household consumption to explore this relationship instead of per capita household consumption. Per capita household consumption is a better measure of a household's living standard than total household consumption, but construction of the per capita variable requires adjustments for costs of raising children, household economies of scale and gender differences which are beyond the scope of this study. To partly account for these effects, the number of children and the number of adults in the household are used as separate control variables in all regressions.

This study uses household consumption as a measure of household well-being. Of course, actual household expenditure may differ from observed household expenditure

because households fail to account properly for their expenditures, do not remember details of many transactions, and forget that they have made some transactions. Even if the dependent variable in the regression is measured with error, Wooldridge (2006) demonstrated that OLS estimation would still be appropriate if the measurement error is a random reporting error that is uncorrelated with the regression's independent variables. For purposes of this analysis, the main implication of the presence of measurement error in Cambodian household consumption expenditures—this study's dependent variable—is that OLS estimation produces larger estimated variances of the estimated OLS coefficients (p. 319).

This Chapter's empirical analysis uses three measures of *de jure* land rights: households who possess land with titles, with application receipts, and with either an application receipt or a land title. Although a household with an application receipt would need to complete several additional costly steps to obtain a land title, many households have treated an application receipt as a land title and have mistakenly reported in the CSES survey that they have a title for their land. This misunderstanding is common due to the limited knowledge by many households of land institutions or their expectation that holding application receipts provides them with some limited property rights in their land and that this may be a better choice than holding land title in some circumstances (So, 2009). In fact, some micro finance institutions also treat application receipts as a form of property rights, often accepting them as collateral. An initial appraisal is that the tenure security given under an application receipt is less than the tenure security provided by *de jure* land rights (i.e., a title) and more than the tenure security provided by *de facto* rights. Given the potentially different household expectations of the land tenure security

provided by a title, an application receipt, and a *de facto* right, separate regressions are estimated for each measure of land rights to test whether they have differential impacts on household consumption.

Table 3.4 displays results for OLS estimates using land title as a measure of land rights. The regression specifications include other factors influencing household consumption, such as household characteristics, size of land operated, distance to all-weather road, type of land, and village dummy variables. The results are broadly consistent with the predictions of economic models of land tenure security: the estimated coefficient on land rights has a positive effect on household consumption. Households with titled parcels consume 2.7 percent more than households with untitled parcels and the effect is statistically significant at the 5 percent level.[4]

Estimated coefficients for all control variables have the expected sign. An additional year of education for the household head raises household consumption by 3 percent and is statistically significant at the 1 percent level. Household consumption increases with the age of the household head and decreases with age squared, with the maximum level reached at 95 years. Female-headed households are estimated to have lower consumption expenditures than male-headed ones. Consumption by an additional female member age 0 to 4 and 10 to 14 is larger than consumption for an additional male member but the result is reversed for adults ages 15 to 54. The estimated coefficient on self-employment is negative and not statistically significant at ten percent level while the estimated coefficient on paid employment is also negative but statistically significant at the 10 percent level.

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[4] I use Kennedy's method to calculate the effect of land rights on household consumption since land rights are dummy variables and household consumption is in logs. See Garderen and Shah (2002) for details.

The estimates discussed above also control for household migration. All regressions include a variable measuring the number of household members who have been away from home for more than two months in the past five years. Finan et al. (2004) suggested controlling for household migration to account for any potential bias in the measurement of the household labor force, as members of households with smaller farms are likely to migrate more. In Cambodia, migration of a member of a household could have a positive impact on its total consumption due to remittances from members who have migrated to foreign countries or urban areas within Cambodia. Remittances could help smooth household consumption and also provide an opportunity to finance expenses associated with obtaining a land title. Finan et al. (2004) found that the estimated coefficients on domestic and foreign migration both have positive and statistically significant effects on household welfare.

I find the opposite result: The estimated coefficient on "Number of Household Members Away From Home" is negative and statistically significant at the 5 percent level. This result implies that total household consumption expenditures fall as an additional member temporarily migrates. This may indicate the fall in household income resulting from the use of less labor in production is not offset by remittances from members who have migrated.

The estimated coefficient on the size of operated land is positive, increasing household consumption by 1.2 percent for each additional hectare of land, and is statistically significant at the 1 percent level. This result is in line with results reported by Finan et al. (2004) who found that for smaller land holders, household welfare increases by 1.3 times the earnings of an agricultural worker with an additional hectare of land. The

estimated coefficient on distance from village to all-weather road is negative and statistically significant at the 1 percent level. An increase in the distance from the village to an all-weather road of one kilometer decreases household consumption by 1 percent.

When land title and application receipt are combined, the estimated coefficient on the combined land rights variable remains positive and is statistically significant at the 1 percent level (Table 3.5). The magnitude of the estimated impact is larger when the regression is estimated with the combined land rights measure. Consumption of a household with land title or application receipt is 4.7 percent higher than consumption of an untitled household, whereas the consumption of households with application receipts increases by almost the same amount, 5 percent (Table 3.6). The signs and statistical significance for estimated coefficients on all control variables remain the same when the regression is estimated with the combined rights variable.

3.4.6 Robustness of the OLS regression results

To consistently estimate α_1 by OLS in equation (5) below, it requires that the regression's error term has a mean of zero and is uncorrelated with the regressors:

$$C_{iv} = \alpha_v + \alpha_1 T_{iv} + \alpha_2 Z_{iv} + \alpha_3 L_{iv} + \varepsilon_{iv} \quad (5)$$

OLS produces inconsistent estimates when there is measurement error, omitted variable bias, or reverse causation issues. Although the results from OLS regressions show that the estimated coefficient on land rights has a positive and statistically significant impact on household consumption for all three measures of land rights, the estimates may not be consistent if the *de jure* land rights are endogenous. The empirical literature on land titling in developing countries shows that households with more education, wealth, and

political connections are more likely to participate in land titling programs. The endogeneity of land rights is accepted in the economics and political literature on titling as a critical issue and authors have used instrumental variable technique to account for selection effects in household participation in programs to convert *de facto* land claims into formal *de jure* holdings. Besley (1995), Braselle et al. (2002), and Markussen (2008) used the mode of land acquisition as an instrument for land rights. This study uses two instruments: the standard mode of land acquisition variable and a variable measuring the length of land occupation. Fenske (2011) argued that the duration of tenure may not be excludable and that the reduced form of the land rights regression is likely to suffer from omitted variables bias. He argued that famers would make an effort to protect the plots that are suitable for investment which would lead them to hold such plots longer and make more investment. Outcomes may be "due to the unobserved plot characteristics" (p.140). For this reason, I include a control variable for the type of land in the regression to partially account for plot characteristics.

Wooldridge (2002) posits that a good instrument has to satisfy two conditions to identify coefficient estimates. First, the instrumental variable must be correlated with the endogenous variable. Second, the instrumental variables should not be correlated with the error term. The first condition can be tested via a reduced form equation for the endogenous explanatory variable. The second condition in most cases cannot be tested as it involves unobserved variables (p. 83).

The results from a reduced form regression equation for land rights (see Table 3.7) show that the estimated coefficients on mode of land acquisition and duration of tenure are statistically significant. The land title and application receipt variables are

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positively associated with the acquisition of land from the government, inheritance, and purchase, whereas gifted land and cleared land are negatively associated with land rights. Further, the land title and application receipt variables are positively related to duration of tenure. An additional year of occupation of a claimed plot of land increases the probability of the household obtaining land title by 0.2 percent and the effect is statistically significant at the 1 percent level. The *F*-test on the joint significance of the instruments (reported in table 3.7) under the hypothesis that they are jointly zero is rejected.

In addition to the results from the reduced form regression estimation, I make a conceptual argument that the two instruments should have a positive impact on the probability that a household will choose to apply for *de jure* rights. First, households who obtained land from the government or purchased it have a higher chance of obtaining *de jure* title. As mentioned in Chapter One, starting from 1989, land in Cambodia was privatized. The government allocated the solidarity group land to households according to family size and availability of land in each village. The land titling program was part of the 1989 land reform in which *de facto* land owners were eligible to apply for *de jure* titles for their residential land and possession rights for cultivated land. Households who obtained land through this allocation might receive an official document such as an application receipt that could serve as a proof of ownership in a future dispute. Further, households who purchased land from their neighbors or outsiders also tended to have some types of document such as a sales agreement between buyer and seller witnessed at the village or commune offices as a proof of land transaction. In general a buyer only wants to purchase a secure land plot. Therefore, a seller has to show some type of

document as proof of land ownership. By contrast, households who acquired plots by clearing empty land or receiving it from friends are less likely to apply for *de jure* rights, at least in part because of the more tenuous nature of their *de facto* claims. Those households usually had no supporting documents for their occupation. Thus, the probability of obtaining a *de jure* title is likely to be higher for those who obtained land from the government or purchased it than those who obtained land from their friends or cleared empty public land.

Second, the duration of tenure should also increase the probability of obtaining land title, as it increases the legitimacy of the household's claim to the land. The 2001 land law allows people who occupy land peacefully for five years to claim *de jure* ownership rights to their land.

Condition two requires that the mode of land acquisition and the length of land occupation are uncorrelated with the regression's error term. Either instrument might not satisfy this condition if it should have been included in the regression equation in the first place or it is correlated with omitted variables that are relevant to the analysis but for which no available samples exist. The situation is bothersome if the correlation with omitted variables leads to a bias in the IV estimates that is much larger than the bias in the OLS estimates (Angrist & Krueger, 2001). Thus, condition two requires that the two instruments not directly affect household consumption. Regardless of how a household received its lands, their mode of acquisition does not directly affect the household's production function or its incentive to use lands as collateral or make investments in land. The same line of reasoning applies to the duration of tenure variable: Increased duration of tenure improves a household legal's claim on its land but should not have a direct

connection with household consumption. As mentioned above, the two instruments mainly affect land rights.

Column 3 of Tables 3.4, 3.5, and 3.6 presents the results from instrumental variable regressions using the three measures of *de jure* land rights. The signs and statistical significance of estimated coefficients for virtually all control variables are the same as in the OLS estimates, except for the estimated coefficient on the land rights variable. When *de jure* land rights are instrumented with the "mode of land acquisition" and "length of occupation" variables, the magnitude of the estimated coefficient on land rights increases from 2.7 percent to about 58 percent for the titles measure, from 4.7 percent to 20 percent for the combined measure, and 5 percent to 28 percent for the application receipts measure.[5] Each of the three estimated coefficients is statistically significant at the 1 percent level. Thus, adjusting for the endogeneity of land rights leads to big increases in the magnitude of the estimated effect of *de jure* land rights on household consumption when compared with results from OLS regressions.

I also test the overidentifying restrictions. As suggested in Wooldridge (2006), the condition that the instrumental variables not be correlated with the error term of the structural equation cannot be tested because it involves an unobserved error. However, researchers can test whether some of the instrumental variables are uncorrelated with the error term when more than one instrument is used. The result of this test for overidentifying restrictions is reported in the bottom of each table. The test's *p*-value

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[5] I use Kennedy's method to calculate the effect of land rights on household consumption since land rights are binary variables and household consumption is in logs.

indicates that the instruments pass the overidentifying restriction test and should be suitable instruments for the land rights variable in this analysis.[6]

For the three measures of land rights, the estimated coefficients on the three land rights variables in the IV estimates are larger than those in the OLS estimates. One might expect the opposite result, that OLS would produce an upward bias in the estimated coefficient. However, many studies of the impact of property rights in land on households have found larger impacts in the IV estimations. For example, Besley's (1995) study of the link between land rights and land investment found that the OLS estimate of the impact of rights with approval was 2.5 percent. By contrast, the IV estimate of rights with approval was 28 percent. Goldstein and Udry (2008) and Markussen (2008) also found larger impacts in their IV estimations of the impact of property rights on household decisions. Markussen (2008) mentioned that the larger impacts in the IV estimations could signal the importance of measurement error and noted that the variable used in his study to measure land rights may not have fully captured the dimensions of *de jure* land rights—a complex amalgam—that were most relevant to households and other market participants. A larger impact in the IV estimation would be expected if the endogenous variable is binary and instruments are correlated with measurement error of the dependent variable. In this case, the IV estimations should be biased upwards (Markussen, 2008; Kane, Rouse, & Staiger, 1999). Thus, in the presence of such measurement errors, OLS

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[6] First, I run the IV regression and obtain a residual. Second, I regresses the residual on all exogenous variables and obtains the *R*-squared. Third, the number of observations times the *R*-squared is distributed χ^2_q, where q is the number of IV variables outside of the model minus the number of endogenous variables. If we reject the null hypotheses, under the assumption that all instrumental variables are not correlated with the error term in the structural model, we know that some of the instruments are not exogenous. See Wooldridge (2006, p.533-34) for testing over identifying restrictions.

estimates provide a lower bound and IV estimates provide an upper bound for the actual value of the estimated coefficient (Markussen, 2008)**.**

3.5 Conclusion

There are only a few microeconomic studies that focus on how *de jure* land rights affect household well-being. This Chapter studies how *de jure* land rights affect household consumption expenditures. Although household consumption expenditure is not a perfect measure of household well-being, it has been widely used to measure household welfare in developing countries due to problems with other measures of well-being, such as annual income.

Both OLS and IV estimates are used to explore the link between *de jure* land rights and household consumption. IV estimation is used to account for selection effects in household participation in Cambodia's programs to convert *de facto* land claims into formal *de jure* land rights supported by a national land registry. Three measures of land rights—titles, titles and application receipts, and application receipts—are used in the analysis to explore potentially different impacts of each type of land right on household expenditure. OLS estimates indicate a positive and statistically significant link between land rights and household consumption. The effect becomes substantially larger when instruments for land rights are used. The larger impact is expected when the endogenous variable is binary and instruments are correlated with measurement error of the dependent variable. In this case, OLS estimates provide a lower bound and IV estimates provide an upper bound for the actual value of the estimated coefficient.

The magnitudes of the effect of land rights on household consumption vary with different measures of land rights. All estimated coefficients on the three measures of land of land rights are positive and statistically significant. In sum, land titles have increased household welfare in Cambodia.

Table 3.1

Village characteristics: Summary statistics

	Mean	Std. Dev.
Village characteristics		
Total land area (hectares)	765.45	1677.91
Total agricultural land area (hectares)	222.37	352.14
Irrigated land area (hectares)	37.83	103.97
Distance from village to		
All -weather road (Km)	2.64	13.51
Bus stop (Km)	17.30	33.23
Taxi stop (Km)	5.42	15.03
Village head office (Km)	10.49	16.57
District head office (Km)	29.68	29.86
Households with		
Electricity (%)	0.27	0.39
Clean water (%)	0.18	0.35
Amount of rain and crop damage		
Normal rain fall (%)	0.27	0.44
Crop damage (%)	0.19	0.40
Development projects		
Conducted by the government (%)	0.40	0.50
Number of observations	900	

Note: The composition of development projects is as follows: 50% out of the 40% reported above is agriculture, 30% infrastructure, 12% education, 4% health, and 3% water related.
Source: All data are from CSES (2004).

Table 3.2

Household loans: Summary statistics

	Mean	Std. Dev.
Purpose of loan:		
Agricultural purpose (%)	0.24	0.43
Household consumption (%)	0.32	0.47
Household medical expense (%)	0.12	0.33
Loans obtained from:		
Relative in Cambodia (%)	0.27	0.44
Friend (%)	0.14	0.35
Money lender (%)	0.25	0.43
Bank (%)	0.036	0.18
NGO[a] (%)	0.16	0.37
Amount borrowed[b] (Reil)	953,324	3,706,033
Monthly interest rate (%)	0.04	0.08
Number of observations	8,024	

Note: a. NGO stands for non-governmental organization.
      b. The Reil is the Cambodian currency.
Source: All data are from CSES (2004).

Table 3.3

Household Characteristics: Summary statistics

	Mean	Std. Dev.
Head of household characteristics		
Education of household head (years)	4.37	4.02
Age of head (years)	45.14	13.74
Female headed (%)	0.22	0.41
Household size (number)	4.94	1.98
Number of males age 10 to 14 years old	0.36	0.60
Number of females age 10 to 14 years old	0.35	0.59
Number of males age 15 to 55 years old	1.29	0.94
Number of females age 15 to 55 years old	1.45	0.90
Number of males age over 55 years old	0.19	0.39
Number of females age over 55 years old	0.26	0.45
Number of household members away from home [a]	0.09	0.40
Head is self employed (%)	0.71	0.45
Head is paid employee (%)	0.19	0.39
Did not have enough food to consume in 2004 (%)	0.16	0.36
Total household net income per month (Reil)[b]	372,492.2	3,339,819
Health status of head		
Good health (%)	0.15	0.35
Average health (%)	0.67	0.47
Bad health (%)	0.18	0.38
Number and size of farmlands		
Number of farmlands	1.31	1.24
Size of operated farmlands	1.29	0.45
Landless households (%)	0.29	0.45
Household consumption expenditures		
Total consumption expenditure per month (Reil)	516,800	661,520
Total food consumption expenditure per month (Reil)	271,644	204,560
Number of observations	14,984	

Note: a. Members who were away from home for more than two months in the past five years.
b. Cambodian currency.

Source: All data are from CSES (2004).

Table 3.4

Land titles and household consumption: OLS and instrumental variable regressions

	Log of total monthly expenditure (OLS)	Log of total monthly expenditure (IV)
Households with land title (%)	0.024 (1.90)	0.465 (4.74)
Education (years)	0.030 (11.47)	0.029 (10.87)
Education squared (*1000)	-0.068 (-3.29)	-0.68 (-3.34)
Age (years)	0.009 (4.47)	0.008 (3.34)
Age squared (* 1000)	-0.056 (-3.18)	-0.007 (-2.45)
Female head (%)	-0.147 (-13.69)	-0.144 (-12.95)
Self employed (%)	-0.018 (-1.10)	-0.025 (-1.48)
Paid employee (%)	-0.060 (-2.98)	-0.053 (-2.53)
Number of males age 0 to 4	0.061 (8.51)	0.059 (7.90)
Number of females age 0 to 4	0.063 (9.22)	0.064 (8.93)
Number of males age 10 to 14	0.058 (8.92)	0.056 (8.30)
Number of females age 10 to 14	0.067 (9.98)	0.063 (8.95)
Number of males age 15 to 54	0.125 (26.23)	0.120 (25.53)
Number of females age 15 to 54	0.118 (25.56)	0.117 (24.18)
Number of members away from home for more than two months	-0.048 (-4.58)	-0.048 (-4.68)
Total value of durable goods (*1000)	0.020 (12.80)	0.020 (12.96)
Size of operated farm land (hectares)	0.012 (4.25)	0.007 (3.09)
Size of operated farm land squared (*1000)	-0.025 (-4.42)	-0.019 (-3.41)
Access to all weather roads (km)	-0.002 (-3.27)	-0.002 (-3.19)
Type of land dummies	Yes	Yes
Village dummies	Yes	Yes
Over identification test (*p*-value)		0.97
R^2	0.65	0.62
Observations	14,976	14,976

Note: All expenditures are in logs. *t*-statistics are in parenthesis.
         The regression is reported with robust standard errors.
Source: All data are from CSES (2004).

Table 3.5

A combined land rights and household consumption: OLS and instrumental variable regressions

	Log of total monthly expenditure (OLS)	Log of total monthly expenditure (IV)
Households with land title or application receipt (%)	0.046 (4.19)	0.192 (3.35)
Education (years)	0.030 (11.33)	0.028 (10.50)
Education squared (*1000)	-0.60 (-3.21)	-0.60 (-3.03)
Age (years)	0.009 (4.44)	0.007 (3.83)
Age squared (*1000)	-0.060 (-3.03)	-0.059 (-2.58)
Female head (%)	-0.146 (-13.62)	-0.143 (-13.28)
Self employed (%)	-0.021 (-1.27)	-0.028 (-1.70)
Paid employee (%)	-0.057 (-3.04)	-0.050 (-2.69)
Number of male aged 0 to 4	0.061 (8.51)	0.060 (8.19)
Number of female aged 0 to 4	0.064 (9.24)	0.064 (8.73)
Number of male aged 10 to 14	0.058 (8.92)	0.057 (8.19)
Number of female aged 10 to 14	0.066 (9.81)	0.063 (8.91)
Number of male aged 15 to 54	0.123 (26.16)	0.121 (26.74)
Number of female aged 15 to 54	0.118 (25.41)	0.116 (25.32)
Number of members away from home for more than two months	-0.047 (-4.357)	-0.046 (-4.25)
Total value of durable goods (*1000)	0.002 (12.82)	0.002 (12.88)
Size of operated land (hectares)	0.011 (4.04)	0.008 (3.28)
Size of operated farm land squared (*1000)	-0.002 (-4.53)	-0.002 (-3.38)
Access to all weather roads (km)	-0.002 (-3.44)	-0.002 (-3.79)
Type of land dummies	Yes	Yes
Village dummies	Yes	Yes
Over identification test (*p*-value)		0.94
R^2	0.65	0.65
Observations	14,976	14,976

Note: All expenditures are in logs. *t*-statistics are in parenthesis.
       The regression is reported with robust standard errors.
Source: All data are from CSES (2004).

Table 3.6

Application receipts and household consumption: OLS and instrumental variable regressions

	Log of total monthly expenditure (OLS)	Log of total monthly expenditure (IV)
Households with an application receipt (%)	0.049 (3.54)	0.25 (3.37)
Education (years)	0.030 (10.37)	0.029 (9.99)
Education squared (time 1000)	-0.60 (-2.70)	-0.54 (-2.51)
Age (years)	0.003 (3.62)	0.007 (3.12)
Age squared (time 1000)	-0.050 (-2.31)	-0.048 (-2.00)
Female head (%)	-0.136 (-11.51)	-0.133 (-11.30)
Self employed (%)	-0.018 (-1.01)	-0.024 (-1.38)
Paid employee (%)	-0.059 (-2.89)	-0.053 (-2.64)
Number of males age 0 to 4	0.065 (8.31)	0.065 (8.23)
Number of females age 0 to 4	0.058 (7.53)	0.058 (7.59)
Number of males age 10 to 14	0.054 (7.51)	0.054 (7.48)
Number of females age 10 to 14	0.066 (8.66)	0.063 (8.24)
Number of males age 15 to 54	0.122 (23.90)	0.121 (23.63)
Number of females age 15 to 54	0.118 (23.90)	0.116 (22.47)
Number of members away from home for more than two months	-0.048 (-4.10)	-0.047 (-4.10)
Total value of durable goods (*1000)	0.019 (12.24)	0.019 (12.54)
Size of operated land (hectares)	0.026 (6.51)	0.021 (5.52)
Size of operated farm land squared (*1000)	-0.016 (-3.95)	-0.016 (-3.82)
Access to all weather roads (km)	0.002 (1.11)	0.001 (0.89)
Type of land dummies	Yes	Yes
Village dummies	Yes	Yes
Over identification test (*p*-value)		0.95
R^2	0.67	0.66
Observations	12,530	12,530

Note: All expenditures are in logs. *t*-statistics are in parenthesis.
          The regression is reported with robust standard errors.
Source: All data are from CSES (2004).

Table 3.7

Regression of land rights on all instruments and exogenous variables

	Land title	Land title or receipt	Receipt
Given by state (%)	0.089 (4.53)	0.173 (13.58)	0.164 (11.91)
Inherited from families (%)	0.052 (4.74)	0.086 (7.38)	0.077 (6.15)
Bought land (%)	0.173 (15.26)	0.237 (20.03)	0.168 (12.14)
Occupied for free (%)	-0.040 (-3.25)	-0.112 (-7.82)	-0.081 (-5.69)
Received from friend (%)	-0.116 (-8.56)	-0.305 (-19.54)	-0.206 (-13.12)
Number of year owned land	0.002 (4.53)	0.003 (5.56)	0.002 (3.29)
Education (years)	-0.000 (-0.44)	0.002 (1.83)	0.003 (2.11)
Education squared	0.000 (0.70)	-0.000 (-1.73)	-0.000 (-2.15)
Age (years)	0.000 (0.53)	0.002 (1.88)	0.002 (1.57)
Age squared	-0.000 (-0.31)	-0.000 (-1.43)	-0.000 (-1.22)
Female head (%)	0.006 (1.02)	0.007 (0.98)	0.007 (1.00)
Self employed (%)	-0.014 (-1.52)	-0.017 (-1.77)	-0.009 (-0.95)
Paid employee (%)	0.007 (0.77)	-0.006 (-0.61)	-0.007 (-0.67)
Number of males age 0 to 4	0.005 (1.01)	0.004 (0.84)	0.000 (0.15)
Number of females age 0 to 4	-0.003 (-0.67)	-0.003 (-0.86)	-0.003 (-0.59)
Number of males age 10 to 14	0.001 (0.32)	-0.000 (-0.02)	-0.001 (-0.23)
Number of females age 10 to 14	0.003 (0.88)	0.012 (2.56)	0.011 (2.35)
Number of males age 15 to 54	0.003 (1.17)	0.002 (0.59)	-0.001 (-0.42)
Number of females age 15 to 54	-0.001 (-0.50)	0.002 (0.63)	0.002 (0.88)
Number of members away from home for more than two months	0.000 (0.01)	-0.006 (-0.82)	-0.002 (-0.37)
Total value of durable goods	0.000 (1.69)	0.000 (3.09)	0.000 (2.47)
Size of operated farm land (hectares)	0.002 (2.16)	0.004 (3.76)	0.002 (1.09)
Size of operated farm land squared	-0.000 (-1.14)	-0.000 (-3.52)	-0.000 (-0.74)
Access to all weather roads (km)	-0.000 (-1.70)	-0.000 (-0.02)	0.001 (0.00)
Type of land dummies	Yes	Yes	Yes
Village dummies	Yes	Yes	Yes
F-test on significance of instruments (*p*-value)	0.00	0.00	0.00
R^2	0.43	0.57	0.54
Observations	14,973	14,973	12,527

Note: The regression is reported with robust standard errors.
Source: All data are from CSES (2004).

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CHAPTER FOUR

THE IMPACT OF PROPERTY RIGHTS IN LAND ON CHILD HEALTH

4.1 Introduction

This chapter explores the relationship between *de jure* land rights and child health in Cambodian urban and rural households with land holdings. The relationship between *de jure* land rights and children's health can result from several distinct types of benefits of land registration. Previous studies have documented a strong correlation between socio-economic status and child health (Currie & Stabile, 2003). Theoretically, establishing systems of formal land rights and the resulting improvement in tenure security can lead to a range of social benefits including increased investment in land (Abdulai, Owusu, & Goetz, 2011; Deininger & Jin, 2006), improved access to credit markets (Feder, Onchan, Chanlamwong, & Hongladarom, 1988; Field & Torero, 2006), increases in the participation of adult labor and decreases in the participation of child labor (Field, 2007), and increases in human capital, housing improvements and maintenance, and children's health in urban squat households (Galiani & Schargrodsky, 2004; Galiani & Schargrodsky, 2010).

There are currently few studies that focus on how the establishment of land rights affects children's health. Galiani and Schargrodsky (2003, 2004) argued that land titles could have positive indirect impacts on children's health because they lead to more investment in housing and household structures. They posit that "under the security provided by proper land titles, families are more likely to invest in improvements in water distribution within their homes, treatment of fecal evacuation, treatment of garbage

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disposal, safety and quality of heating systems, air ventilation conditions, and quality of the soil. Moreover, the possibility of exchanging houses when their size is inadequate for family needs may help to avoid overcrowding" (p. 354). These investments have been shown to contribute to increased child health. Using data from a 1984 land reform in a poor Buenos Aires suburb in which *de jure* rights were exogenously assigned to households in their sample, they found "that in the titled parcels children enjoy better weight-for-height *z*-scores (but similar height-for-age *z*-scores), and teenage girls have lower pregnancy rates than those in untitled parcels" (p. 353). A similar study for Peru highlighted the same results but also found that titles were associated with an increase in the risk that the household's children would be overweight or obese (Vogl, 2007).

This study examines whether the establishment of *de jure* land rights in Cambodia caused changes in child health in Cambodian urban and rural households with land holdings. The econometric model builds on a second study, Galiani and Schargrodsky (2004), who directly estimated the impact of establishing *de jure* land rights on child health, as measured by weight-for-height and height-for-age variables. This study estimates this relationship for a sample of households drawn from the 2003-2004 Cambodia Socio-Economic Survey (CSES) that includes information on 8,745 children below six years of age. The study uses three alternate measures of *de jure* land rights collected by CSES for each household in the sample. *De jure* rights to a household's land claims were not exogenously imposed but were awarded when and if a household completed a costly and complex bureaucratic process to establish title in the land. My analysis uses instrumental variable regression techniques to account for the selection

effects in a household's decision to participate in a land titling program to convert *de facto* land claims into formal *de jure* land rights.

The analysis in this study contributes to this field's empirical literature by broadening the scope of study to include the effects of land titling programs on child health in both urban and rural areas. Galiani and Schargrodsky (2004) and Vogl (2007) estimated the effect of residential land title on child health in households living in urban squats whereas this study examines the effect of *de jure* rights on child health in households living in both rural and urban areas. In this study results from OLS regressions indicate that children living in households with *de jure* land rights have similar weight-for-height and height-for-age *z*-scores as children living in households with *de facto* land rights. Use of instrumental variable regression techniques to account for endogeneity of land rights yields essentially the same outcomes weight-for-height regressions but different outcomes height-for-age regressions: Children living in households with titled parcels have better height-for-age *z*-scores than children living in households with untitled parcels. The study's results may contribute to illuminating policy questions regarding the ongoing implementation of land titling programs in Cambodia.

4.2 The impact of land property rights on children's health

The effect of *de jure* land rights on various social indicators such as land investment, crop productivity, access to credit markets, and land values have been widely studied in the past two decades, but only recently have a few studies focused on how *de jure* land titles affect child health. Galiani and Schargrodsky (2003, 2004) showed that

land titles in Argentina's urban squats could have positive indirect impacts on child health because they lead to more investment in housing and household structures. They asserted that "under the security provided by proper land titles, families are more likely to invest in improvements in water distribution within their homes, treatment of fecal evacuation, treatment of garbage disposal, safety and quality of heating, air ventilation conditions, and quality of the soil. Moreover, the possibility of exchanging houses when their size is inadequate for family needs may help to avoid overcrowding" (p. 354).

Their study indicated that in the titled parcels children have higher weight-for-height z-scores--an indicator of current nutrition status--but similar height-for-age z-scores, an indicator of cumulative growth deficits. Further, teenage girls living in households with titled land parcels had a lower pregnancy rate than girls living in households with untitled land parcels. Another study on child health and nutritional status in urban areas of Peru, using data from a survey of 27 Lima communities conducted in 2004, showed that land titles improved children's weights but not their heights (Vogl, 2007). Vogl asserted that the positive effects of land rights in urban areas of Peru on child nutrition might be due to increases in labor force participation, housing investment, and credit access. A previous study of an urban land titling programs in Peru (Field 2007) showed that adults living in households with titled parcels increase their labor force participation because they do not have to keep people at home to guard their informal properties. Field found that weekly household labor hours on titled parcels were 16-17 hours higher than on untitled parcels. Vogl (2007) maintained that increases in income from an additional member participating in the labor market might improve child nutrition but that working could impact time spent taking care of children if the labor

force participant is the child's primary caregiver. Thus, the change in time allocation might affect the child's nutrition and care. "The direction of this change depends on the balance of income and substitution effects" (Volg, 2007, p. 303). Further, Field (2005) and Field and Torero (2006) showed that housing investment and credit access increased among those households with titled parcels. Empirical findings from Volg (2007) and Galiani and Schargrodsky (2004) are similar: Children living in households with titled parcels have better weight-for-height *z*-scores but the same height-for-age *z*-scores. However, Volg (2007) highlighted that *de jure* title increased the risk to a household's children of being overweight or obese.[1] This study only examines the effect of land rights on child nutritional status in Cambodia measured by weigh-for-height *z*-scores and height-for-age *z*-scores, as there were few overweight children in Cambodia in 2003-2004. The survey data from the 2003-2004 CSES shows that approximately 0.2 percent of children had a Body Mass Index (BMI) more than 25.[2] O'Donnell, Doorslaer, Wagstaff, and Lindelow (2008) maintained that the incidence of overweight or obesity is relatively low in South and East Asia.

De jure land rights in Cambodia may have impact on children's health through increases in household consumption, land investment, and housing investment. The empirical results from Chapters Two and Three indicate that *de jure* land rights enhance land investment and raise household consumption. Secure land rights facilitate smoothing household consumption, thereby avoiding low consumption periods that may also be

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[1] Vogl argued that the observed weight gain does not imply an improvement in the child's nutritional status (p. 302). A study of gender and land ownership in Nepal showed that children of mothers who own land are less likely to be severely underweight (Allendorf, 2007).

[2] I use the adult BMI cutoff for children. A person is considered to be overweight if their BMI exceeds 25, normal if their BMI is between 18.5 to 24.9, and underweight if their BMI is below 18.49 (O'Donnell et al., 2008).

associated with lower nutrient intakes for the children in the household. Further, the household's additional income generated from its higher land investment may also improve children's nutrition. On the other hand, a household with *de jure* titles may have the ability to exchange its house when its size is inadequate for family needs or to use their increased access to credit markets to finance improvements in their housing structures. The investment in housing or improvement in household structures as articulated in Galiani and Schargrodsky (2004) may have an indirect impact on child health.

4.3 Children's health in Cambodia

In 2003-2004, Cambodia was the poorest country in Asia despite considerable growth over the previous decade (CDHS, 2005). Cambodia's population had the worst health in the Western Pacific Region and its overall health system performance was classified 174th among members of the World Health Organization (CDHS 2000; WHO, 2000). Life expectancy at birth for males was 58 years and for females was 64 years (CDHS 2005). One in ten children died before their fifth birthday due to insufficient health care services, poor hygiene, and poverty (CDHS 2000). Nearly half of Cambodian children were malnourished in their second year of life (HKIC, 2002). Preventable diseases, such as diarrhea, acute respiratory infections, dengue hemorrhagic fever, malaria, and malnutrition have affected the lives of many children in Cambodia (CDHS, 2005).

Although Cambodia is a poor country with a fragile health system, the 2005 Health Demographic Survey (CDHS) showed that health outcomes of children had

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improved. Infant mortality declined from 95 in 2000 to 66 in 2005 per 1,000 live births. The mortality rate of under-five children decreased from 124 to 83 over the same period. The percentage of children under five years of age who were stunted declined from 45 percent in 2000 to 37 percent in 2005, while the percentage of children who were wasted declined from 15 percent in 2000 to 7 percent in 2005, and the percentage underweight declined from 45 percent in 2000 to 36 percent in 2005.[3] The rate of primary school attendance rose from 68 percent in 2000 to 77 percent in 2005.

Despite these improvements, inequality in health remains a critical issue for Cambodia. Economic growth seems to benefit the rich more than the poor (Hong & Mishra, 2006). About one third of the population is unable to pay medical bills from either private or public providers. Annual per capita health expenditure is about US$37; out-of-pocket expenditures are 68 percent of the total. Unexpected health expenditures can easily drive people who live above the poverty line into poverty (MH, 2008). Several qualitative studies indicate that expenditures for medical emergencies and household consumption often are associated with a household's sale of its lands and subsequently becoming landless. Lands have often been sold at fire sale prices in case of emergency needs (Kenjiro, 2005; Damme, Leemput, Por, Hardeman, & Meessen, 2004; Huy, Wichmann, Beatty, Ngan, Duong, Margolis, & Vong, 2009).

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[3] The WHO found that amongst children who are under five years of age in Cambodia, 49.2 percent were stunted and 39.5 percent were underweight (WHO, 2007). The CHDS (2010) showed that 40 percent of children under five years of age were stunted and 11 percent were wasted.

4.4 Empirical analysis

4.4.1 Data

The 2003-2004 CSES incorporates a section on child health that allows an estimation of the effect of *de jure* land rights on some dimensions of child health. The nationwide survey provides information on 8,745 children less than 6 years of age, of which 3,900 are children under 2 years of age. Mothers or caregivers were asked about the child's date of birth, immunization, nutrition intake, weight, height, vitamin A intake, and nighttime blindness. During the interview, the mother or caregiver was requested to answer questions related to immunization and nutrition intake for household children under two years of age. Interviewers first asked for an immunization card and recorded the dates and type of vaccinations: TB, polio, DTC/DPT and measles. If the card had been lost, the interviewer asked the mother or caretaker to recall types and approximate dates of vaccinations. Either the household head or spouse was asked about height, weight, and vitamin A intake of children less than 6 years of age. The interviewers also recorded the date of measurement and position of the child (standing up or lying down) while measuring their height. In the survey, 68 percent of the children were measured standing up, with the rest measured lying down. Height was recorded in centimeters and weight was recorded in kilograms.

The analysis in this study uses two variables—weight-for-height and height-for-age—to measure children's health. These variables have been used in several empirical studies as measures of child health (Miller & Rodgers, 2009; Allendorf, 2007; Vogl, 2007; Galiani & Schargrodsky 2004; Hong & Mishra, 2004). Generally, both measures are used to assess nutritional status because they give "different information about growth

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and body composition" (CDHS, 2000, p. 172). Weight-for-height measures body weight in relation to body length or height. It reflects a short-term change in nutrition status and is generally used as a measure of current nutritional status. Children who have low weight-for-height compared to children of the same age and sex in the reference population are considered thin and children who have very low weight-for-height are considered wasted. The most commonly used cutoff to determine whether a child is malnourished or not is a *z*-score of minus two, i.e., two standard deviations below the median of the reference population (O'Donnell et al., 2008). Children are too thin or wasted if their weight-for-height measure is below minus two standard deviations and severely wasted if their weight-for-height measure is below minus three standard deviations. The height-for-age measure reflects a long-term inadequacy of nutrition. Children who have low height-for-age compared to children of the same age and sex in the reference population are considered short and children who have very low height-for-age are considered stunted. Children are stunted if their height-for-age measure is below minus two standard deviations and severely stunted if their height-for-age measure is below minus three standard deviations (O'Donnell et al., 2008; CDHS, 2000).

These anthropometric indicators are established by "comparing relevant measures with those of comparable individuals (in regard to age and sex) in the reference populations" (O'Donnell et al., 2008, p. 41). Before the release of a new international growth chart for children from birth to five years of age by the World Health Organization (WHO) in 2006, the reference groups that were frequently utilized were based on a sample of the children in the United States. U.S reference groups were inappropriate for children in developing countries, who have different growth paths with

different feeding practices, led to a comprehensive review of the existing reference groups and the development of a new reference group. The new international growth chart developed by WHO in 2006 is considered more appropriate as it takes into account the growth of children from different cultural settings (O'Donnell et al., 2008). Recently, the Centers for Disease Control and Prevention (CDC) suggested that clinicians in the United States use the 2006 WHO international growth charts for children ages less than 24 months and use the 2000 CDC growth charts for persons with ages 2-19 years (Grummer-Strawn, Reinold, & Krebs, 2010). The 2006 WHO international growth charts were based on data of healthy children from Brazil, Ghana, India, Norway, Oman, and the United States (WHO, 2006). The 2000 CDC growth charts were created utilizing data from five national surveys collected in the United States together with data extracted from birth certificates and medical records (Vidmar, Carlin, Hesketh, & Cole, 2004).

The comparison of "relevant measures" with those of comparable individuals in the reference populations to create anthropometric indicators can be done in three ways: *z*-scores, percent of the median, and percentiles. A *z*-score is defined as "the difference between the value for an individual and the median value of the reference population for the same sex and age (or height), divided by the standard deviation of the reference population". *Z*-scores are frequently used by researchers because they have desirable statistical properties. *Z*-scores can be used to describe means and standard deviation of population and sub-populations, a comparison that cannot be done with percentiles (O'Donnell et al., 2008, p.42). "The percent of the median" is easier to compute than a *z*-score or percentile, while it neglects the distribution of the reference population around

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the median (Gorstein, Sullivan, Yip, de Onis, Trowbridge, Fajans, & Clugston, 1994, p. 276).

In this analysis, the weight-for-height z-score and height-for-age z-score are computed using the 2006 WHO growth charts as the reference population. The 2006 WHO growth charts are more appropriate for this study as they have been calculated using children of diverse ethnic backgrounds and different cultural settings. Table 4.1 presents summary statistics for the weight-for-height and height-for-age z-scores for the sample of Cambodian children in the health section of the 2003-2004 CSES. The sample shows that 13 percent of children ages 0-6 have weight-for-height z-scores below minus two standard deviations and 41 percent have height-for-age z-scores below minus two standard deviations. This implies that 13 percent of children ages 0-6 are wasted and 41 are stunted. About 5 percent are severely wasted and 22 percent are severely stunted. Figure 4.1 indicates the distributions of weight-for-height z-scores and height-for-age z-scores. Weight-for-height z-scores are skewed more to the right whereas height-for-age z-scores are concentrated more to the left, which show a prevalence of stunting.[4]

Table 4.2a reports summary statistics for children's z-scores, children's characteristics, and parental education when the data are sorted by the type of document under which the land parcel is held. Three categories of land documents are used in this study: Land title, application receipt, and no document. The weight-for-height z-scores for children living in households with titled parcels are similar to children living in households with untitled parcels but there are statistically significant differences between

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[4]The percentage of children who were wasted and stunted in Cambodia declined in 2005 yet increased in 2010. The CDHS 2000 shows that 15 percent of children were wasted and 45 percent were stunted; the CDHS 2005 indicates 7 percent were wasted and 37 percent were stunted; the CDHS 2010 shows that 11 percent were wasted and 40 percent were stunted.

the groups when land titles and application receipts are combined in a single measure. There are statistically significant differences in height-for-age z-scores for children living in households with titled and untitled parcels. The difference is also present when titles and application receipts are combined in a single measure.

Parental education is the same for land owners with title and *de facto* land owners. Table 4.2b shows that educational attainments of the children's parents are very low. On average, the child's father has completed 4 years and the child's mother 3 years of education.

This study uses three alternate measures of *de jure* land rights: land titles to their plot, measure combining titles and application receipts, and application receipts to their plot. As explained in Chapters Two and Three, land titles and application receipts may have different impacts on children's health as the tenure security and other benefits provided by a land title and an application receipt are likely to differ. A *de jure* title can theoretically be used to secure loans from formal credit institutions that provide land owners with relatively low interest rates (compared to the informal loan market), whereas access to these institutions is impossible for a land owner with just an application receipt. The application receipt can only be used to secure loans from a micro finance institution or a money lender in the informal credit market. With this limited access, farmers are less likely to be able to secure favorable loans for investment or to smooth household consumption. Further, without a land title, the market price of land is likely to be lower due to the higher risk of expropriation that potential buyers face. For these reasons, I conduct separate analyses of the impact of each land rights measure on children's health.

4.4.2 Estimation strategy

Ruhm (2000) mentioned that child health hangs on several factors such as "the stock of health capital, the level of medical technology, the price of and access to health care, household income, and the time investments of parents" (p. 933-34). As discussed above, *de jure* land rights in Cambodia are most likely to affect child health through improvement in household income. This channel was carefully articulated by Volg (2007). Higher income may improve household nutrition, provide the means for households to improve their housing structures, and increase their access to medical care.

Rosenzweig and Schultz (1983) posited that the empirical analysis of health production models are mainly concentrated on estimating input demand functions or reduced form health equations. These estimations are essential in providing policy-relevant parameters and for prediction but the empirical analysis of the relationship between health and health inputs have been hindered by the unavailability of data. In return, "the equations (hybrids) with less desirable properties" have been estimated (p.726).

The econometric model used to test the effect of *de jure* land rights on children's health in this study is based on Galiani's and Schargrodsky's (2004) model. Due to unavailability of data on some inputs such as the price of medical care and access to medical care, the child health specification here is a hybrid of the reduced form demand function. The effect of land title on children's health outcomes is specified as:

$$H_{ih=}\alpha_0 + \alpha_1 X_i + \alpha_2 Z_h + \alpha_3 P_h + \varepsilon_{ih} \qquad (1)$$

where H_{ih} measures the health of child i in household h, X_i is a vector of child i characteristics (gender, age, and relation to head), Z_h is a vector of household h

characteristics (father and mother education, father and mother employment), P_h is a binary variable denoting whether household h holds farm land with title, and ε_{ih} is an error term. α_3 is the parameter of interest which highlights the impact of *de jure* land rights on children's health of household h. The potential issue in estimating equation (1) is the endogeneity of land rights. As discussed in Chapters Two and Three, families with more education, resources, and power tend to have a higher probability of obtaining a land title. Empirical studies of this issue in other developing countries have frequently used an instrumental variable technique to account for selection effects with respect to household participation in programs implemented to convert *de facto* land claims into formal *de jure* rights. This study also uses an instrumental variable technique to account for endogeneity of land rights.

4.4.3 Results

For each of the two health measures, equation (1) is estimated with and without instrumentation for *de jure* land rights. The instrumental variables used in this Chapter's analysis are the same as those used in Chapter Three's analysis: Mode of land acquisition and length of land occupation. As discussed in more detail in Chapter Three, a valid instrument must satisfy two conditions: The instrument must be correlated with the measure of *de jure* land rights and be uncorrelated with the equation's error term. The survey indicates that some households received land from the government, purchased land, inherited land from their families, received land from their friends or cleared empty public land. The "mode of land acquisition" variables indicate the method by which the household obtained their land plot. I argue that different types of mode of acquisition

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were associated with different degrees of land tenure security. For example, households who obtained land from the government or purchased it have a higher chance of obtaining *de jure* title. As mentioned in Chapter One, starting from 1989, land in Cambodia was privatized. The government allocated the solidarity group land to households according to family size and availability of land in each village. The land titling program was part of the 1989 land reform in which *de facto* land owners were eligible to apply for *de jure* titles for their residential land and possession rights for their cultivated land. Households who obtained land through this allocation might receive an official document such as an application receipt that could serve as a proof of ownership in a future dispute. Further, households who purchased land from their neighbors or outsiders also tended to have some type of document such as a sales agreement between buyer and seller witnessed at the village or commune offices as a proof of land transaction. In general a buyer only wants to purchase land with secure rights. Therefore, a seller has to show some type of document as proof of land ownership. On the contrary, households who acquired plots by clearing empty land or receiving it from friends were less likely to apply for *de jure* rights, at least in part because of the more tenuous nature of their *de facto* claims. Those households usually had no supporting documents for their occupation. Thus, the probability of obtaining a *de jure* title was likely to be higher for those who obtained land from the government or purchased it than those who obtained land from their friends or cleared empty public land. Duration of tenure is also likely to affect whether a household acquires title. The length of time that a household has occupied farm land affected its legal claim to their land. Basically, duration of tenure increases the legitimacy of the household's claim to its land. The 2001 land law allows

people who had already occupied land peacefully before the adoption of the law to complete a five-year possession term and then to claim *de jure* ownership rights to their land. Both instruments affect rights to a family's plot of land but have no direct impact on children's health.

4.4.4 **Weight-for-height**

First, I consider the impact of *de jure* land rights on the weight-for-height *z*-score, which is an indicator of current nutritional status. The regression specifications include other factors influencing children's health, such as children's characteristics, parents' characteristics, and village dummies. Village dummies are included to control for fixed differences across villages affecting the two measures of child health. Table 4.3a presents the outcomes from OLS estimations when land rights are measured by whether a land-holding household has a land title. The estimated coefficient on mother's education is positive but is not statistically significant at the 10 percent level. This result is in line with several other studies that find that wasting is not substantially influenced by mother's education as articulated in Miller and Rodgers (2009). Using the 2005 CDHS, Miller and Rodgers (2009) indicated that the estimated coefficient on mother's education is positive but statistically insignificant. Galiani and Schargrodsky (2004) found the same result. Miller and Rodgers (2009) maintained that maternal characteristics have less influence on wasting.

The estimated coefficient on father's education follows the results for the mother's education, as it is statistically insignificant at the 10 percent level. Galiani and Schargrodsky (2004) and Miller and Rodgers (2009) found similar results. The estimated

coefficient on parent's occupation is not statistically significant at the 10 percent level. The estimated coefficient on household wealth is positive and statistically significant at the 5 percent level. Its small magnitude indicates that it has only a very small effect on children's current nutritional status.

The OLS regression results indicate that children living in households with titled parcels have similar weight-for-height z-scores as children living in households with untitled parcels. Table 4.3b presents estimation results when land rights are measured with a variable combining title and application receipt. The estimated coefficient on the combined measure of land rights remains statistically insignificant at the 10 percent level. The result is the same when rights to the land are measured with an application receipt (see Table 4.3c). Using instrumental variables for land rights, I find no significant differences in weight for height z-scores between children of owners with land title to their plot and without land title to their plots. The estimated coefficients on land rights are not statistically significant at the 10 percent level for the three measures of land rights.

4.4.5   Height-for-age

Next, the estimation focuses on the effect of *de jure* land rights on the height-for-age z-score, which provides a measure of cumulative nutritional inadequacies. Table 4.4a provides results from OLS estimations when land rights are measured by land title. Again, the estimated coefficient on mother's education is positive and statistically insignificant at the 10 percent level. When land rights are measured by application receipt, the estimated coefficient on mother's education is positive and statistically significant at the 10 percent level. Miller and Rodgers (2009) showed that the estimated

coefficient on mother's education in Cambodia is positive and statistically significant whereas outcomes from Galiani and Schargrodsky (2004) were mixed. In their study, the estimated coefficient on mother's education was not statistically significant in a full sample of children but it was statistically significant at the 10 percent level in a sub-sample of children ages 5-11. Miller and Rodgers (2009) also found that the estimated coefficient on father's education to be positive and statistically significant whereas this study and Galiani and Schargrodsky (2004) did not.[5]

The results from OLS estimations indicate that children living in households with titled parcels have similar height-for-age z-scores as children living in households with untitled parcels. The results are the same for the rights variable combining titles and application receipts. When land rights are measured by application receipts, the estimated coefficient on land rights remains statistically insignificant.

The estimated coefficient on land rights becomes, however, statistically significant at the five percent level when land rights are instrumented with mode of acquisition and duration of tenure variables. When land rights are measured with a combined measure of title and receipt, the estimated coefficient on the land rights variable remains statistically significant at the five percent level (Table 4.4b and 4.4c). The outcomes from IV regression estimations show that children of land owners with a land title are about 0.4 standard deviation taller than children of land owners without a land title. The effect corresponds to an increase of 0.39 centimeter for a boy 48 months old and 100 centimeter tall. I used Sargan tests to check whether the instrumental variables are correlated with the error term in equation (1) for all three measures of land

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[5]The regression estimation in Miller and Rodgers (2009) did not include a village fixed effect to account for differences in each village.

rights. Results are reported in Tables 4.3a, 4.3b, 4.3c, 4.4a, 4.4b, and 4.4c. *P*-values show that the instruments pass the over-identifying restriction test.

This study's estimate of the effect of land rights on the two measures of child health finds results that are similar to and different from Galiani and Schargrodsky's (2004) study and Volg's (2007) study. Their studies found that children of titled parcels have higher weight-for-height *z*-scores than children of untitled parcels. However, there are no statistically significant differences in height-for-age *z*-scores between the two groups. This study finds that children of titled parcels have higher height-for-age *z*-scores than children of untitled parcels but there are no significant differences in weight-for-height *z*-scores. The differences between the results in this study and the two studies above may be due to the length of time between the household surveys and when the household received its titles as well as the nature of the data. For Galiani and Schargrodsky's (2004) study, the survey was conducted in 2003 and they selected households who received land titled in 1989-1991 and in 1997-1998 for their study. By the time that the survey was conducted, some households had land titles for 13 years and some for 7 years. Whereas the survey in Volg's (2007) study was conducted in the 2004, he selected a sample of households who received titles in 1996-1997 and in 2000-2003 for his study. Therefore, by the time of the survey, some households had land titles for 7-8 years and some just 1-4 years.

This study's survey was conducted in 2003-2004 and titling program was started in 1989. The 2003-2004 CSES did not include the date that the title or application was awarded to each household. Title or application could be awarded to a household anytime

between 1989 and 2003. Both surveys focused on urban land titling program whereas this study's survey covered both urban and rural land titling program.

4.5 Conclusion

The analysis in this Chapter contributes to the empirical study of the effect of *de jure* land rights on children's health, a topic that has not been widely studied. The outcomes from OLS estimations indicate that children of titled parcels have similar weight-for-height *z*-scores and height-for-age *z*-scores as children of untitled parcels. The outcomes from IV estimations show that children living in households with titled parcels have better height-for-age *z*-scores than children living in households with untitled parcels; the differences in the weight-for-height *z*-scores of children livings in households with titled and untitled parcels are, however, not statistically significant. Children of titled parcels are 0.4 standard deviation taller than children of untitled parcel.

This study's results are similar to but different from the results found in Galiani and Schargrodsky's (2004) study and Volg's (2007) study. They found that land title has positive effects on children's current nutritional status while this study found that land title is associated with higher long-term nutritional status. The differences between the results in this study and the two studies above may be due to the length of time between the household surveys and the receipt of title as well as differences in the nature of the data. Their studies observe the effect of urban land titling programs on child health while this study broadens the scope by including the effects of land titling programs on child health in both urban and rural areas. Findings in this study suggest that a land title is associated with improvements in the long-term health of children in Cambodia.

Table 4.1

Descriptive statistics of z-scores for child nutritional status in Cambodia, 2003-2004

	Weight-for-height *z*-scores	**Height-for-age *z*-scores**
Mean	-0.49	-1.32
Standard deviation(S.D.)	1.74	2.14
Percent below < -2 S.D.	0.13	0.41
Percent below < -3 S.D.	0.05	0.22
Number of children	6,567	6,567

Source: All data are from CSES (2003-2004).

Figure 4.1

Distributions of weight-for-height and height-for-age z-scores in Cambodia, 2003-2004
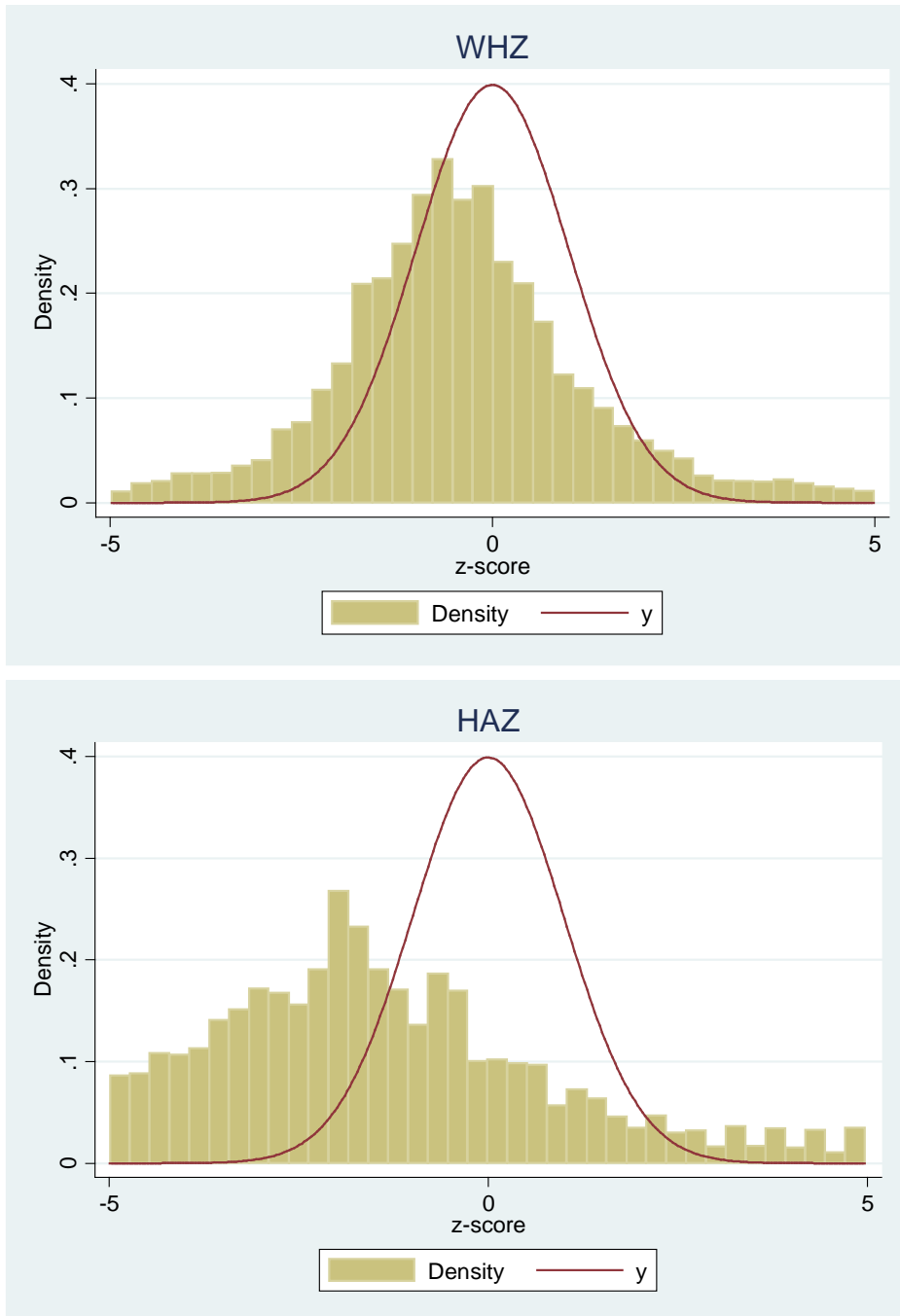
Table 4.2a

Characteristics of children and their families by type of document

	Titled plot	Untitled plot	Sig.	Title or receipt plot	Untitled plot	Sig.	Receipt plot	Untitled plot	Sig.
Weight-for-height	-0.48	-0.40		-0.48	-0.38	**	-0.48	-0.38	***
Height-for-age	-1.46	-1.32	***	-1.42	-1.31	***	-1.39	-1.31	
Male children (%)	0.51	0.50		0.53	0.50	**	0.54	0.50	**
Age of children (years)	3.07	2.94	*	3.03	2.93	**	2.97	2.93	
Relation to head									
Son or daughter (%)	0.80	0.84	*	0.79	0.85	*	0.78	0.85	*
Grandson or granddaughter (%)	0.17	0.14	**	0.18	0.13	*	0.19	0.13	*
Education of father (years)	4.36	4.37		4.29	4.41		4.22	4.41	
Education of mother (years)	3.11	3.04		3.06	3.05		3.01	3.05	
Father is self employed (%)	0.70	0.63	*	0.71	0.61	*	0.72	0.61	*
Mother is self employed (%)	0.08	0.07		0.09	0.07	*	0.09	0.07	**
Father is paid employee (%)	0.13	0.20	*	0.12	0.22	*	0.10	0.22	*
Mother is paid employee (%)	0.08	0.02	*	0.02	0.00	*	0.01	0.02	**
Total value of durable goods (million Reil)	1.55	1.66		1.43	1.74	**	1.32	1.74	**
Total value of live stock (million Reil)	1.97	1.28	*	1.91	1.15	*	1.85	1.15	*
Number of rooms in the house	1.31	1.30		1.29	1.31		1.26	1.31	***
Access to all weather roads (km)	2.76	3.87	***	3.30	3.87		3.82	3.87	
Number of observations	8.744						7440		

Note: a. "Statistically significant" refers to the differences in sample means for families with different types of documents for their plots.

           b. * significant at 1%; ** significant at 5%;*** significant at 10%.

           c. Reil is Cambodian currency.

Source: All data are from CSES (2003-2004).

Table 4.2b

Characteristics of children and their families: Summary statistics

	Means	Std. Dev.
Male children (%)	0.51	0.50
Age of children (years)	2.30	1.73
Relation to head		
Son or daughter (%)	0.83	0.38
Grandson or granddaughter (%)	0.16	0.36
Education of father (years)	4.35	3.96
Education of mother (years)	3.01	3.20
Father is self employed (%)	0.64	0.48
Mother is self employed (%)	0.08	0.27
Father is paid employee (%)	0.19	0.39
Mother is paid employee (%)	0.02	0.13
Number of observations	8,745	

Source: All data are from CSES (2004).

Table 4.3a

Land title and children's health: OLS and instrumental variable regressions

	Weight-for-height (OLS)	Weight-for-height (IV)
Land title (%)	-0.043 (-0.65)	0.149 (0.47)
Male children (%)	-0.069 (-1.77)	-0.070 (-1.80)
Son or daughter of head (%)	0.072 (0.41)	0.085 (0.48)
Grandson or granddaughter of head (%)	0.141 (0.79)	0.147 (0.81)
Age of children (average)	-0.174 (-13.51)	0.115 (6.34)
Education of father (years)	-0.006 (-0.98)	-0.008 (-1.10)
Education of mother (years)	0.012 (1.52)	0.025 (1.54)
Father is self employed	0.182 (1.87)	0.182 (1.87)
Mother is self employed	0.140 (1.22)	0.142 (1.24)
Father is paid employee	0.168 (1.59)	0.172 (1.63)
Mother is paid employee	-0.087 (0.47)	-0.072 (-0.40)
Total value of durable goods	0.000 (2.61)	0.000 (2.45)
Access to all weather roads (km)	0.002 (0.57)	-0.005 (-1.00)
Over identification test (*p*-value)		0.72
Village dummies	Yes	Yes
R^2	0.29	0.29
Number of observations	6,478	6,478

t-statistic in parentheses.
Source: All data are from CSES (2003-2004).

Table 4.3b

*Combined land rights measure and children's health: OLS and instrumental variable
regressions*

	Weight-for-height (OLS)	Weight-for-height (IV)
Land title and application receipt (%)	-0.043 (-0.65)	0.077 (0.48)
Male children (%)	-0.069 (-1.77)	-0.070 (-1.81)
Son or daughter of head (%)	0.074 (0.42)	0.084 (0.47)
Grandson or granddaughter of head (%)	0.132 (0.72)	0.146 (0.80)
Age of children (average)	-0.174 (-13.49)	-0.174 (13.51)
Education of father (years)	-0.006 (-0.96)	-0.006(-0.94)
Education of mother (years)	0.012 (1.60)	0.012 (1.57)
Father is self employed	0.182 (1.87)	0.181 (1.86)
Mother is self employed	0.140 (1.22)	0.142 (1.24)
Father is paid employee	0.168 (1.59)	0.175 (1.65)
Mother is paid employee	-0.087 (-0.49)	-0.074 (-0.41)
Total value of durable goods	0.000 (2.61)	0.000 (2.51)
Access to all weather roads (km)	0.003 (0.57)	-0.012 (-2.44)
Over identification test (*p*-value)		0.73
Village dummies	Yes	Yes
R^2	0.29	0.29
Number of observations	6,478	6,478

t-statistic in parentheses.
Source: All data are from CSES (2003-2004).

Table 4.3c

Application receipt and children's health: OLS and instrumental variable regressions

	Weight-for-height (OLS)	Weight-for-height (IV)
Application receipt (%)	-0.008 (-1.11)	0.035 (0.14)
Male children (%)	-0.077 (-1.77)	-0.135 (-2.45)
Son or daughter of head (%)	0.075 (0.37)	0.081 (0.40)
Grandson or granddaughter of head (%)	0.129 (0.62)	0.136 (0.66)
Age of children (average)	-0.194 (13.59)	-0.193 (13.59)
Education of father (years)	-0.007 (-1.01)	-0.007 (-0.95)
Education of mother (years)	0.008 (1.01)	0.009 (1.07)
Father is self employed	0.211 (1.97)	0.211 (1.97)
Mother is self employed	0.129 (0.89)	0.232 (1.31)
Father is paid employee	0.127 (0.96)	0.184 (1.57)
Mother is paid employee	0.089 (0.40)	0.007 (0.04)
Total value of durable goods	0.000 (1.50)	0.000 (2.04)
Access to all weather roads (km)	-0.005 (-0.90)	-0.012 (-2.40)
Over identification test (*p*-value)		0.40
Village dummies	Yes	Yes
R^2	0.32	0.32
Number of observations	5,481	5,481

t-statistic in parentheses.
Source: All data are from CSES (2003-2004).

Table 4.4a

Land title and children's health: OLS and instrumental variable regressions

	Height-for-age (OLS)	Height-for-age (IV)
Land title (%)	-0.061 -(-0.73)	0.40 (1.79)
Male children (%)	-0.113 (-2.29)	-0.117 (-2.37)
Son or daughter of head (%)	-0.454 (-2.04)	-0.400 (-1.78)
Grandson or granddaughter of head (%)	-0.259 (-1.13)	-0.245 (-1.06)
Age of children (average)	-0.570 (-35.01)	-0.577 (-35.05)
Education of father (years)	0.006 (0.83)	0.006(0.81)
Education of mother (years)	0.015 (1.56)	0.013 (1.37)
Father is self employed	0.201 (1.63)	0.200 (1.62)
Mother is self employed	0.121 (0.83)	0.136 (0.94)
Father is paid employee	0.123 (0.92)	0.146 (1.09)
Mother is paid employee	0.086 (0.38)	0.149 (0.65)
Total value of durable goods	0.000 (1.50)	0.000 (1.10)
Access to all weather road (km)	-0.000 (-0.86)	0.010 (1.56)
Over identification test (*p*-value)		0.62
Village dummies	Yes	Yes
R^2	0.34	0.34
Number of observations	6,478	6,478

t-statistic in parentheses.
Source: All data are from CSES (2003-2004).

Table 4.4b

Combined land rights measure and children's health: OLS and instrumental variable regressions

	Height-for-age (OLS)	Height-for-age (IV)
Land title and application receipt (%)	-0.114 (-1.68)	0.396 (2.35)
Male children (%)	-0.111 (-2.26)	-0.067 (-1.31)
Son or daughter of head (%)	-0.460 (-2.07)	-0.403 (-1.80)
Grandson or granddaughter of head (%)	-0.267 (-1.16)	-0.254 (-1.11)
Age of children (average)	-0.570 (-34.99)	-0.571 (-35.72)
Education of father (years)	0.007 (0.86)	0.007 (0.86)
Education of mother (years)	0.015 (1.56)	0.015 (1.56)
Father is self employed	0.201 (1.64)	0.195 (1.59)
Mother is self employed	0.119 (0.82)	0.127 (0.88)
Father is paid employee	0.115 (0.86)	0.119 (0.90)
Mother is paid employee	0.077 (0.34)	0.079 (0.35)
Total value of durable goods	0.000 (1.54)	0.000 (1.22)
Access to all weather road (km)	-0.001 (-0.90)	0.004 (1.05)
Over identification test (*p*-value)		0.68
Village dummies	Yes	Yes
R^2	0.35	0.35
Number of observations	6,478	6,478

t-statistic in parentheses.
Source: All data are from CSES (2003-2004).

Table 4.4c

Application receipt and children's health: OLS and instrumental variable regressions

	Height-for-age (OLS)	Height-for-age (IV)
Application receipt (%)	-0.192 (-2.11)	0.509 (1.86)
Male children (%)	-0.127 (-2.32)	-0.113 (-2.02)
Son or daughter of head (%)	-0.664 (-2.22)	-0.511 (-1.99)
Grandson or granddaughter of head (%)	-0.349 (-1.32)	-0.340 (-1.29)
Age of children (average)	-0.566 (-31.29)	-0.122 (-31.35)
Education of father (years)	0.006 (0.70)	0.004 (0.52)
Education of mother (years)	0.024 (2.25)	0.025 (2.30)
Father is self employed	0.219 (1.60)	0.216 (1.58)
Mother is self employed	0.115 (0.71)	0.143 (0.68)
Father is paid employee	0.055 (0.38)	0.115 (0.78)
Mother is paid employee	0.008 (0.03)	0.007 (0.29)
Total value of durable goods	0.000 (1.53)	0.000 (1.41)
Access to all weather roads (km)	-0.001 (-0.28)	0.004 (0.64)
Over identification test (*p*-value)		0.25
Village dummies	Yes	Yes
R^2	0.36	0.33
Number of observations	5,481	5,481

t-statistic in parentheses.
Source: All data are from CSES (2003-2004).

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