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"Patterns of access to land by Chinese agricultural investors and their impacts on rural households in Mandalay Region, Myanmar"

Master Thesis

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Abstract

After more than fifty years of socialist regime, Myanmar opened up their land market with the modifications to their Land Laws and Foreign Investment Law in 2011. Since then, large land concessions have increased dramatically. These land concessions are undertaken with no consultation or compensation and are characterized by natural resource exploitation. In the uplands of Central Myanmar rural farmers who still rely on cattle to plough their lands and on rainfall to irrigate their fields, are pressured to decide between receiving a fixed income by renting their farmland to Chinese investors or, preventing their land from being used for unsustainable cultivation practices driven by these investors. This study presents an analysis of the impacts that short-term land leases to Chinese agricultural investors has on farmers' livelihoods in Chuang Kwa tract of Mandalay Region in Myanmar. This research sought to understand: a) Chinese investor's strategies to access farmers' land, b) estimate effects on farmers' income and food security c) implications on land-user rights and d) implications on land and water use. This study follows the Institutional Analysis and Development (AID) Framework, applying a convergent methodology. Average effects of these land deals on total income and food security are estimated through the Propensity Score Matching (PSM); effects on household food diversity and food quality are explored through the Food Consumption Score (FCS) from the World Food Program. Results indicate that farmers leasing land have increased their total income and have improved their food consumption. However, externalities such as soil impoverishment and groundwater depletion were recorded. Moreover although these land deals do not lead to formal land dispossession or people displacement, a dispossession of user rights was manifested. Findings suggest that renting land may not bring significant improvements in the long-term. Farmers' income increase might not continue and farmers' food production might be under threat due to resource depletion. It is recommended that a legal agreement should be established between farmers and tenants to define the terms of land use, emphasizing sustainable land management.

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*"**Be strong and courageous. Do not be afraid; do not be discouraged, for the LORD your God will be with you wherever you go**" Joshua 1:9*

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List of abbreviations

ADB	Asia Development Bank
AID	Institutional Analysis and Development Framework,
ATT	Average Treatment of the Treated
CIA	Conditional Independence Assumption
FAO	Food and Agriculture Organization
FCS	Food Consumption Score
FDI	Foreign Direct Investment
FGD	Focus Group Discussion
FIL	Foreign Investment Law
IHLCA	Integrated Household Living Conditions
KHRG	Karen Human Rights Group
LCG	Land Core Group
LIFT	Livelihoods and Food Security Trust Fund
MOA	Ministry of Agriculture
NGO	Non-Governmental Organization
PSM	Propensity Score Matching
VFV	Vacant, Fallow, Virgin Land Management Law
WFP	World Food Program

Chapter 1 – Introduction

Land, a word that for many could mean just a physical asset, is for others a means of life. However, access to and disbursement of land has always been subjected to power and politics. Since the recent global financial crisis in 2007/2008, demand and pressure on land has increased dramatically, largely driven by developed countries that look to fulfil their internal bio-fuel and food demand (Borras, Franco 2012). Covered under the guise of industrial agricultural investment, large-scale land acquisition, also known by its political nomenclature as "land grabbing", is a manifestation of this increasing demand for land (Kay 2012), that has since accounted for an estimated 45 - 227 million hectares of leased land globally (Borras, Franco 2012; OXFAM 2011).

Myanmar, a country in the Global South, is privileged by its vast natural resources with fertile land, different agro-ecosystems and enormous water supply (Baroang 2013). This makes it a great destination for large scale land investment. However, Myanmar is considered one of the poorest countries in the world: 70% of its total population live in rural areas, while 25.6% live under poverty line (1.25USD/day), largely depending on agriculture for their livelihoods (IHLCA 2011; Woods 2013). Furthermore, agriculture represents 34.8% of national gross domestic product (GDP), 61.2% of employment and 30% of exports by value (OECD 2014; Baroang 2013).

With modifications to the land laws and Foreign Investment Law (FIL), the livelihoods of the rural population have become vulnerable, as their most valuable asset, land, is jeopardized (Oberndorf 2012). Land concessions in Myanmar have increased in just one year (2011/2012) to about 2.5 million acres (101.2 million ha) while foreign direct investment (FDI) is estimated on 4,644USD million (Woods 2013). However, these land concessions are underestimated as they do not capture informal land deals. For example in the case on agribusiness, foreign investors use local companies as proxies to benefit from land resources (Buchanan et al. 2013). Thus, little information is available on small-scale land transfers or short-term land leases.

In order to analyze the dimension and impacts of short-term land leases, as foreign agricultural investment, this preliminary study will firstly present its objectives and justification. Relevant literature on the implications of foreign direct investment on land

is reviewed in Chapter 2, followed by a socio-economic background on Myanmar (2.4). The Institutional Analysis and Development (AID) Framework, along with a theoretical perspective on property rights, is described in Chapter 3. Then, a detailed description on the different methods used in this study, for data collection and analysis, is given (Chapter 4). In the results section, the determinants for a farmer to rent land, (5.2), the analyses on land-user rights changes (5.3), and the mapping of consultation process (5.4) are presented; followed by the estimation of average effects on farmers' total income and food security (5.6). After discussing the results (Chapter 6), this study offers a policy option as an alternative to regulate the rent of land (Chapter 7). Lastly, conclusions (Chapter 8) and research limitations (8.1) are given.

1.1 Research objectives

In order to provide an economic and social assessment on a case of land transfer, the main objective of this study is to analyse positive and negative impacts of short-term land leases to Chinese investors on Burmese farmers' livelihoods. To achieve this, the study addresses the following research questions:

- By which means and terms do Chinese investors control and acquire land?
- Do Chinese agricultural land deals contribute to an improvement of income and food consumption of rural farmers?
- What are the major impacts on land and water use in the village?
- Are there any changes on land-user rights?

1.2 Problem statement

There is little evidence in literature about foreign agricultural investment in Myanmar, partly because most of the FDI documented are large-scale projects on extractive sectors such as mining and hydropower (Buchanan et al. 2013). Local people have not yet far experienced any benefit from these large-scale land acquisitions, but on the contrary, in the worst case have led to confiscation of land and displacement of people (Bissinger 2014; Buchanan et al. 2013; KHRG 2013). Furthermore, although it is found that different patterns of foreign investment on land are happening throughout the

country, little research has been done on the implications of land transfers at the small-scale or short-term land leases in Myanmar and no information is available if these land transfers deals are done by contract farming or what farmers' gains are from them (LCG/FSWG 2012, Woods 2013).

With the upcoming presidential elections this year (2015) and the draft of the national land use policy, there is an ongoing debate on how farmers would be benefitted, as the current land laws and FIL promote private investments and industrial agriculture (Franco et al. 2015). While some advocate for an enforcement in land tenure security to protect farmers' rights, this does not guarantee that land would be disposed or poor households would be displaced (Borras, Franco 2014; Liversage 2010; Oberndorf 2012). Moreover, since farmers are now able to exchange their "right to work" (a right given by the government to farmers to work a certain area of land), this situation seems more problematic. Burmese farmers follow a customary law and lack of formal education. Therefore, this study analyses the extent to which foreign investors, in particular Chinese agricultural investors, access and control farmers' land and identify its implications on farmers' livelihoods.

Chapter 2 – Literature review

2.1 A global view on foreign direct investments on land

The purchasing or leasing agreements of large areas of arable land in developing countries for the purpose of agricultural development, and involving drastic livelihood changes on the people that depend on that land, is known as large scale land acquisition or land grabbing (Borras et al. 2012; Deininger, Byerlee 2011; McMahon 2013). The term of large-scale land acquisitions emerged to compensate the negative weight that land grabbing has; given a more institutionalized meaning (Borras, Franco 2012). It is used greatly by international agencies such as the World Bank, IFPRI (International Food Policy Research Institute), FAO (Food and Agriculture Organization) and Governments, as synonym of investment needed for rural development (Kay 2012). The trend of large-scale land acquisitions was reported first in 2008 by the NGO Genetic Resources Action International (GRAIN), followed by FoodFirst Information and Action Network (FIAN). Then, IFPRI stated, in 2009, that an estimation of 15-20 million of hectares have been transferred to foreign investors in the form of selling, leasing or negotiation agreements (Borras, Franco 2012). Since then, a series of reports have been published on this topic: land grabbing (McMahon 2013).

These land deals, not always driven by foreign entities, have transformed the way land is used, basically land which was used before for local subsistence, being transformed into a global commodity (McMahon 2013). The idea behind large-scale land acquisitions comes from the theory that "idle" or "underutilized" land, which represents globally "445 million ha minimum and 1.7 billion ha maximum" (Borras et al. 2012:8) can be productive if investors provide capital, technology and market, in a way that food for domestic markets supply would increase and the surplus would be then used for international demand (Braun, Meinzen-Dick 2009; Deininger, Byerlee 2011; Mirza et al. 2014).

When a land transfer occurs, there is a radical change in the nature of land rights (McMahon 2013). This is mainly resulted by the ambiguous consultation process and

inexistence involvement of local farmers, which characterize these land deals (Cotula et al. 2009). Therefore, Borras and Franco (2012) emphasize the importance (though sometimes left out) of understanding the dynamics of land use change and property relations change. They argue that the key is on identifying who has access and what are the benefits drawn from this access (Ribot, Peluso 2003).

In addition, McMahon (2013) argues that large-scale land acquisitions do not make economic sense, even though the compensation for leasing land is as low as 5USD/acre/year (in the case of Liberia) or 2USD/acre/year (in the case of Ethiopia) (Cotula 2011). His argument is that, given the hostility created by the environmental externalities in local communities, reactions from the affected people do not allow for an effective and productive work. In addition, in some cases production practices used by foreign companies are not compatible with local conditions of host countries. For example, farmers may not know how to drive a tractor or the lack of roads would make difficult to transport the crops after harvest.

In the light of the increasing large-scale land acquisitions, multinational agencies, particularly the World Bank, FAO and IFPRI encourage governments to promote sustainable agricultural investments and to regulate land deals by following or adhering to voluntary guidelines on responsible investment or by enforcing land tenure security (Deininger, Byerlee 2011; Liversage 2010). However, the adherence to a code of conduct such the Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests from the FAO, or the Principles of Responsible Agricultural Investment from the World Bank, could contradictory, facilitate large-scale land transfers if they are not enforced properly (Borras, Franco 2014). Therefore, De Schutter (2011) acknowledging that large-scale land acquisition are inevitable, calls for a real alternative on land investments towards a human right approach.

2.2 Opportunities and threads of large-scale land acquisitions

Advocates argue that large-scale land acquisitions have the potential to boost the agricultural sector and stimulate rural economies by creating off-farm jobs that could diversify local livelihoods, developing infrastructure in rural areas (for example roads) transferring know-how of agricultural technology, opening international markets and providing financial capital (Braun, Meinzen-Dick 2009; Haralambous et al. 2009). Another opportunity pointed out by Dauvergne and Neville (2010) is that areas with dry land, the production of industrial crops might contribute to job creation since food crops might not be suitable. Further, they emphasize that large-scale land acquisitions might contribute to national food security if food crops are produced for domestic demand, instead of cash crops for exports. A successful case is the Lao-Japanese joint venture, in which the Lao PRD government allowed the lease of 18,500 ha for rice cultivation under contract farming. This agreement gives farmers not only market access, but also a stable price and agricultural inputs (Haralambous et al. 2009).

However, despite the potential benefits that large-scale land acquisitions could have on rural communities, there are multiple examples on how they have disrupted small-farmers' livelihoods and undermined food security across Africa, Asia and Latin America, by the dispossession or displacement of their land (Borras, Franco 2012; Deininger, Byerlee 2011; De Schutter 2011). Just to mention 3,491,453 ha have been leased in South Sudan, 2,978,769 ha in Monzambique and 1,020,807 ha in Ethiopia. While in Indonesia 3,901,655 ha have been transferred as large-scale land acquisitions, 528,335 ha in Laos, and 783,187ha in Cambodia (Land Matrix 2015). In most of the cases there is no consultation or compensation with local communities.

Furthermore, giving the cultivation practices applied by foreign investors, large-scale land investments lead to negative environmental externalities that have made households economically vulnerable. For example, Shi (2008) found that in Lao PRD, a Chinese investor on rubber practice "smaller holes, narrower terrace" a technique that would give rapid yield due the intensive use of fertilizers. This, however, has led to soil degradation and slow down crop yields. Siddiqui (1998) suggests that this self-interest

behaviour leads to environmental damage like overexploitation of groundwater, soil salinity and soil impoverishment. To which, according to Haralambou s et al. (2009) would result in the migration of 135 million of people by 2020.

2.3 Alternative solution to large-scale land acquisitions: contract farming

A solution considered as alternative in this debate, is contract farming. Ideally, a contract farming or out-grower scheme, should benefit both parties, farmers and contractors (or foreign investors); farmers by receiving new techniques, market and inputs; whereas contractors increasing their production (Glover 1984). This agreement should describe terms and commitments from each party involved. Miyata et al. (2009) argues that farmers engaged on contract farming have increased their income and welfare. For example in Senegal farmers increased 55% their income by growing sesame under contract farming.

Contracts involving large-scale land acquisitions are different in nature, and mostly characterized by lack of transparency on the consultation process (Cotula 2011). Some governments, particularly Lao PRD, promote a 2+3 model for cross-border contracts. Shi (2008) explains that in a 2+3 contract, farmers would provide labour and land while investors would give capital, techniques and market access, with a profit sharing of 70% for villagers and 30% for investors. However, this type of model ends up dissolving into a 1+4 model, in which farmers provides land in exchange of a rent compensation, in this case, farmers have less control over their land (Shi 2008).

Barrett et al. (2012) and Bijman (2008) argue that through contract farming, farmers would hold higher decision power over their production and might alleviate environmental externalities. Yet, contract farming has their drawbacks. Cotula et al. (2011) and Miyata et al. (2007) point out that although governments promote large-scale land acquisitions on “marginal” lands, usually investors target fields with rich fertile soil and water access. This is logical as they are looking for large and intensive crop production, and because firms hold higher decision power to select the area and

the type of crop they want to grow (Barret et al., 2012). The problem arises when there is no a sustainable land management by investors (Bijman et al., 2008). To this, Johnston et al. (2013) argue that if farmers are giving control over land and irrigation systems, they would hold higher bargaining power and would then preserve these natural resources.

2.4 Large-scale land investments in Myanmar

2.4.1 Myanmar: socio-economic and food security indications

Myanmar was a British colony for more than a century (1824 to 1948), which left some structural problems behind. During this colonization period, despite having been a leading Asian economy on paddy production, and reason it was referred to as the "Asia's rice bowl" local people did not enjoy the profits of rice industry growth or was favored in any sector (Thein 2004). Prior to independence, Myanmar's economy was disrupted by the devastations of World War II and reached independence in 1948 (Buchanan et al. 2013). Since that date, the country has experienced different periods of political and economic transition. The period that has affected Myanmar's economy, was during the socialist system, better known as "The Burmese way to Socialism" (1962/1988) and it was characterized by centralization and control, predominantly on agriculture (Bissinger 2014; Thein 2004).

Located in a strategic geographic position, Myanmar shares borders with Thailand, Laos, China, India and Bangladesh (See Figure 1). It is the largest country in South East Asia accounting for an estimation of 51 million people, with an annual growth of 1% and population density of 72 inhab/km2. From the total population 75% live in rural areas and 25.6% live under poverty line (1.25USD per day). The national income per capita is estimated on 750USD per year while agricultural per capita income is 194USD on average (IHLCA 2011; MDRI/CESD 2013; UNDP 2014).

The diverse agro-ecological systems, vast areas of fertile land and access to water, make Myanmar a potential agent to meet the energy and food demand of its regional market (MSU/MDRI 2013). However, Myanmar is classified as one of the poorest countries of

the world and its ranked on the position 150th out of 187 on the Human Development Index, with a life expectancy at birth is 65.7 years (UNDP 2014). Moreover, there is a big disparity when looking at the access to basic needs between rural and urban population. From the 75% of the population living in rural areas, 55% have access to safe drinking water, 64% to sanitation and 34% to electricity (ADB 2014; IHLCA 2011) .

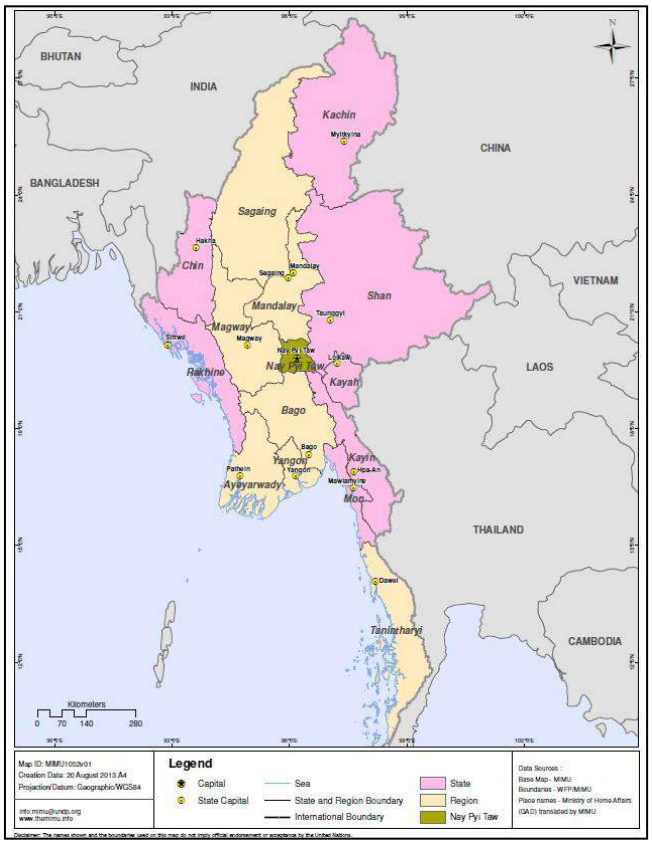

Figure 1: Myanmar location of states and regions

Source: http://www.themimu.info

Estimated Myanmar's gross domestic product (GDP) growth between 2012/13 was 6.5%, representing by sector: 38% agriculture, 20.3% industry and 41.7% services (CIA factbook 2015; World Bank 2013). Furthermore, agriculture accounts 61.2% of employment and 30% of exports by value (Baroang 2013; OECD 2014). Cultivable land is 17.83 million ha, irrigated area is 2.28 million ha, while inland and ground water resources represent 1082 km^3 and 495 km^3. Its large reserve of natural gas (12.2 trillion cubic feet) made the country even more attractive (Thein 2006). Yet, only 0.06USD per 100USD of agricultural export value, is spent in agriculture research, while, agricultural income per worker is 194USD/year, the lowest of South East Asia (MDRI/CESD 2013).

Myanmar, is a rich country on natural resources and has adequate availability of food (mainly because of rice production). Still, there is large wealth inequality and low investment on education, health and agriculture that altogether affect a household' food security (Wilson et al. 2012). Some factors influencing this inequality is the economic slowdown of the past decades, the lack of investment in productive sectors, isolation from international markets and political instability (ADB 2014).

Furthermore, despite being a net-exporter of rice and pulses, there are high levels of under-nutrition across the country (Rammohan, Pritchard 2014) with moderate underweight children under-five year of age at 34 % (IHLCA 2011). Wilson et al. (2012) remarks that the delta region is more vulnerable to food insecurity due climatic shocks, while the dry zone and hilly areas are less likely to be food insecure.

After rice, maize is one of the most important crops in Myanmar, particularly in Chin State (Baroang 2013). Pulses are consumed almost daily in the different states and divisions of the country especially in the dry zone (Wilson et al. 2012). Household expenditure is used mainly for food, but given that the government has kept a low domestic price for rice, households are able to purchase diverse food items that have contributed to a higher nutritional diet (ADB 2014).

On average, there is a relative availability of adequate food provisioning throughout the year (Wilson et al. 2012) except before harvest, when farming households have exhausted their rice stocks or have problems on purchasing food (Rammohan, Pritchard 2014). For landless and near-landless households is different, as they depend on seasonal off-farm jobs to have an income. But on average, households do not have enough food for two months each year (Deininger, Byerlee 2011; Wilson et al. 2012), with June and July being the months reporting difficulty to access food (Sibson 2014).

2.4.2 Current state of foreign investment in land

Since 2011, the current government declared their intentions on bringing the country on a path to democracy. These efforts have been noticed by western countries, which upon witnessing political changes within the country, rushed to remove sanctions and to inject foreign aid. However, just a few months before the next democratic elections, these efforts have been reduced. Little or no change has been noted at ground levels, causing western countries to question and scrutinize Myanmar's democratic transition more closely (Jones 2014).

The land market in Myanmar has opened up with the recent modifications to the Farmland Law and Vacant, Fallow, Virgin Land Management Law (VFV) and the Foreign Investment Law (FIL). The modifications that have been highly politicized and concerned with this study are regarding the Farmland Law and Foreign Investment Law. On the one hand, the Farmland Law in their Chapter IV, Section 14 and 55 establishes that Burmese farmers should request permission to the Government in case of selling, pawning, leasing, exchanging or donation their "right to work" (also known as Form-7). Yet, this law does not recognize customary rights, and does not provide detail information on how authorization or approval process for these transfers should be (Oberndorf 2012). On the other hand, the Foreign Investment Law allows 100% foreign capital and lease periods of up to 70 years (Woods 2013). It also establishes that any foreigner interested on carrying out agricultural investments should do so by forming a joint venture with holders of the "right to work" and should grow a crop of mutual interest (Chapter XV, Section 108). Moreover, the law established that environmental assessments should be performed only for agricultural activities that required large areas of farmland; neglecting the small transfers (Buchanan et al. 2013).

The modification to the VFV land allows private, foreign or state owned enterprises grants of wasted or abandoned lands from 5,000 acres up to 50,000 acres (2,000ha to 20,000ha) for an initial period of 30 years (Oberndorf 2012). In addition, it provides access to loans or credits for technological and agricultural inputs (Oberndorf 2012). Buchanan et al. (2013) have remarked that this law encourages the most large scale land acquisitions because these lands are occupied by minority ethnic groups or are

used for grazing (Woods 2013). Furthermore, Woods (2013) warns on the fact that 10 million acres of waste land would be converted to industrial agricultural crops plantations (notably palm oil, jatropha and rubber) under this law.

Since these modifications, land concessions by the Ministry of Agriculture in Myanmar have increased by 76 %; from 1.94 million acres to 3.42 million acres in about one year 2011/2012 (Myanmar Times 2013). Other sources (Woods 2013) have reported an increase of land concession of 2.5 million acres on the same period. While Buchanan et al. (2013) emphasized that since 2011, 800,000 ha were transferred to 204 companies as agricultural concession. So far, some large-investment projects approved are: the Dawei Special Economic Zone, the Kalandan Gateway project and the Shwe Gas pipeline funded by Thailand, India and China respectively, these contrary to bring an improvement on Burmese livelihoods, have lead to displacement and land dispossession of rural population (Buchanan et al. 2013).

Woods (2013) remarks that foreign direct investment is underestimated in Myanmar and that foreign investors enter into Myanmar through informal channels, through local people as proxy investor, mostly seen investing on industrial crops (rubber, maize, paddy, sugarcane, jatropha and palm oil). This is to avoid rigid regulations and bureaucracy. Moreover, Buchanan et al. (2013) suggest that investment is likely to be focused on the borderlands, to a certain extent because in these areas ethnic groups have Chinese roots and are known as Kokang Chinese. This ethnic group lives in the North of Shan State and represents the access to markets and capital for farmers and traders in Shan borders given their cultural ties.

China is one of the major investors in Myanmar. However, its investments have had many negative impacts resulting in a growing resentment among Burmese people toward the Chinese (ADB 2014; Bissinger 2014). The most recent event against Chinese investment was the protests to stop the construction of the Myitsone Dam, which lead to its suspension. This caused surprise on China's expectations (Sun 2012). The 3.6 USD billion Myitsone hydropower dam, located on the northern Myanmar along the Irrawaddy River and close to the border with China, aimed to supply energy to China (90% of the energy produced), however, environmentalist and activist groups protested

as feared ecological damage and dispossession of land from local residents (Buchanan et al. 2013; Rieffel 2012; Sun 2012).

In light of investors' willingness to invest in Myanmar, there is a wave of analysis composed by international financial institutions on how Myanmar could improve its governance and create a favorable environment for foreign direct investment (OECD 2014). Furthermore, despite the calls for responsible investments by Daw Aung San Suu Kyi (Woods 2013), international agencies have published reports that enthusiastically show investment opportunities in Myanmar. The potential for intensive cultivation of palm oil in Tanintharyi region, rubber in northern areas, rice in delta areas and fruits and vegetables in highland areas have been published (Neo et al. 2012). These cash crops, however, are being produced at the cost of the eviction of small-holder farmers (Buchanan et al. 2013).

Western governments have been cautious on investing in Myanmar, to a certain extent due to its weak governance and lack of rule of law (Haralambous et al. 2009; Woods 2013). Nevertheless, investments by the European Union, although currently limited and not significant, are expected to grow, especially with the re-instatement of the European Union General System of Preferences (GSP) in July, 2013, an initiative that offers duty-free access to the European market on imports of all products except arms and ammunitions from least developed countries (European Comission 2013) .

2.4.3 Case study: short-term international land lease

In order to examine another pattern of access to land by foreign investors in Myanmar, this section presents a case of short-term land lease to Chinese investors based on the existing literature. This case will be elaborated on since it reflects the current situation in the study area, in which this thesis was conducted.

For a number of years (the first known case stems from 1998), Chinese investors have been leasing land from paddy farmers in Central Myanmar for the production of Seedless Watermelon (L. *Citrullus lanatus*) (hereafter melons) to supply Chinese

demand. Mostly, because these fields have sandy loam soil and favorable climatic conditions (high temperatures and low rainfall) that make suitable fruit and horticulture production (Baroang 2013).

Accordingly to Myint et al. (2013) fruits produced in Central Myanmar, in particular melon, muskmelon and plum are sold to intermediaries in Muse (Myanmar-China border). Furthermore, they suggest that Chinese traders buy fruit produce from farmers in Sagaing and Mandalay through intermediaries at Muse border. Reardon (2014) remarks the great opportunity for Myanmar to strength this export value chain for fruits. He mentioned that trucks containing melons (value 8000USD each) are delivered every day to traders in Muse, to be sold in Yunan, China.

However, Myint et al. (2013) found that Chinese companies, through fruit traders in Muse, are leasing paddy land to grow melons with a compensation of 100,000 kyats - 250,000 kyats (100USD - 250USD) per acre. It also mentions that technology and market access is given to farmers. Sowing of melons starts from August, while the harvest takes place in February, around the Chinese New Year celebrations, which tend to drive up the market price of melons. In the year 2013/2014, the price for melons reached a value of 6 yuan (0.96USD) per kilo while this year it ranged between 1 yuan and 3.4 yuan (0.16USD and 0.54USD) (MyanmarTimesÉ(Myanmar Times 2015).

While there are farmers willing to rent their land in exchange of a “fixed income”, others prefer to have control over their land and production (Myanmar Times 2011b). Therefore, given the high interest from Chinese firms to lease farmland in Myanmar (high demand) and having the willingness of farmers to lease their land (supply), the question is: what is the actual farmers’ trade-off by leasing their most important production factor?

Chapter 3 - Conceptual framework

The analytical framework used to examine impacts of short-term international land lease, on Burmese famers' livelihoods is described in this section. The Institutional Analysis and Development (IAD) Framework, from Elinor Ostrom (see Figure 2) provides an integration of multidisciplinary elements of a policy, emphasizing the role of institutions to understand complex social situations (Ostrom 2005). It underlines external motivations and incentives that influence behaviours of actors in a specific situation. It also describes the outcomes from interactions between actors involve in this situation. Furthermore, it allows to evaluate these outcomes and to step back to assess whether these are positive or negative. If these outcomes do not improve the situation or policy, then; the IAD-framework facilitates to identify areas that need change in order to bring an institutional social change (Andersson 2006; Ostrom 2005). Therefore, this theoretical framework was found suitable to understand the drivers and outcomes from leasing land as well as the main stakeholders involved.

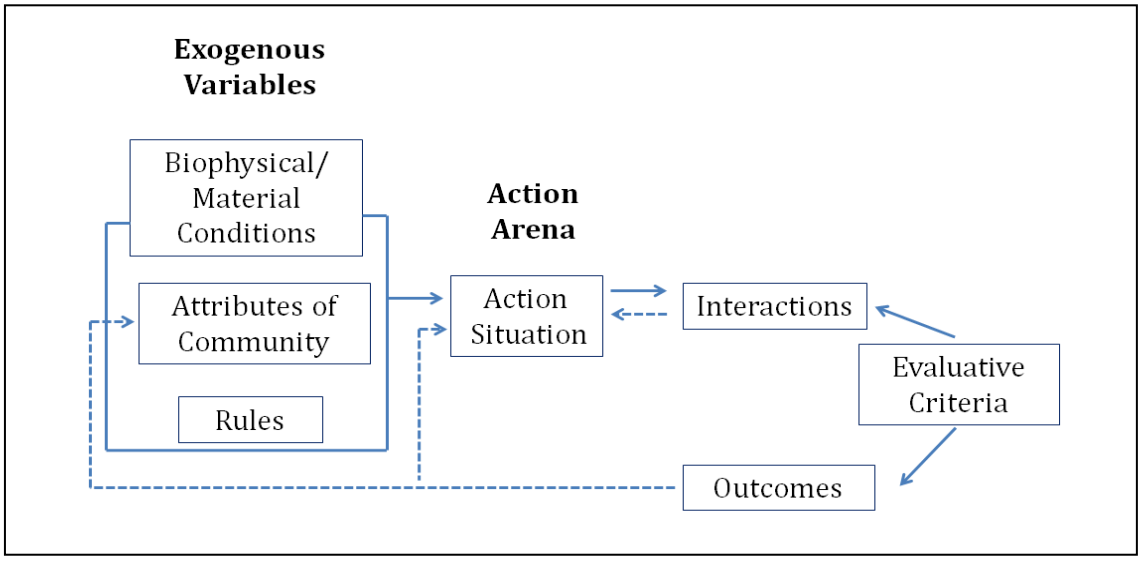

Figure 2: Institutional analysis and development framework
Source: (McGinnis 2011:172)

3.1 Applying the institutional analysis and development framework

Biophysical/Material Conditions: Defined as all the capabilities, human and physical capital that provides and produce goods and services (Polski, Ostrom1999). These conditions would influence participants' behaviors in the action arena by providing incentives and motivations. Most importantly and crucial for the framework is the economic nature[1] of the good produced in the action arena. This nature would help to understand incentives and motivations from the actors (Andersson 2006; Polski, Ostrom 1999).

Community attributes: This element of the framework is a set of socioeconomic and demographic conditions that characterized a group of individuals, englobing values, beliefs, religion, traditions and preferences. This allows knowing what cultural background set back on each actor and provides the ground of social relations (Andersson 2006). This study would examine the different actors, its relationships and what are their positions and perceptions to land lease deals with foreign investors, by in-depth interviews and focus group.

Rules-in- association with bundle of rights: In connection with community attributes and as a manifestation of the different interactions; rules are essential to understand actors' behavior. The understanding of formal and informal rules that participants follow is crucial for understanding positions and rights for each actor in the action arena (McGinnis 2011; Ostrom 2005). Furthermore, the author combined this element of the framework with property rights to identify user-rights changes; influence and power levels of relevant stakeholders (see 3.2).

Action situation: This is the core part of the IAD-Framework. In here actors would interact and exchange information, would make decisions motivated by incentives and rules. The interactions from here would bring outcomes that would serve for policy evaluation (Ostrom 2005). This study is interested on knowing the impacts or outcomes from interactions between farmers and Chinese investors during the leasing of land.

[1] Economic nature refers to the nature of the good that could be classified as public, private or common.

Interactions: Andersson (2006:29) explains that the interactions taking place in the action arena will create patterns that with time, lead to predictable outcomes. These patterns could help policy analysts to identify the institutional incentives behind each action that participants take. With the support of different participatory research methods (See 4.5), the consultation process for the land rental agreements and the interactions between the main stakeholders (Chinese investors, farmers, brokers and workers), will be studied.

Evaluating the outcomes and interactions: Outcomes are the result of the interactions between actors and are indicators used to analyze the performance of the system. If interactions produce favorable outcomes, participants would keep up with the same system but if these outcomes are undesired, the system will be transform up to a point that will bring a change (Ostrom 2005). A matching method will be used to estimate the outcomes of effects on farmers leasing land. Explanatory variables would be constructed by socio-economic demographic characteristics of both, farmers leasing land and farmers not leasing land. The outcomes analyzed in here will give the average impact on income and food consumption.

After identifying each aspect of the framework, the illustration for the IAD framework is shown in Figure 3:

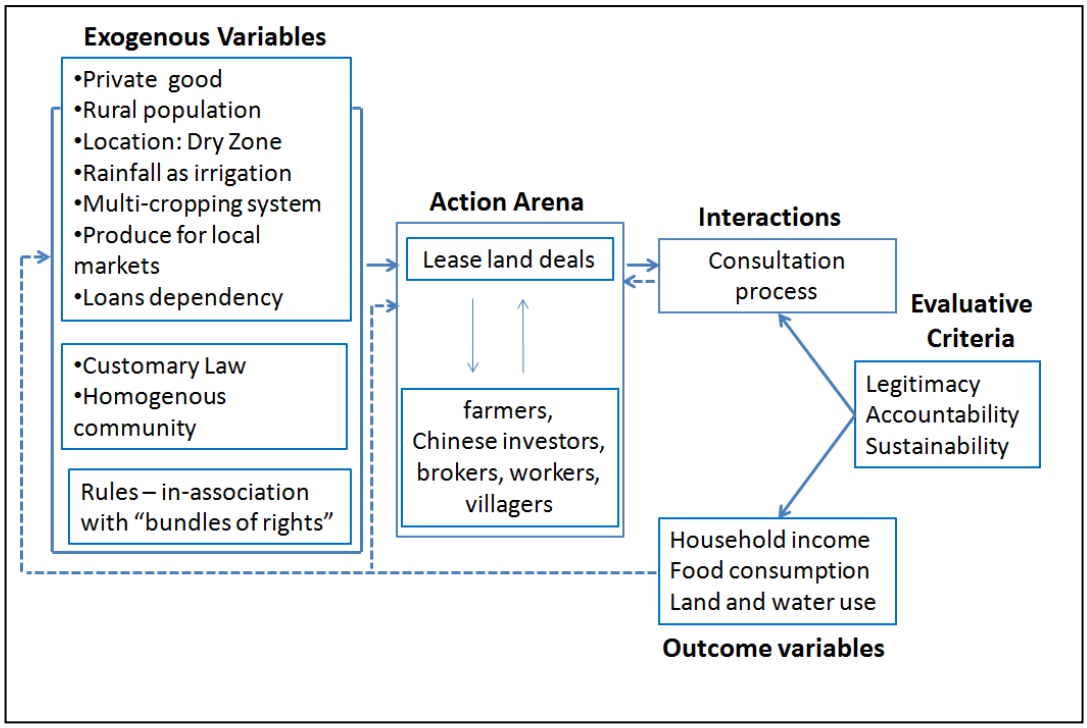

Figure 3: Institutional analysis as conceptual framework

Source: Adaption from McGinnis (2011:172)

3.2 Theoretical perspective

Property rights on natural resources are complex to understand given their traditional typology of private, communal and state ownership (Galik, Jagger 2014). It was found in literature diverse points of view towards property rights. Delville (2010) conceptualized the different actors that are embedded in land rights and ownership, aiming to identify which type of rights should be legal formalized, based on a set of rights, while for Aggarwal and Elbow (2006:3), land and property rights are a product of "social embeddedness"[2]. Ostrom's approach, however, was found to be the most practical and appropriate. Schlager and Ostrom (1992) offer a conceptual scheme on which they match property rights and users in a common-pool resource. The important differentiation is their definition on rights and rules "Rules generally agreed-upon and enforced prescriptions that require, forbid, and permit specific actions for more than a single individual. "Rights refer to particular actions that are authorized" (Schlager, Ostrom 1992:250).

[2] "Social, economic and political relations and associates institutions within which land and property rights are situated and constituted" (Aggarwal and Kent, 2006:3)

From another point of view, Ribot and Peluso (2003:1) argue that the dimensions of access have not been properly accountable within property rights, and that attention is needed to understand the dynamics and relations to resources' access. They defined access as "the ability to derive benefit from things"; and property as "the right to benefit from things." Thus, they call for a focus on "bundles of power" and not solely on a "bundle of rights". Further, analysis on access allows identifying by which "means, relations and processes" a user could draw benefits from the resource. Following this theory of access, Borras and Franco (2012) argue that, particularly in the increasing wave of large scale large acquisitions, is important to analyse and understand the dynamics of land use change to have a clearer picture why these changes happen, and what would be their effects on those who depend on the land. Their recommendation is to link the changing land-based social relations with the changing land use on direction to an agro-ecology system.

This study aims to investigate how the user rights and social relations change in the case of farmers leasing land to foreign investors. The idea is to use the "bundle of rights" designed by Schlager and Ostrom (1992) and adapt it to the rent of land situation. They classified property rights into two levels: a) operational-level (only performed for those who can physically enter the property and could withdraw products from the resource), and b) collective-choice level (decision-maker on who could withdraw, access, transform the resource and has the authority to transfer rights) (Galik, Jagger 2014; Schlager, Ostrom 1992).

Authorized users are those who are granted permission to access and extract from the resource. Withdrawal goes in hand with access because one cannot take without entering into the property, for example, villagers entering the field to pick up what is left after harvest. These right holders have the duty to respect the terms defined by the right giver. Claimants share the same rights, access and withdrawal, and additionally management. Management implies "operation within a given resource system" (Galik, Jagger 2014:5). Therefore a claimant is able to establish rules over production of the resource or to make decisions to improve the resource. While proprietors are able to access, to withdraw and to manage, they are also capable of excluding others and

transforming the resource. Proprietors authorize access and set rules on resource use. Finally, owners are holders of all rights. They are the only entity that can alienate (sell or lease) collective-choice rights (Schlager, Ostrom 1992). Positions and rights are presented in Table 1.

Table 1: Bundles of rights associated with positions

	Owner	Propietor	Claimant	Authorized User
Access and withdrawal	X	x	X	X
Management	X	X	X	
Alteration	X	X		
Exclusion	X	X		
Alienation	X			

Source: (Galik, Jagger 2014:6)

Chapter 4 - Methodology – data collection

This research is a preliminary study aiming to provide an estimation of the actual impacts that land transfers to Chinese agricultural investors, by rental agreements, have on local farmers in Tada Oo Township, in Mandalay Region, Myanmar.

The study was developed under a convergent research design. As its name refers, convergent mixed methods converges qualitative and quantitative data to make an in-depth and comprehensive analysis of the case study (Creswell 2009:18). This approach is a mix of qualitative and quantitative data that by integrating simultaneously would produce meaning insights (Collingridge 2012) There are two ways on how to combine them. On the one hand, separate analysis of quantitative and qualitative data would be shown in the results, but would be interpreted together in the discussion part. On the other hand, data can be transformed into qualitative or quantitative. This means that qualitative data is converted into quantitative and vice-versa (Collingridge 2012).

Since this study involves the understanding of farmer's perception qualitative methods is suitable, while at the same time to estimate average effects on farmers' income and food consumption a quantitative method is necessary. Therefore, a combination of both research designs was required for this thesis. This section describes the research area (see 4.1), how the field work was conducted (see 4.2 and 4.3) and the analytical methodology used (see 4.4 and 4.5).

4.1 Research area[3]

Tada Oo Township is located in Mandalay Region (see Figure 4), in the dry zone, which is characterized by low precipitation which ranges from 500mm to 1000mm, high temperatures of up to 43 degrees Celsius, and flat plans with clay, sandy loam and sandy soils (Baroang 2013) (PoeÉ. The traditional land types in this region are: a) paddy land (*Le*) characterized for access to irrigation throughout the year and suitable for paddy

[3] Some details of research area description is based on author's data, collected through the field work and based on official documentation provided from the Management office of Tada Oo Township. Available upon request.

production, b) dry land (*Ya*) given their low precipitation and sandy loam soils, cultivation of groundnut, sesame, sunflower and pulses is predominant. Then, c) alluvial areas (*Kaing-Kyung*) are located near rivers with fertile soil, finally d) hilly areas (*Taung-Ta*), where maize, sesame, soy bean and vegetables are more suitable for cultivation (Johnston et al. 2013). Farmers' cropping systems are determined by the three seasons: dry or hot season, referred as pre-monsoon (mid-February to mid-May), rainy season known as monsoon (mid May to mid October); and the cool season (mid-October to mid February) (Poe 2011).

Figure 4: Dry zone of Myanmar
Source: http://www.themimu.info

Tada Oo township, it is a total area of 364miles (586km), accounting 19,833 acres (8,000ha) of paddy land and 125,855 acres (51ha) upland. There are 61 village tracts[4], with 164 villages. Total population is 130,986 habitants, out of which 92% live in rural areas and dependent on agriculture. Farmers follows a intercropping system with

[4] Village tract is an administrative area for a group of villages.

moonsoon paddy and pulses, oilseeds and vegetables (Johnston et al. 2013). Just in 2011, villagers had access to the road, which enlarged their market to Mandalay. This newly constructed road goes from the village to the highway (15-20 miles distance). It connects with the Yangon-Mandalay express-way and Mandalay-Muse highway. To reach the village is either from Mandalay or Sagaing mostly by motorcycles or car. Moreover, the international Mandalay airport is located just few miles from Chuang Kwa tract.

Chuang Kwa tract, the village where the fieldwork of this study was conducted, comprises Chuang Kwa, Chuang Bat and Oat Twin Kan villages. Its total area covers 4,461 acres (1,805 ha) of upland and 652 acres (264 ha) of lowland. There are as well 81 acres (33 ha) for pasture and 111 acres (45 ha) for the village (close to the irrigating canal). From the 841 households established, about 300 households are landless. Rural farmers, who still rely on cattle to plough their lands and on rainfall to irrigate their fields, practice a multi-cropping system. The most profitable crops are sesame and groundnut. Additionally, farmers depend on hawkers to sell their produce to a relative higher price than in the village, but traditionally and still practiced, farmers would carry their produce by bullock cart to the nearest village and sell their produce there (Johnston et al. 2013).

For the production of cash crops, men and women perform different activities. For example, in the production of chili, men are in charge of preparing the land, while sowing, weeding and harvest is done by women. Wages among men and women are different and vary according to jobs. In average, daily wage for women is between 1,500kyats (1.5USD) and 2,000kyats (2USD) by making baskets or being seamstress. For men, blacksmithing is more popular but only provides 2,000kyats per day (2USD). There is no electricity in the village, but the villagers have created a fund to build a community electric system that is expected to start working this year (2015).

4.2 Sampling selection

Knowing that short-term land rental for melon production is happening in the uplands, Mandalay Region, the village selection was framed taking into consideration cost of data

collection, time availability and logistics. However, the final decision was highly influenced by ability of access to the village. Interviewing knowledgeable people on land rental cases allowed the author to decide where would be the study site. It was found out that Tada Oo Township in Mandalay Region is a target place for rent of land by Chinese investors. The validation of this information was supported by an in-depth interview with the Township Manager. Thereafter, Chuang Kwa village tract was selected as the study place. Since the first cases of land rental happened here, it was assumed that farmers would have more experience on dealing with Chinese investors. This decision was taken after visiting the villages Chaung Kwa, Pyar, Nga Zin Yaing.

Two groups of farmers were needed to be able to conduct the quantitative analysis: a treated and a control group (the quantitative method is descriptive in section 4.5.3). The basic idea is to match these two groups, which are similar in their demographic and socio-economic characteristics, but one group has taken part in a treatment, in this case rent of land (Caliendo, Kopeining 2008). Thus, after matching, selection bias is reduced and mean differences between both groups could be attributed to the treatment (Leung et al. 2008). As such a treated and a control group is necessary. For this study, the treated group consists of those farmers renting land to Chinese investors and producing paddy for their own consumption (hereafter referred to as land-renting households). The control group consists of those farmers who do no rent land (control households). Ravallion (2001) suggests that when selecting both groups, the sample size for control group should be larger than for the treated group, this is to increase the probabilities of a higher matching selection.

In general, a representative group of a population is drawn from a household list; however, given the national population census on March 2014, there was not an updated household list in the village, and the author was not able to access the previous one. Thus, respondents were selected by conducting a purposive and snowball sampling techniques, with the advice from the village chief and key-informants. As reference, it was considered the official figures 2012 provided by Tada Oo township department (See Table 2).

Table 2: Sample distribution on Chuang Kwa village tract

No. of Households	Total Population	Total (HH) Sample	
		Treated Group	Control Group
841	3,728	82	110

Source: Official figures 2012, Tada U Township.

4.3 Survey process

The field work took place from June 2nd to August 31st, 2014. Throughout this period, visits to the villages, in-depth interviews, focus groups and participant and non-participant observation were conducted. On the first day of interviewing, the village chief or an influence person accompanied the author and data collectors. This facilitated acceptance and trust from the villagers. Each interview started by an introduction of the author and the purpose of the research; interviewee was given the opportunity to ask questions and the right to not answer if that was their wish.

The survey process was conducted in two phases. First, the survey to land-renting households were conducted, followed by the surveys to control households. Translations and double-check data entry was performed during the field work, but in case of inconsistent or missing information, this was re-checked when possible.

Pre-test of the household survey was conducted on each village. After this, the questionnaire was adapted to local context. Information on physical and socio-economic characteristics was covered in the first part of the questionnaire, questions on food consumption and coping strategies followed. The final part was structure by questions on agriculture, land tenure, contract farming and supply chain. Impacts on renting land were asked only for the treatment group, with duration of approximately 1.3 hours, while the surveys for the control group lasted on average 1 hour. The aim was to conduct a comprehensive survey that respondents and data collectors were able to cope with. To smooth data collection by enumerators, the household questionnaire was translated to local language.

4.4 Methods for quantitative analysis

4.4.1 Measurement for food security

The Food Consumption Score (FCS) and the Household Dietary Diversity (HDD) from the World Food Program (WFP) have been commonly used in Myanmar to monitor and assess food security across the country (Poe 2011; IHLCA 2011; Wilson et al. 2012). The Food Consumption Score (FCS) is an instrument of data collection on food frequency, diet diversity and a relative caloric intake. This information serves as proxy variable that indicates quality and diversity of a household's food consumption (Wiesmann et al. 2009). Although it is recommended to have an indicator that captures diet diversity, there are diverse critics towards the FCS. Wiesmann et al. (2009) have validated the FCS against a benchmark of calorie consumption, they found that in the context of their research, food insecurity was underestimated, furthermore, when small amounts of food items consumed are excluded, the predictive power of FCS improved. Similarly, Sibson (2014) states that a 7-day recall period could under-estimate the real household consumption, comparing with a 24-hour recall period.

The FCS was chosen to calculate food diversity among farmers in Chuang Kwa, since one objective of this study is to find differences on food consumption between land-renting households and control households, so having a method that can be quantified facilitates this analysis.

The FCS yields a score that is calculated by the sum of frequencies of 8 standards food groups eaten by a household in the previous week (7 days) of the survey (WFP 2008). Frequency is obtained by using a list of food items regularly consumed in the village and by responding questions such as "How many days in the past 7 days have your household members consumed x?" where x is the food item. The food items included in the household survey were tested by people from the village and adapted to local context (see Table 3).

Table 3: List of food items included in the household survey

	Food items (adapted)	Food group (definitive)	Weight (definitive)
1	Rice, bread, potatoes	Main Staples	2
2	Beans (including peas, chickpeas and groundnuts)	Pulses	3
3	Vegetables	Vegetables	1
4	Fruits	Fruits	1
5	Beef, mutton, chicken, pork, fish and eggs	Meat and Fish	4
6	Milk and other dairy	Milk	4
7	Sugar and sugar products, honey	Sugar	0.5
8	Oil, fats and butter	Oil	0.5
9	Spices, tea, coffee, salt, fish powder	Condiments	0

Source: (WFP 2008:8)

Single food items will be summed up to record a value for each food group, if food frequency (consumption days) is above 7, will be recorded as 7. The recorded value for each food group is multiplied by its weight, creating a new weighted food group score (WFP 2008). Weights reflect nutrient density, good quality protein, micronutrients and capture quality and diversity diet (Wiesmann et al. 2009). The weights are said to be standard and constant in any context with a minimum value of 0 and a maximum of 112 (WFP 2008). To finally create the FCS, the new weighted score for each food group are summed up. Its mathematical function is given by the WFP (2008):

$$FCS = a_{staple}x_{staple} + a_{pulses}x_{pulses} + a_{vegetable}x_{vegetables} + a_{fruits}x_{fruits} + a_{animal}x_{animal} + a_{dairy}x_{dairy} + a_{sugar}x_{sugar} + a_{oil}x_{oil} \quad (1)$$

Where:

FCS= Food Consumption Score (proxy indicator)
x_i= frequency (number of days the food items has been consumed in the past 7 days)
a_i= weight

Having estimated the FCS for each household, it is necessary then to look at the cut-offs to determine the level of food security, if there is a high frequency of consumption of oil and sugar, it is recommended to raise the thresholds by 7 points (see Table 4) (WFP 2008).

Table 4: Cut-offs recommended by World Food Programme

Categories	Normal	High sugar and oil consumption
Poor	0-21	0-28
Borderline	21.5-35	28.5-42
Acceptable	>35	>42

Source: Adapted from WFP (2008:9); IFPRI (2009:48)

Since it has been argued that FCS alone could not be enough to determine an appropriate food security assessment (Pangaribowo et al. 2013; Wiesmann et al. 2009), it is necessary to define other variables that cover other aspects of food security. The following variables (Table 5) are used to assess the differences on food diversity, food stability and food accessibility:

Table 5: Definition of food security variables

Variable Description	Description
Food Consumption Score (Proxy variable)	Quality and diversity diet for the past 7-days prior the survey.
Months not enough income to eat	Number of months that a household do not have sufficient income to buy food.
Food Expenditure	Expenditure on rice, meat, fish, vegetables and fruits in the past 7 days.

Source: WFP (2008), *Own data*

4.4.2 Propensity score matching

This study aims to estimate the effects that renting land has on farmer's income and food security. However, when estimating effects of a treatment in a group, there is a missing problem data (Rosenbaum, Rubin 1983). This means that when studying casual effects, only one result is observed, the other is unobserved or counterfactual (Caliendo, Kopeining 2008). The average treatment effect, therefore, would be estimated to overcome the missing data problem. To do so, the counterfactual response for the treated group is constructed by using the mean outcome of the observed response of the untreated (in this case from control households), then, it would be equivalent as

treated (Heinrich et al. 2010). However; the decision of renting land is influence by factors that influence outcomes simultaneously; leading to a "selection bias" which is the difference between the means of the counterfactual (E[Y(0)|T=1]) and the observed outcome E(Y0 /T=0) (Heckman et al. 1997). The mathematical notation of average treatment of the treated is shown in Table 6:

Table 6: Average treatment of the treated (ATT)

Mathematical Expression	Description
$E(Y_1 - Y_0 \mid T=1) = E(Y_1 - Y_0) = E(Y_1 \mid T=1) - E(Y_0 \mid T=1)$	Counterfactual outcome of those who did not participate is estimated. It shows the most accurate analysis on the difference of outcomes on those who in fact participate.

Source: (Caliendo, Kopeining 2008)

Increasing its popularity among authors in multidisciplinary disciplines, the propensity score matching (PSM) is preferable over other matching models due its properties of reducing selection bias on the estimation of treatment effects. The idea of PSM is to compare or match two groups similar in their demographic and socio-economic characteristics, but one group has taken part or a treatment. When implementing PSM is assume that the treatment assignment is strongly ignorable (Rosenbaum and Rubin, 1983). This principle encloses two core assumptions: a) the conditional independence assumption (CIA) or also called unconfoundedness, states that after balancing the selected covariates, the potential outcomes are independent from the assignment treatment. Then b) the overlap or common support, which is the range in which both treated and un-treated group would have the same positive probabilities of being included in the treatment (Caliendo, Kopeining 2008). Distribution of propensity scores among both groups is visualized with a histogram, giving an idea on the overlap of propensity scores between both groups, those observations outside the common support are left out, meaning that those could not be matched (Heinrich et al. 2010).

When the CIA condition is not met, it is assumed that may be un-observed factors that affect the outcome and treatment assignment, leading to a "hidden bias" (Caliendo, Kopeining 2008) To test how robust is the outcome to this hidden bias, it is suggested to perform a sensitivity analysis that although would not eliminate this hidden bias, would

just give an idea of how strongly unobserved factors influence treatment participation and outcomes. Using Rosenbaum (2002) bounding approach, it is possible to detect the influence levels of unobserved variables (Loos, Zeller 2014).

The implementation of the PSM is by following the steps described by Caliendo and Kopeining (2008): 1) estimation of propensity score, 2) selection of a matching algorithm, 3) check overlap/common support, 4) average effects estimation and test of matching quality, finally, if after matching outcome variables are significant, 5) a sensitivity analysis is performed (Caliendo, Kopeining 2008; Loos, Zeller 2014).

The estimation of propensity scores for each observation is done by using a probit model. By doing so, treated and control groups become comparable on their observable characteristics (Rosenbaum, Rubin 1983). These characteristics are variables not linked to the treatment, but affect outcomes and decision on taking part of the treatment (Caliendo, Kopeining 2008). The covariates used in this study capture socio-economic characteristics that could influence the decision of a farmer to rent their land, as well as the outcome variables (total income and food security). This probit model was also used to find the determinants for a farmer to rent their land. The mathematical expression is given by (Dougherty 2011):

$$Pi(Y) = \frac{1}{1 + e^{-zi}} \qquad (2)$$

Where e is the base of natural algorithms and z represents the constant ($b0$), coefficients (bi) of explanatory variables xi and the error term (e). Dougherty (2011) suggests that as Z tends to infinity; e^{-z} would yield probabilities between 0 and 1. Values close to 1 indicate that farmers are most likely to rent their land, while values close to 0 show high probabilities of not renting their land. As dependent variable; a discrete binary variable is used (Y*) to represent land-renting households (if 1) and control households (if 0). To validate the quality of the data and to know whether the model fits well the data, correlation analysis and goodness of fit were performed[5]. This model then provides the levels of significance of the covariates, and its marginal effects, which

[5] Hosmer-Lemeshow test for Goodness of fit and estimation of the Variance Inflation Factor VIF to test multicollinearity.

serve as an explanation on factors that influence the decision on farmers whether to rent or not their farmland (Ravallion 2001).

The next step is to choose a matching algorithm. This can be done by comparing which approach present less bias[6] (Baser 2006). For this study, radius matching, suggested by Dehejia, Wahba (2002), was selected as it increases the changes of higher number of matches within a pre-defined range. Simply put, to use as many units from the control group to one unit from the treated group (many-to-one) (Heinrich et al. 2010). To improve the matching quality, Caliendo and Kopeining (2008:38) propose to impose a tolerance level on the maximum propensity score distance (caliper). So far, there has not been a consensus on a standard caliper width (bandwith), but it is found that Rosenbaum and Rubin (1983) approach reduce considerable the remaining bias after matching (Loos, Zeller 2014). The caliper width is calculated by taking one-fourth of the total standard deviation from the predicted propensity (c=0.25xSD) (Rosenbaum, Rubin 1983; Loos, Zeller 2014).

Then, an assessment on the quality of covariates matching is performed to check the unconfoundness condition (Heinrich et al. 2010). Using *pstest* one could verify that no differences exist between groups. Caliendo and Kopeining (2008) consider a level of 3% - 5% as acceptable level for the remaining bias after matching.

Finally, the ATT is performed by using the statistical program *psmatch2* in Stata (Heinrich et al. 2010). If after matching, there is a significant outcome variable, a sensitivity analysis will be run by using Rosenbaum (2002) bounding approach. Results on the implementation of the PSM and sensitivity analyses will be provided as appendix.

Table 7 show the outcome variables for which the ATT will be estimated in this study:

[6] Caliendo and Kopeinig (2008) provide a detailed overview on the different estimators; while Baser (2006) and Heinrich et al., (2010) provides a guidelines on choosing a matching technique

Table 7: Hypothesis and definition of outcome variables

Variables	Expected sign	Definition
Total Income	+	Includes farm and off-farm income in the past season. It is expected an increase on total household's income due the additional income from renting land.
Food Consumption Score	+	Food diversity. It is assume that land-renting households would increase their food consumption due higher purchasing power.
Months not enough income to eat	?	It cannot be determined if the additional income would result on food stability as the dry zone is vulnerable to climatic shocks, causing seasonality food insecurity.
Food Expenditure	+	More income would allow a household to purchase more food

Source: Own data, household surveys 2014

4.5 Methods for qualitative analysis

4.5.1 In-depth interviews and focus group

Semi-structured questionnaires were designed for in-depth interviews and adapted accordingly to the situation. Duration varied, usually would take from 1 hour to 2 hours per interview. The purpose of in-depth interviews was to have a greater understanding of positive and negative experiences from land transfers by rent agreements. Target for these interviews were farmers, workers, civil organizations and government institutions.

Participants of the focus group discussion (FGD) were pre-selected by the village chief and key-informants. Three in total were conducted; each had 8 participants and different purpose. One FGD had as purpose to gather farmers to design a seasonal calendar and to map the rent of land process. A second FGD was conducted with only workers with the aim to know their experience while working on Chinese rented fields. The last FGD gathered women whose fields were rented. Participants ranged from 19 years old to 70 years old, and included youth, elderly, women and farmers to have diversity on views.

Household surveys and in-depth interviews were also conducted in villages located in Monywa, Sagain region with the purpose to know about the supply chain for those farmers producing melons by themselves.

4.5.2 Net - map tool

This research tool is a mind map designed to visualize the interactions of social relations, interests and level of influence between actors in which conflict of interest exits, with an aim to find ways of improvement (Schiffer, Waale 2008). The map is built by active participation from the respondents to a set of questions already designed. However, at first, it is suggested to define the situation and objectives. For this study it is important to identify which are the main actors that take part on the consultation process for renting land and to understand their decision power. Schiffer (2007) offers a guideline to perform the Net-Map tool. This includes responding the following questions:

(1) *Who is involved?* Participants are encouraged to mention and add actors that they consider are involved in the situation. Names of actors are place in cards or post-it notes to move it freely according to participants' opinion.

(2) How are they linked? It is expected to find out which type of relation links each other actor, as well as communication flows. These links are represented by arrows that show the direction of the communication, and can be of different colours.

(3) How influential are they? Most importantly in this question is that there should be an agreement on the meaning of "*influence*". In the decision to rent the land, the central aspect is who actually has the decision power over renting land and who decides the value of compensation. This influence is represented by setting a tower (chess maker pieces), as higher the tower, the higher actors' influence.

(4) What are their goals? Defining each actor's goals over the situation; provides information for this study to know their positions and perceptions.

Chapter 5 - Results

This chapter provides the results obtained from the analysis of data collected for this study and it is described accordingly to the IAD-Framework.

5.1 Biophysical conditions – descriptive statistics

The data used in this study was gathered from 192 household surveys. From the households interviewed, 90% are male-headed household with only 10 % female-headed household. The average age is 47 years old and almost all household heads are able to read and write; only 5% is illiterate. The majority of the houses are built with bamboo and bricks, only 20% of respondents own a house made of wood and 2% of concrete. Commonly, batteries or generators (40%) are used for lighting, just a small group of households (5%) use candles. Firewood is usually the main source for cooking; only 6% rely on charcoal. Almost every household had a latrine with only 3% does not have toilet facilities.

To be able to evaluate socio-economic differences between land-renting households and control households an independent t-test was used. Based on results (see Table 8) there is a large difference of 1.7 million Kyats (1,750USD) on household physical assets between both groups. Household surveys revealed that land-renting households have higher purchasing power from the land rental income. This has allowed them to purchase new assets, particularly motorcycles, mobiles and gold. Farmers have been able as well to buy cows and in few cases, additional acres of land (only 5 farmers). The ownership of motorcycles and mobile phones facilitates communication and access to market in Mandalay, which is the closest city. Likewise, it seems that this extra income has also influenced the purchase of agricultural assets[7] for land-renting households whom show a significant difference of 1.1 million kyats (1,100USD).

[7] Trawlagyi (small tractor), tractor, farm machinery, bullock cart and cattle

Further, land-holding size is significantly different, but in average land holdings between both groups is 8.4 acres (3.4ha). Findings suggest that land-renting households own 3.5 acres (1.4ha) more than control households. This also suggests that in the village there are predominantly medium size farmers.

Table 8: Differences on socio-economic characteristics

Variable	Mean Total Sample (192 0bs)	Mean Control Group (Y=0) (110 obs)	Mean Treatment Group (Y=1) (82 obs)	Mean Differences (C-T)	P-Value
Household age	46.56	47.03	45.91	1.12	0.520
	(.859)	(1.123)	(1.339)	(1.740)	
Level of education	1.40	1.32	1.51	-.184	0.101
	(.055)	(.075)	(.081)	(.112)	
Household size	4.21	4.15	4.30	-.150	0.451
	(.098)	(.134)	(.143)	(.199)	
Dependency ratio	0.45	.445	.457	-.012	0.873
	(.037)	(.046)	(.061)	(.075)	
Total value assets	4.4	3.6	5.3	-1.7	0.022**
(MM Kyats)	(3793)	(3918)	(7037)	(7580)	
Household assets	1.7	1.3	2.1	-.755	0.325
(MM Kyats)	(379)	(3967)	(6844)	(7483)	
Agricultural assets	2.7	2.2	3.3	-1.1	0.010**
(MM Kyats)	(1924)	(2223)	(3288)	(3832)	
Land Size	8.4	6.9	10.4	-3.5	0.000*
(Acres)	(.467)	(.462)	(.858)	(.9144)	
Dummy for Form-7[a]	.943	.945	.939	.006	0.850
	(.017)	(.021)	(.027)	(.034)	
Dummy for loans in	.744	.727	.768	-.041	0.521
the past season	(0.031)	(.042)	(.046)	(.063)	
Dummy for savings	.864	.845	.890	-.044	0.372
	(0.025)	(.0346)	(.0347)	(.0500)	

Standard errors in ()
*Indicates significant difference at α = 0.01 and ** at α = 0.05 level.
[a]: "Right to work"
Source: *Own data*

Contrary to what it was expected, there is no significant difference on education and household size. Moreover, most of households, except 5%, have received a Form-7 from the government. Also, it is not observed high differences on loans and savings between both groups.

5.2 Community attributes - determinants to rent farmland

To predict the probability of farmers to rent their farmland, a probit regression was used. Explanatory variables were selected according to their relevance for a household to decide whether to rent or not. As dependable variable a binary variable is used to show if land is rented = 1 or otherwise = 0.

Table 9: Determinants for farmers to rent land

N = 192
LR chi2 (11) = 81
Prob> chi2 = **0.0000**
Pseudo R2 = 0.3091
Sensitivity = 71.95%
Specificity = 80%
Correctly classified = **76.56%**

Independent Variables	Marginal effect (dF/dx)	Std. Err	Significance (P>|z|)	95 Confidence Intervals		X-bar
HH head age	-0.00	0.003	0.958	-.007	.006	46.56
Gender~	-0.11	0.156	0.468	-.418	.194	0.89
Education ~	0.244	0.130	0.142	-.010	.499	0.94
Household size	0.046	0.032	0.146	-.016	.109	4.2
Agricultural assets	1.76e-08	1.96e-08	0.369	-2.1e-08	5.6e-08	2.7e+06
Livestock ownership~	0.344	0.093	0.013**	.160	.528	0.85
Loans past season~	0.197	0.097	0.059***	.007	.388	0.74
Land size	0.028	0.008	0.001*	.011	.044	8.39
Crop production ratio	0.048	0.037	0.188	-.023	.121	1.10
Water access	0.059	0.037	0.109	-.013	.131	3.08
Soil Quality ~	0.502	0.072	0.000*	.361	.643	0.45

Gender (Male=1; Female=0)
Education (iliterate=0; literate =1)
Loans past season (Received loan=1; otherwise=0)
Livestock ownership (hh owing cattle=1, otherwise=0)
Water access (rainfall=1; stream=2; well=3; dam=4)
Soil quality (poor or slightly fertile =0; fertile=1)

* Indicates significant difference at α = 0.01; ** at α = 0.05 and *** at α = 0.1 levels.
~ Dummy variables
Source: *Own data*

Table 9 presents the results for the difference in attributes between land-renting households and control households. It is shown that the model is significant (p-value=0.0000) and there is also a good fit of the data[8]. Predictive power is acceptable 76.56%. Covariates were adequately chosen to predict the probability of a farmer to rent their land. These explanatory variables are also appropriate to estimate propensity scores for matching. Yet, it is expected that the covariates are insignificant since the data was gathered from the same village, as households have similar socio-economic characteristics, a condition to implement the PSM. Therefore, knowing which aspects are statistically different, it provides insight on factors that influence farmer's decision on renting land.

Typically, a farmer requests loans from the Ministry of Agriculture (MOA) at the beginning of the season. For paddy production a farmer would receive a loan of 100,000 kyats (100USD) while for other crops 20,000kyats (20USD). Since, this amount does not cover the total production cost, farmers look for informal money lenders, who would borrow money with an interest rate up to 6% per month. In both cases, loans should be repaid after the harvest. Drawn from qualitative analysis, it was found that farmers are trapped into a vicious loans cycle. If at the end of the season there was not enough harvest, farmers would end up on requesting additional loans to repay past loans. Having a secure income attracts farmers to rent their land. Results suggest that farmers that have received a loan in the past season are more likely to rent their land with a probability of 20%.

Land size is significant determinant for a land-renting household. The average land holding for interviewed farmers is 8.4 acres (3.4 ha). Findings suggest that medium and large farmers are most likely to rent their fields. Farmers expressed that the lack of investment, not enough labor at times and climatic variations, also contribute to the decision of rent their land. Furthermore, there is a positive probability of 34% for farmers owning livestock, to rent their land. This result might steam from the fact that dairy production is slowly increasing in the village.

[8] Goodness of fit-test is provided in Appendix 3.

Another main determinant to rent land is the type and quality of soil. Results show that farmers with fertile land are most likely to rent by an exactly 50% probability, this was expected since Chinese investors target fields with fertile soil. Whereas, contrary to what it was expected, is the insignificant influence that access to water would have on the decision to rent land. Nevertheless, a closer view shows that results imply that on average the main source of irrigation for farmers is by wells, and there is no significant difference between both groups on this aspect.

5.3 Rules-in- association with property rights

In this section, the adaptation of user-rights in Tada Oo Townsip, based on the "bundles of rights" theory (see 3.2) is described. Also, it is addressed the way how these rights changed when farmers rent land.

In practice, renting of land among the villagers is a straight forward process. If a farmer wishes to rent land, one year in advance would inform to the owner and through a verbal conversation, they would agree and negotiate the price at that moment. This behavior is influenced by the customary law. However, officially, in Myanmar, land is a resource owned by the state (**owner**). This influences the rules or rights of access over land, financial capital and labor. Furthermore, through the Farmland law, the state provides a certificate that establishes the area in which Burmese farmers (**proprietors**) are allowed to farm. This private use of land is called Form-7. This document however, is not a land title and establishes only the "right to work". Burmese farmers are allowed to transfer or exchange it, but in the case that involves selling, pawning, leasing, exchanging or donation it to any foreigner, government permission is required. Other farmers and workers (**claimants**) are able to operate other fields. They could influence or advise which crop to produce and share knowledge on cultivation practices. Farmers with access to pasture fields allow others to enter into their field for grazing, but sometimes cow dung is given as exchange. Finally, villagers (**authorized users**) are able to enter the fields and take from the harvest without permission. Free-rider problem was not visible in the village as everyone respects each other's fields. Therefore, a villager would extract produce without affecting other people's extraction.

Table 10 shows an illustration on the rights and positions in Chuang Kwa village tract, Tada Oo Township:

Table 10: Ownership and Individual Rights in Tada Oo Township

	Government	Burmese Farmers	Other Farmers, workers	Villagers
Access and withdrawal	X	X	X	X
Management	X	X	X	
Alteration	X	X		
Exclusion	X	X		
Alienation	X			

Source: Adapted from (Galik, Jagger 2014:6)

It is seen that the role of the State is the most important on land activities in Myanmar. However, for this study, the focus is on how user rights have changed in a land lease deal between Chinese investors and farmers.

Chinese agricultural investors lease land for a period of 4-6 months with a minimum pay per acre; as compensation, from 280,000kyats (280USD) to 300,000kyats (300USD). There is not an official contract for farmers, the author called it instead a collective terms of agreement, in which different parties are involved (see 5.4). Additionally, Chinese investors are permitted to bring their own labour to Chuang Kwa village tract with prior authorization from the village chief. Usually, these workers come from the Yunan-Muse border and are known as Kokang Chinese due their Chinese ethnic roots. Being able to speak both languages, Burmese and Chinese, facilitate the communication between Chinese investors and workers. The Kokang workers that come to the village live during the cultivation period in huts that are built in the rented fields (see Figure 5).


Figure 5: Hut where Kokang workers live during the rented period
Photo: Author

Chinese investors offer advance payment for the rent of land, this action is very welcoming from farmers. But, farmers stressed that there are "rules" requested from Chinese investors only to farmers whose land will be rented, showing that Chinese investors' control over land goes beyond the rental period. Based on qualitative data, this is illustrated as follows:

- No visit of fields (*access and withdrawal; exclusion*)

During the rental period farmers and villagers are not allowed to enter a rented field. If a farmer does, he would receive warnings and questions. There was no evidence that Chinese investors would take harmful actions, but farmers expressed their concern about the consequences if these unwritten "rules" are broken.

- No growing watermelons (*management*)

Farmers have been prohibited from growing melons in the season prior to the rental period. No reasons are given, except "*this crop is grown only by Chinese investors*"[9].

- No use of well (*alteration*)

Chinese investors built wells to extract groundwater without any authorization from farmers. Moreover, there is one person taking care of this well during the rental period

[9] In-depth interviews

and once the field is returned, the farmer would need to pay a minimum compensation for the well, half its cost up to 200,000 - 250,000 kyats (200 - 250USD). If he refuses, the well is blocked and unusable. The land is also transformed by the way Chinese investors cultivate the melons (see 5.4.2). Furthermore, farmers owing fields located in the middle or next to fields rented to Chinese investors, have found difficulties to work their land, since the use of bullock cart would be necessary. Below is described a story of a farmer facing this problem.

Box 1: Leasing land or not alternative

A 57 years old man, owns a field of 7 acres (2.8ha) since 35 years ago, 4 acres were heritage from his parents. He has been a farmer all his life and never thought on renting or selling his land before. However, the location of his field is surrounded by lands which are currently rented by Chinese investors. During this rented period, he was not allowed to enter his field by bullock cart, or even by foot, so he found difficulties on cultivating his own crops, in this way, he felt that the best option was also to lease his land. He said that the 300,000kyats (300USD) paid is not enough; if weather is good, he could earn much more by growing sesame and groundnuts. He has reduced the land where he used to produce food for own consumption, as he is now leasing 5 acres (2ha).

Although his contract is for 4 months, he noticed some drastic changes after leasing his land, soil was rigid and hard to plough, there was plastic all over his land and more weed and insects than usual. He also found out a new well in his field, which he is not able to use unless he pays a fee of 250,000kyats (250USD). "*When we sign a contract, we only agree on renting the land, but it seems that Chinese also rent the water without income…I do not have a copy, we just sign a piece of paper without official stamp*". During the year his land is not rented, he grows his usual crops, albeit he was instructed to fallow their fields. The last harvest, he experienced a 50% yield decrease. "*I do not have an option, if I don't rent my land, I can't work on it either. But now, the soil is so damaged that my production has been reduced to half*".

The establishment of this requirements or "rules" by Chinese investors caused a changed on user-rights over the land in Chuang Kwa tract. Table 11 reflects the new positions on a "bundle of rights".

Table 11: Ownership and individual rights – rent of land situation

	Government	Chinese Investors
Access and withdrawal	X	x
Management	X	X
Alteration	X	X
Exclusion	X	X
Alienation	X	

Source: Adapted from (Galik, Jagger 2014:6)

5.4 Action arena- consultation process

In order to identify the patterns of access to land by Chinese agricultural investors, the consultation process was drawn by using the Net-Map tool based on Schiffer (2007) guidelines (see 4.5.2). The actors are placed in boxes of different colors. Orange color represents actors from China, blue color represent actors from Shan state (Kokang Chinese) and green color stands for actors from the village (Chuang Kwa). The arrow shows the direction of communication and interactions. As a first step in building the net-map tool, an in-depth interview was conducted with the village chief to understand the flow of the consultation process. Then, a focus group with farmers provided the insight on how the consultation process occurs in detail and in reality.

Every March, a Chinese investor accompanied by a Chinese agronomist visits the fields of Chuang Kwa tract in Tada Oo Township in Mandalay Region. The agricultural technician performs pH tests in the fields aiming to identify the ones with the best soil fertility which could potentially be appropriate for renting. These fields also have easy access to water. Once fields are identified, a translator is hired. The translator is known to be from Shan State (Kokang ethnicity), and can speak Burmese and Chinese languages. At the same time, a Chinese broker is also contacted, who might be a fruit

trader (later on, it was found that this broker is also stationed in Mandalay). Then, the Chinese investor and the Chinese agricultural expert return to the village and contact a local broker. The local broker becomes the mediator between the farmers owning the fields that were previously identified, and the Chinese investors (see Figure 6).

The rental compensation is negotiated between the Chinese investor and the local broker. Once this price is agreed, the local broker would contact the local farmers who own the fields requested by the Chinese investors. Then, the local broker asks the farmers if they would be interested in renting their fields for the season. If they agree, the local broker gathers them together with the village chief to authorize the rent. What is next is that farmers would gather at the village chief house and sign a rental statement. This statement is basically a list with all the names of farmers, their respective field number, and number of acres rented by farmer. This statement would be read aloud, by the local broker, and describes the rental period, purpose of rental and compensation per acre. Farmers reported that they usually do not understand this statement or have forgotten what it says, but they sign it collectively, next to their names. Despite that there is an oral authorization from the village chief to lease their land; there is not an official contract between the Chinese investors and farmers.

Terms of agreement are also influenced by the customary law. Most of the contracts in the village are produced orally and based on trust; therefore this is the first time farmers are singing such an agreement. It is worth mentioning that the farmers did not question this type of agreement due to their trust and close relation with the local broker, but also due to their lack of formal education.

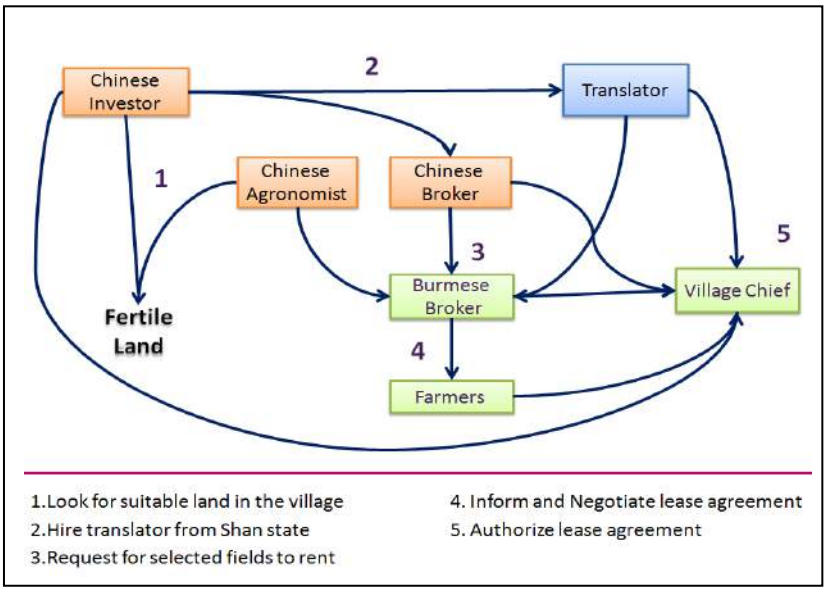

Figure 6: Lease land process in Chuang Kwa tract, first time (2009)

Source: Own data

During the same focus group, farmers explained that this practice of renting land has been ongoing already for some years; however, farmers have experienced a change in flows of communication and interactions (see Figure 7). The major change has been when signing the rental agreement. Farmers expressed that this collective terms of agreement is now agreed only between them and the local broker, without the participation of the Chinese investor or village chief. It is only afterwards, that the local broker will inform the village chief on the number of acres than will be rented.

In an in-depth interview, the village chief expressed his concern on this sort of agreement. He mentioned that he would have the responsibility to solve any dispute or issue over an agreement, even though he did not authorize it or sign it. Further, he stressed that the production practices by Chinese investors are not bringing any good to the environment, strongly emphasizing on the high use of fertilizers. He suggested then that a soil test would be suitable to know the level of degradation, however, since no such test has been performed before, there is no baseline to compare to. Moreover, he urged that legal rent contracts must come along with provisions on permitted and prohibited cultivation practices.

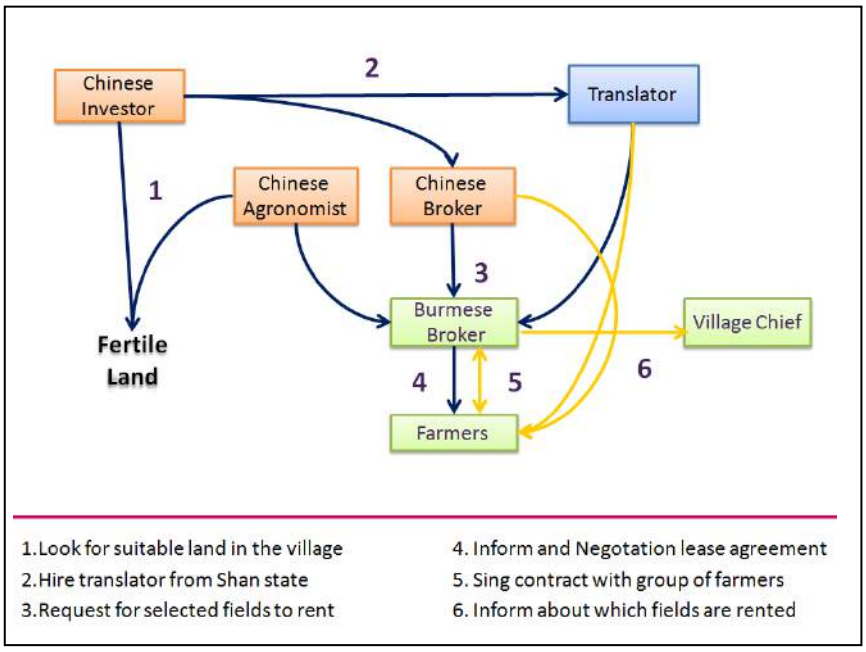

Figure 7: Lease land process in Chuang Kwa tract, currently (2014)

Source: *Own data*

Furthermore, it was found that the Chinese agronomist is a crucial actor, pictured as very influential on the decision of which field to lease (see Figure 8). It might be expected that Chinese investors have greater influence than the agronomist he brings along. This has to do with the soil knowledge carried by the agricultural agronomist. Clearly, his advice has the highest power decision. As indicated by the participants, "*the agricultural technician searches for fields with easy access to water and far from the road, with good soil fertility*". This is also because Chinese investors prefer isolated areas to avoid visitors.

On the other hand, a local broker, who might not influence the process, would be a source of information for a Chinese broker. His main function would be to identify the owners of the fields that the agricultural technician has chosen, and inform farmers about the Chinese firm's interest on leasing his field, so, direct relation between the Chinese firms and farmers is inexistent.

Farmer's decision on whether to lease their land or not, in principle, is based on free consent. But, some farmers whose fields are located between rented fields are indirectly forced to rent their fields (see 5.3). When speaking about the negotiation on the rental compensation, the local broker plays a crucial role. Since there is no communication between the Chinese investors and farmers, the local broker is the one who discusses the price. Prior to this, large holder farmers, larger than 10 acres (4 ha) talk to the broker and establish minimum rental compensation based on their assumptions. Medium and small-holder farmers have no bargaining power over the price because of hierarchies within the village. Furthermore, money flows are driven mainly by the Chinese investors. Advanced payment is given to the local broker who would then use to offer a local farmer to rent their land and would also give a commission to the Chinese broker. A small commission is given to the village chief, who would use it for the development of the village. In addition, farmers give 1% -10% of commission to the local broker from the lease of land. These influence levels are map on the Figure 8.

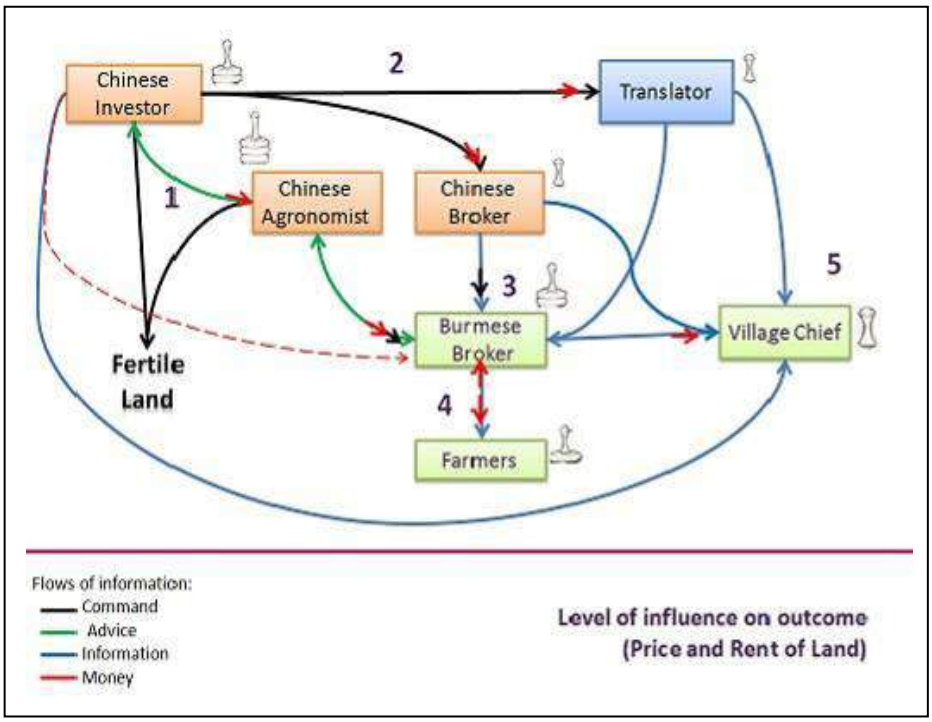

Figure 8: Level of influences on outcomes

Source: *Own data*

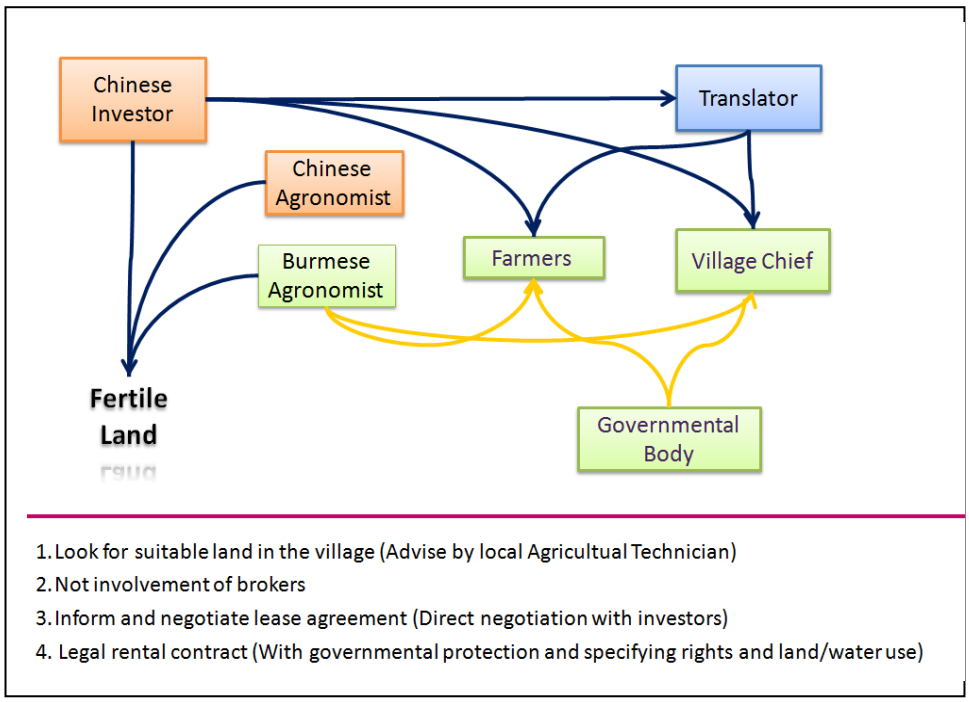

Figure 9: How do farmers would like it to be?
Source: *Own data*

Figure 9 shows farmers' wishes on how they would prefer the consultation process to flow. Given the farmers' experiences on leasing their lands, it was highlighted the priority of having a governmental body that could protect them from the misuse of soil and water, also highlighted by the village chief. As a second priority, it was stressed that a local Burmese agronomist could bring improvement on agricultural techniques and soil management within the village. Finally, the direct contact with the Chinese firm could facilitate the land deal contracts and land use management.

5.5 Outcome (1) - land and water use

There was no informal talk or interview, in which the importance for Chinese investors to look for fields with easy water access and fertile soil was not emphasized. Through in-depth interviews with key informants it was found that since fields are rented, drastic changes have been noticed in the soil and water.

The cultivation practices by Chinese investors are: a) application of about 400kilos/acre of compound chemical fertilizer (15% nitrogen, 15% potash, 15% phosp hate), b) building of wells on rented fields to irrigate melon plantations with groundwat

er, c) using large tractors to plough the land and d) covering melon raising beds with plastic sheets in order to create heat and water retention.

Household surveys and in-depth interviews revealed that, the amount of fertilizer use by Chinese investors, compare with the average of 250kilos/acre that farmers usually apply to their fields, has reduced soil fertility and capacity for water retention in a short period (see Figure 10). While the main source of irrigation for farmers is rainfall, the extraction of groundwater does not only drained farmers' water sources but it leads to soil salinity. Furthermore, the use of tractors turns the soil over to a depth of more than 6 inches (15.2 cm) leading to a rapid nutrient loss and a top soil loss. Given that the production of melon it was unknown to farmers before renting their land, the use of plastic sheets is a new technique to farmers, and the removal of it is not done neither for Chinese investors or farmers, with only few farmers practicing harrowing to clean their fields. More to this point, is that on the following season, land is mixed with the plastic remained on the soil. In addition, farmers expressed that more pest and an increase of weeds have also been noticed.

Figure 10 Tube well built by Chinese investors in a farmer's field (left) and field rented last season (right). The yellowish area is where heavy fertilizers were applied in the previous season

Source: Author

Altogether, these practices have reduced the yield for the traditional crops by up to 30%, in worst cases by even up to 50%. Table 12 shows the main changes experienced by renting-land households in relation to the use of land and water.

Table 12: Changes on land after land - rental period

Changes	% total sample (Treated group)
Soil compaction	27%
Yield decrease	20%
Increase of pests and weeds	14%
Plastic remained in the soil	3%

Source: *Own Data*

The way that farmers cope with these impacts has not mitigated the environmental damage. The most common technique, is applying cow dung as organic fertilizer. However, a local fertilizer trader explained that in order for the soil to recover its fertility, the land would need 3 fallow years, a recommendation that farmers do not follow due to the needs of their household food production. Nevertheless, farmers also expressed that the leftover fertilizer remaining in the soil has led to higher yields for their following season. Albeit, this only occurred after the first year that farmers rented out their land.

5.6 Outcome (2) – propensity score matching

To know what would be the effect of the decision of renting land on farmers' income and food security, the propensity score matching (PSM) is performed by following Caliendo and Kopeining (2008) guidelines (see 4.4.2). Earlier in this chapter (see 5.2), a probit model was run to obtain marginal probabilities of the decision to rent their land. This is the first step on employing the PSM. The radius matching was used with a bandwidth of 0.075, to perform the matching. With this, the common support is restricted. The caliper (bandwidth) is estimated by considering one fourth of the total standard error from the predicted propensity. After matching it is expected that covariates would be not significant and the mean bias would be reduce to an acceptable level (3% - 5%). The quality of the matching can be seen by running a *pstest*.

5.6.1 Covariate balance

Table 13 shows the results from a t-test on the pre-selected covariates after matching. It is observed a considerable reduction on bias for each covariate and mean differences are not significant. Remaining bias after matching is 4% by radius matching with caliper, leading to an improvement on the matching quality. This implies that the effects of renting land can be estimated through the propensity score matching, since control households are now comparable to land-renting households.

Table 13: T-test results

Variables	Treated	Control	Bias	Bias reduction	t-value	p-value
Household head age	44.86	44.73	1.0	88.8	0.06	0.951
Gender~	.923	.949	-8.6	-171.1	-0.61	0.541
Education~	.969	.965	1.9	91.4	0.13	0.896
Household size	4.23	4.27	-3.5	68.4	-0.21	0.832
Value for Agricultural assets (kyats)	2.6e+06	2.6e+06	1.0	97.4	0.08	0.936
Livestock Ownership~	.969	.950	5.9	90.8	0.54	0.592
Loans past season~	.815	.836	-4.9	47.5	-0.32	0.748
Land size	8.04	7.99	0.8	98.5	0.06	0.956
Crop production ratio	1.09	1.12	-2.8	37.2	-0.16	0.873
Water Access	3.2	3.05	12.1	53.1	0.72	0.472
Soil Quality	.661	.667	-1.2	98.7	-0.07	0.947

Ps R2= 0.08 LR chi2 = 1.49
Mean Bias=4.0 Med Bias=2.8
Source: *Own data*, calculation using *pstest*

5.6.2 Common support

Figure 11 visualizes the distribution of propensity scores between land-renting households and control households. This indicates that the "common support" or overlap assumption holds. Cases where treated farmers did not find a match within the control group (off support) are shown as well.

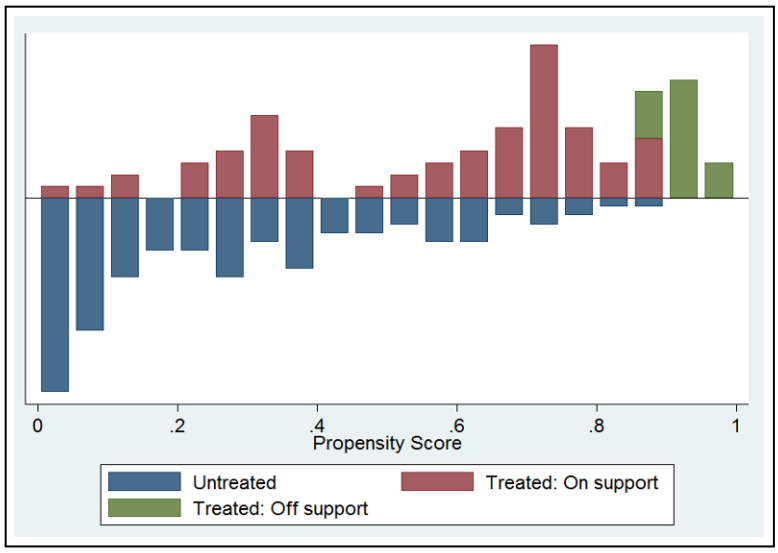

Figure 11: Visualization of the common support

Source: *Own data*, calculation using *psgraph*.

5.6.3 Average treatment effect (ATT)

Table 14 reports the estimates of unmatched and matched ATT and bootstrapped standard errors. In general, results suggest a positive difference for each outcome variable after matching. Further, a significant higher average household' food consumption and total income per capita was found.

Table 14: Average treatment effect

Variables		Treated	Control	Difference	S.E.#	R-bounds (γ critical)
Food Consumption Score	Unmatched	74.42	64.38	10.03**	2.18	
	ATT	72.8	65.77	**7.02****	2.68	1.85-1.9
Months not enough income to buy food	Unmatched	.5244	.6455	-.1211	.1242	
	ATT	.5692	.6233	**-.0541**	.1372	n.a.
Food Expenditure past 7 days_pp	Unmatched	3994.4	4356.18	-361.73	269.61	
	ATT	4034.58	4138.39	**-101.81**	299.93	n.a.
Total Income_pp	Unmatched	917382.1	486740.0	430642.0**	81179.3	
	ATT	815666.3	600716.3	**214950.1****	109322.5	1.25-1.3

ATT standard errors after bootstrapped (250 replications)
** Indicates significant difference at $\alpha = 0.05$
Nr. of treated: 65; Nr of untreated: 110
(17 cases lost to Common Support (8.8))
Source: *Own data*, calculation using *psmatch2 and rbounds*.

However, even the common support condition holds, the conditional independence assumption (CIA) remains a problem for the food consumption score and total income. This indicates that might be unobserved variables influencing the participation decision. Since access to road has been recently possible, farmers have the opportunity to sell their produce in Mandalay market, which is the closest and largest market. Thus, this unobserved bias may be influenced by the access to road to Mandalay, as well as the purchasing of motorcycles, which is the main transport. This may contribute to an increase of income and higher food diversity. So, in this case it is likely that access to Mandalay market is a critical factor for farmers to rent their land. To assess how strong this unobserved bias is to the model, a sensitivity analysis is performed. Nevertheless, the critical levels of gamma only reflect how strongly an omitted variable may influence the decision of a farmer to rent their land.

Food consumption score

The food diversity and diet quality was captured by using the food consumption score (FCS) from the WFP (see 4.4.1). Results in Table 14 indicate that after matching land-renting households have higher FCS by 7 points than control households. Yet, in average both groups report acceptable levels of food consumption, with only three households presenting borderline levels.

Figure 12 shows a stacked food frequency of the food groups[10] as it evolves the FCS (WFP 2008:9). Households report a daily consumption of staple (which is basically rice) and a high consumption of vegetables, oil and animal protein. Given that households are self-sufficient on sesame and groundnut, the high consumption of oil was expected. Dairy is almost rarely consumed, with only those households with a high end of FCS. However, it is attributed to the fact that households consume more frequently eggs and dry fish than other type of meat. This lead to a high weighted group and consequently a high food consumption score. Regardless that household surveys did not capture food quantity, it is assumed that dry fish is eaten in small portions, on almost daily basis. When comparing the FCS excluding dry fish from the estimation, the number of household under borderline level increase to eight, and also there is a reduction on the FCS for the rest of the households. It seems that dairy, fruits and sugar are not often consumed by the households.

[10] For each FCS value, a running average of the previous 5 values for that food group and the value in question was used to smooth the graph (WFP 2008).

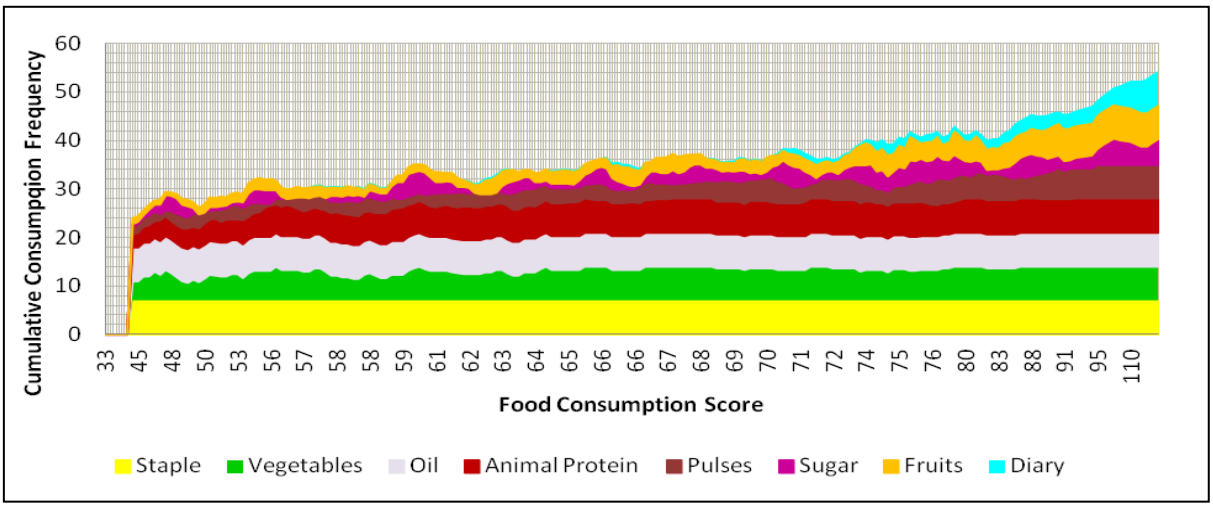

Figure 12: Stacked food frequency

Source: *Own data*

A typical meal in the village is a big portion of rice with chickpeas and fish paste, in some cases together with vegetables. This meal is consumed at least twice per day and farmers mentioned that meat is usually consumed 1 – 3 days a week and in small portions. However, when comparing land-renting households and control households, remarkable differences are notable in their consumption patterns. Another comparison through PSM was done to assess the average effect of the decision to rent land on consumption for each food group (see Table 15).

After matching, it is found that renting land has a positive casual effect on consumption for the eight food groups. Within the reference period, staples and oil were consumed on daily basis on both groups. Pulses show the major difference between households, while land-renting households consumed pulses for an average of 4.29 days, control households 3.26 days. Further, there is a difference of 1.07 day on the consumption of vegetables for land-renting households and control households. Fruits were consumed in average 3.44 days for land-renting households and 2.46 days on control households. The rest of the food groups present positive difference of 0.63, 0.85, 0.22 days on the consumption of animal protein, milk and sugar respectively.

Table 15: Average differences on food consumption

Food Group	Treated Matched	Control Matched	Difference (on days)
Staple	7	7	-
Pulses	4.29	3.26	**1.20**
Vegetables	6.84	5.77	**1.07**
Fruits	3.44	2.46	**.981**
Animal Protein	6.56	5.94	**.629**
Milk	1.24	.392	**.854**
Sugar	2.15	1.93	**.218**
Oil	7	7	-

Source: *Own data*, calculation using *psmatch2*

Months not enough to eat

Stability on farmers' food security was capture by the number of months a household does not have enough income to buy food. Results after matching (see Table 14) suggest that land-renting households have reduced their months in which they cannot purchase food, though the difference of -.0541month is not statistically different between groups.

From the total respondents 40% do not have problems for purchasing food throughout the year, but in average farmers face uncertainty of income from 1 to 3 months, normally from August to October. Some causes for households to not being able to purchase food as normally they would, is that prior cultivation part of the income is used for farming or when a member of the family falls sick. Furthermore, only 16.7% from total farmers interviewed, 16.7% reported to have being concerned on not having food the previous season, while 5.2% have reduced their meal portions (see Table 16). The main coping strategy is by borrowing money from relatives, villagers or brokers and selling livestock or pawning gold.

Table 16: Variations on food consumption in the past season

	Total Freq	Control	Treated	% total sample
Change on household's food consumption.	14	7	7	7.3
Concerned on not having enough food.	33	19	14	16.7
Intake of undesirable food due lack of income to buy other type of food.	8	4	2	4
Reduction of meal portions.	10	7	3	5.2

Source: *Own data*

Food expenditure past 7 days per capita

Household food expenditure per capita was calculated by the sum of the expenses on rice, vegetables, fruits, dry fish and meat, in a 7-days recall period divided by the number of member of the household. In-depth interviews revealed that generally, a minimum income of 1,000kyats/day/person (1USD), is required to cover the basic needs (80% in food). But when looking at the results in Table 14, it is observed a average food expenditure per capita of 4,000kyats (4USD). Moreover, average effect between groups show that there is no significant difference on food expenditure, on the reference period (7-days prior the survey).

Total income per capita

As hypothesized, there is a significantly higher average income for land-renting households. After matching, it is found that the casual effect of renting land on per capita income is 214, 950kyats (215USD). Average farm income per capita (crop production and livestock) have reduced 52,833kyats (53USD) for land-renting households. Off-farm has a remarkable higher average difference of 276,894kyats (277USD) per capita (see Appendix 3).

Findings revealed that land-renting households have increased their total income since their land has been rented out. This difference is attributed to the compensation for renting land that was captured as off-farm income. Additional earnings allowed land-renting households to purchase physical assets that they were unable to afford before, principally motorbikes, livestock (cows and pigs) and mobile phones. Only two farmers mentioned purchasing few acres of land, and only three farmers have bought a small

tractor, commonly called trawlagyi. Therefore, from a statistical point view, it is assumed then that the additional earning from renting land has brought benefits to the household as a whole.

5.6 Operational magnitude estimation at Township level – additional findings

5.6.1 How do Chinese investors operate?

After analyzing the pattern on how Chinese investors access to land and the estimation of casual effects of renting land on farmers' income and food consumption, the remaining question was: *how do Chinese investors operate?* When a farmer or government official was asked whether they know who the Chinese investor is, the response remained the same, "I do not know". Given the circumstances on how the lease of land is agreed, there is little or no interaction between farmers and Chinese investors. Thus, this response was not surprising. The author was not able to access to any Chinese investors, neither to gather any names. However, it was found that Chinese investors do collide with local brokers at Muse border (these brokers might be fruit traders and Kokang Chinese), so names that villagers known remain Burmese.

In an in-depth interview a supervisor (Kokang Chinese) from a rented field explained that a Chinese company would operates throughout Tada Oo Township by hiring people from Shan State. These people would supervise a certain number of acres, with a maximum number of 100 acres (40.5 ha) per supervisor. In his case, the company that hired him has additionally 5 supervisors in different villages. It was found that about 20 companies follow the same pattern in Tada Oo and approximately 40 companies in Mandalay Region.

In theory, after harvesting the melons, trucks are sent to Muse in which Chinese investors would store them to transport them to Ruili, Yunan. However, it is unknown what final destination is of the melons after that point, although it is suggested that the melons are exported to a regional market, for example Singapore.

5.6.2 Is it a fair rent-paid?

To define whether the compensation per acre is fair, is a complex issue and rather depend on perceptions. Without considering environmental externalities, an estimation of the value of production from the most common cash crops, would give a rough idea on how much profits farmers would have earned if they would produce instead.

Table 17: Cropping production in Chuang Kwa village tract (per acre)

	Paddy	Groundnuts Pod	Sesame Grain	Sesame	Chickpeas
Yield (baskets)	80-100	35	12	10	17
Cost * (kyats)	150,000	100,000	100,000	150,000	150,000
Price per unit	5,000	10,000	32,000	50,000	15,000
Revenue (kyats)	500,000	350,000	384,000	500,000	255,000
Profit (kyats)	**350,000**	**250,000**	**284,000**	**350,000**	**105,00**
Profit (USD)	**350**	**250**	**284**	**350**	**105**

Exchange rate at the time of the study 1,000kyats=1USD
*Considering own land preparation
Source: Own data

Table 17 gives an estimation on the costs and earnings from producing traditional crops at Chuang Kwa tract. When looking at the profits of each cash crop, it is evident that the rental payment (280USD – 300USD) for the 4 - 6 month period of one acre it is almost equivalent. However, production of paddy and sesame would give to a household an additional 50,000kyats (50USD) profits.

Above profit estimations are calculated based on normal yields, careful consideration should be given to the fact that climate variations and soil degradation is leading to yield reductions, and consequently less profits. This might be a time consistency problem in the near future.

5.6.3 Revenues estimation at a township level

Border trade figures were provided by the Director of export section, from the Ministry of Commerce. Table 18 reflects these figures since the year 2010/2011, when they

started to be recorded. There is no information on prior years. Further, he remarked that melon exports from Myanmar, has been only exported to China and no other country.

Drawn from interviews with farmers, it is assumed that the price per melon per ton is 2,200yuan with a current exchange rate of 160 kyats to one yuan (1 yuan = 0.16USD), at the time of the field work. Estimation on border trade revenue could only be calculated for the year 2013/2014, since melon prices may vary on other years. So, based on the figures provided by the Ministry of Commerce on the year 2013/2014 there is a revenue estimation of 152 million kyats (152,064USD).

Table 18: Border trade figures of watermelon to Muse, China

Year	Tons (mt)
2010-2011	178
2011-2012	248
2012-2013	309
2013-2014	431

Source: Ministry of Commerce, export section

However, when contrasting these border trade figures with an estimation of melon production, from acres rented to Chinese Investors, these figures triple. Based on official documentation, provided by the Tada Oo Township Management, on the registered number of acres rented to Chinese Investors, it is possible to estimate the number of tons produced and sent to Muse. Table 19 shows the number of acres rented and their yield estimation (based on a yield of 15tn/acre) considering the same price of 2,200yuan per ton. Revenues estimation for the same year (2013/2014) rose to 17.3 billion kyats (17.3 million USD).

Table 19: Number of watermelon growing acres by Chinese investors in Tada-Oo

Year	Number of Acres	Tons (mt)
2010-2011	n.a.	n.a.
2011-2012	1,562	23,430
2012-2013	2,155	32,325
2013-2014	3,285	49,275

Source: Tada-U Township Management

Different versions on the number of acres rented in Chuang Kwa tract and in Tada Oo Township were found. Official figures given by the Township Management compared with the estimation of number of rented acres at village level were highly different. Furthermore, in an effort to validate the monetary value on melon trade, the author gathered border-trade figures from the Ministry of Commerce.

These assumptions were drawn with the purpose of having a more macro idea on why Chinese investors are interested on producing melons in Mandalay Region. However, above revenue figures are author' assumptions and own calculations, so may not reflect the reality. Furthermore, total profit for Chinese investors was not able to calculate since their total cost was not gathered as the author was not able to access any Chinese investors.

Chapter 6 – Discussion

This study aimed to assess the implications that short-term land leases to Chinese investors have on Burmese's livelihoods. After presenting detailed results from this study, this section will discuss the main findings guided by the research questions. The consultations process of renting land, the effects on income and food security on farmers' and the changes on user-rights and impacts on land and water use will be addressed. At the end of this chapter, a brief discussion on how the outcomes from this study are reflected in the AID-framework is presented.

6.1 Mechanisms used to access and control land

The consultation process as well as in-depth interviews revealed that Chinese agricultural investors access to land in Chuang Kwa tract through local brokers in the village. This is validated by Woods (2013), who argue that most of the foreign direct investment in Myanmar is done by informal channels, mostly through local companies that would operate as proxies for foreign investors. In addition, it is worth to mention that, although this study found that Chinese investors control the land by setting "rules" to farmers whose land will be rented (see 6.2), the relation with Kokang Chinese is another way to control land. This is corroborated by Buchanan et al. (2013) who emphasized on the cultural ties that Chinese investors have with ethnic groups on the borderlands.

Furthermore, contrary to what Cotula et al. (2009) mentioned that in large-scale land transfers usually there is no consultation process with local communities or when there is one, it is ambiguous. This study found the opposite; in Chuang Kwa tract there is a consultation to the farmer who is selected to rent their land, however, there is no direct relation and communication between Chinese investors and farmers. What raises concern about the manner the consultation process is carried out in Chuang Kwa, is the non-involvement of the village chief or township manager and the absence of governmental institutions to regulate these land deals. Although, as it is established in Chapter IV, section 14 and 55 of the Farmland Law as well as in Chapter XV, section 108

of the Foreign Investment Law, farmers should report to the Myanmar Investment Commission when their "right to work" would be transferred to a foreign entity. This official instruction is not followed in Chuang Kwa tract, when farmers lease their land.

A reason for this, as Buchanan et al. (2013) mention, is that the law does not specify clearly how this consultation or approval process should be carried out. In addition, there is a gap on knowledge about the law among Burmese farmers. Farmers in Chuang Kwa have been isolated and oppressed for many years, so it is normal that they are not legally prepared to deal with this type of agreements.

In regard to the participants on the consultation process, it was found that a Chinese agricultural expert might have the highest influence on the rental process, since he selects the fields. However, it can also be argue that the influence of a local broker is equally high. Two reasons are found here: first, Chinese investors depend on local brokers to access to farmers, and second, local brokers may be motivated to persuade farmers to rent their land due the commission they received. Furthermore, a focus group discussion with farmers revealed that the trust on the local broker undoubtedly facilitates these land deals.

Additionally, contrary to what is found in literature, that land transfers involve the participation of national Government and foreign investors (Haralambous et al. 2009). This thesis shows that this is not always the case, but local people are crucial for foreign investors to access land. Furthermore, despite the claim that land transfer to foreign investors may displace or force farmers to leave their land, farmers in Chuang Kwa are given the option to rent or not their land. Farmers' decision to not rent the land is respected, only for those farmers whose fields are located between rented fields, may end up being indirectly forced to rent (see 5.3). However, findings revealed that social relations have changed (see 5.4.1) in these land deals. Thus, it might be that, the way Chinese investors rent the land is already institutionalized in the village.

6.2 Average effects on income and food security

Despite the arguments stating that land transfers to foreign investors may not always result on positive impacts for rural livelihoods, results from this study proved the contrary. This study found that renting land has a positive causal effect of about 214,950 kyats (215USD) on total income for farmers renting land.

When comparing the rental payment (280USD – 300USD) for the 4-6 months period of one acre with the profit farmers can expect if they would have used the land for their personal production of other crops (rice, groundnuts or sesame), it is found that both are almost equivalent. Suggesting that farmers might have a "fixed income" and could also look for off-farm jobs, as advocated by, for example, Braun and Meinzen-Dick (2009). However, this "fixed income" is not guaranteed on a yearly basis. Chinese investors rent the fields in alternate years, if soil is found poor; they would rent different fields with fertile soil. Therefore, it may be that on the long-term these economic benefits on farmers' welfare may not continue. Deininger and Byerlee (2011) corroborates this finding by pointing out that large environmental damage in the future would not compensate these short-term benefits, since the land would not be productive for farmers agricultural production, thereby making farmers worse off.

From another point of view, large-holder farmers (above 10 acres) may benefit the most on these land deals. Given that they do not have the capital, labor and agricultural techniques necessary to exploit the potential of their land, is then more profitable to rent. Thus, if proper arrangements are done between Chinese investors and large-holder farmers, the opportunity of investment argue by international financial institutes, for instance the World Bank (2013) could it be reached. Furthermore, this could be achieved by the implementation of a 2+3 contract model. As Shi (2008) explains, in this type of contract farmers offer land and labour, while investors give capital, technology and market access. In the case of renting only land (1+4 model) small-holder farmers may benefit due the opportunity to look for off-farm jobs and diversify their income sources. In both cases, this may prove right what is argue by

Miyata et al. (2009) and Haralambous et al. (2009) who suggest farmers engaged in contract farming have increased their income and welfare.

In regards to the food security, land-renting households and control households have showed acceptable levels of food consumption, and higher quality and diverse diet. The food groups that showed at least 1 day difference on their food frequency is pulses, vegetables and fruits. This improvement of food diversity may have been influenced by farmers' accessibility to Mandalay Market. Travelling to Mandalay provides farmers the ability to sell their produce a higher price and to purchase a variety of food items that are not found in the village. However, given that the FCS does not capture quantities, it might be possible for a household FCS to be both, under or overestimated. This is corroborated by Wiesmann et al. (2009) whose study prove that food security is underestimated by using the FCS approach.

Furthermore, although this study has found that total income has increased by renting land, and that households have acceptable levels of food consumption a macro view revealed that farmers in Chuang Kwa remained living under poverty line (1.25USD/day). As stated by MDRI/CESD (2013) that Myanmar has the lowest agricultural income of 194USD/year compared to its neighboring countries. Furthermore, a close view on the average food expenditure per capita on the reference period of about 4,000kyats (4USD) revealed that it is under the average income necessary for a household to cover their food needs of 1,000kyats/day (1USD/day).

6.3 Changes on land-based user-rights

Borras and Franco (2012) explain that in land issues, what it is important is to know who has access and control over the land rather than to focus on property rights. So, although defining property rights is a necessary condition, it is not sufficient. This study found that rights are changed when land is rented to Chinese investors. These changes are driven by "rules" set prior the rent of land. The fact that farmers could not grow watermelons prior the rent of land, or enter into their field prevent farmers' control over their own land.

Thus, regardless if there is a consultation process, that farmers are free to decide to rent their land and that there is no dispossession of land, this thesis argues that there is a manifestation of rights dispossession. This is because farmers do not set any permitted or required actions on the use of the land. For example, Chinese investors do not request any authorization to build a tube well, for which farmers would pay for its use; even the well was not required. As a consequence, Chinese investors have negatively transformed the land. One major issue here is that the physical land alteration, is leading to soil erosion and exploitation of groundwater. Furthermore, Schlager and Ostrom (1992) argue that a holder of the right of exclusion might provide incentives and motivations to purse long-term investments in the resource, in this case land, results from this study indicate that Chinese investors, holding this right, are not pursuing this type of investments.

On the other hand, as a counter measure of some sorts, much emphasis has been given to the contribution of land tenure security to Burmese farmers' rights protection as stated by Oberndorf (2012). In-depth interviews with farmers indicate that, the case of Chuang Kwa is found not to be a land tenure issue. In the rent of land, farmers do not provide their official or copy of the "right to work" (Form-7). This private right is considered by farmers as equivalent to a land title and empowers them. So their view towards renting land is that farmers still have ownership over their land, but less control and access to it.

6.4 Implications on land and water used

As presented in section 5.4.2, the cultivation practices used by Chinese investors, lead to an environmental damage. Furthermore the way how Chinese investors selected the fields (see 5.4.1) in which the Chinese agronomist perform pH-tests to identify fields with the best soil fertility, and water access, is similar to observations made by Cotula et al. (2009) and Miyata et al. (2009) who both argue that, despite that host governments promote abandoned or waste lands, foreign investors target fields with fertile soil and easy water access. In addition, Da Vià (2011) and McMahon (2013) stress that foreign investors are constantly searching and changing to fields with fertile soil, an

attribute, which according to them characterizes land grabbers. Siddiqui (1998) adds that this type of behavior tremendously damages the environment by exploiting groundwater and increasing soil salinity. Results from this study indicate that a similar behavior is found in Chinese investors, who only rent land with fertile soil. These externalities have been pointed out by the village chief who is interested on perform pH-tests to know the levels of soil degradation, however, since there has not been any test like this before, there is no baseline to compare to. As indicator, farmers look at the reduction of their yields and the physical changes on the soil, such as soil compaction, plastic remaining in the soil and increase of weeds and pests. Moreover, as pointed out by Sibson (2014), these soil changes combine with the vulnerability caused by climatic shocks, for example dry spells, are threatening farmers' agricultural systems.

6.5 An institutional social change proposition

Working with the Institutional Analysis and Development (AID) Framework allows a critical thinking on the factors influencing the observed outcomes (see Chapter 3). Ostrom (2005) advises to step back and evaluate these outcomes, if these do not bring any improvement to the system, then, the IAD framework facilitates to identify areas that need change. These are mostly linked to incentives and motivations in the behaviour of participants within the system.

Figure 13 reflects the outcomes generated by farmers' renting land to Chinese investors. As discussed in this chapter, there are some positive and negative impacts in these land transfers. In one hand, positive aspects are that farmers find it profitable to rent their land since they receive an additional income that is used to purchase physical assets, or gives them the alternative to look for off-farm jobs. In addition, renting land has also contributed to households having better food consumption. On the other hand, negative aspects are misuse of land and water by Chinese investors, and neglecting farmers' to decide how the land and water should be used during the rental period. Since it is expected that Chinese investors would continue renting land in Chuang Kwa, and farmers would rent out their fields, this thesis suggest that the implementation of a legal agreement and regulation on these land deals would make accountable farmers' rights and improve environmental conditions. These findings, however, only reflect the

impacts of these short-term land leases and may not be representative of the implications that large-scale land investments have across Myanmar.

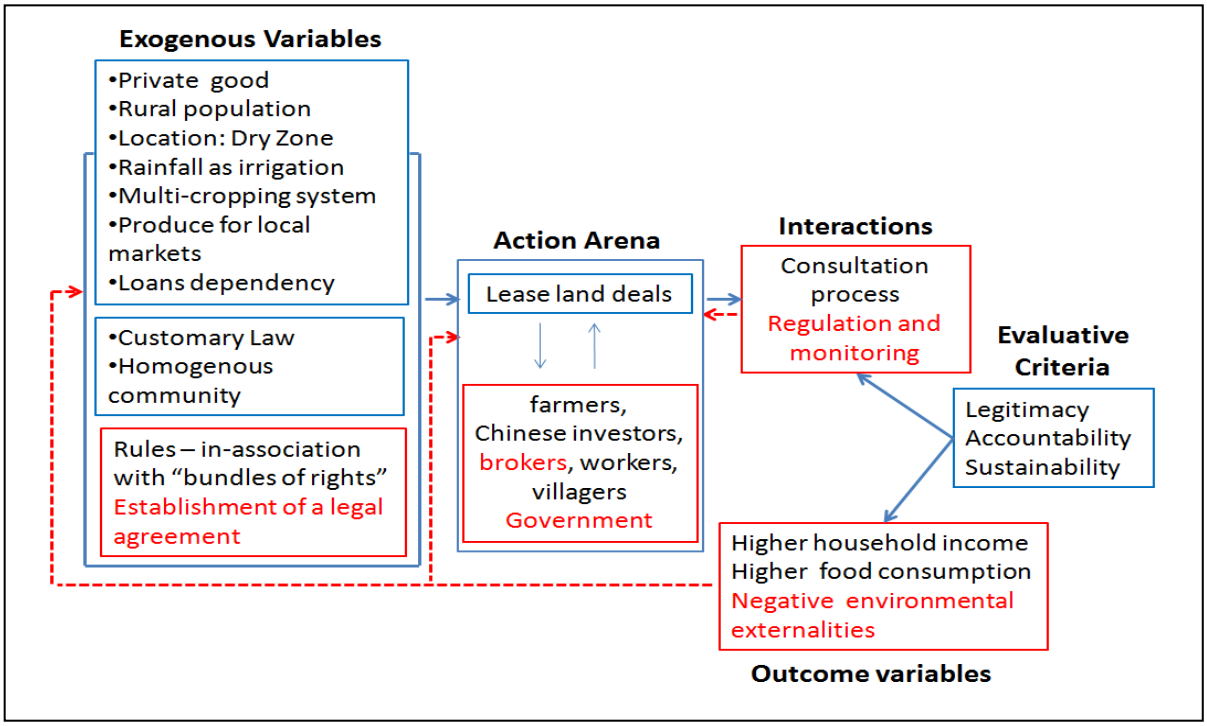

Figure 13: Institutional analysis and development framework with an institutional change

Source: *Own data*

Chapter 7 – Policy recommendations

7.1 Establishment of a legal contract

This study identifies that the main priority area from these short-term land lease is the need to establish a legal agreement that sets guidelines for resource management. This agreement should define provisions on permitted and required uses by Chinese investors and farmers, for example on the amount of fertilizer use. The acknowledgment of farmers in the definition of this legal agreement is central as they are the main affected group. However, given that farmers follow a customary law and do not have knowledge on law formalities, this study finds crucial the involvement of local organizations to close this gap. The Land Core Group, which is an advocacy coalition of national and international organizations in Myanmar, could provide its expertise on Myanmar law in order to design an appropriate legal agreement between Chinese Investors and farmers. This group could also raise public awareness through the national symposiums that regularly organize. Furthermore, an environmental and social assessment should be carried out to identify priority areas for the management of land and water and to evaluate the dimension of soil erosion. International agencies such as LIFT and GRET could provide technical support on these environmental assessments, and provide know-how to cope with the actual problems of soil compaction, increasing of pests and exploitation of water. Besides that, it is suggested the participation of the village chief and township manager, who both advocate for a sustainable use of land. Local brokers should be responsible for the accountability of this legal agreement given their highest influential role in the rent of land process. The State could internalize environmental externalities by taxing foreign investors if the provisions of this legal agreement are not respected.

7.2 Regulation of foreign investment through contract farming

This study found evidence that farmers rent land as an alternative to have a fixed income and to avoid the uncertainty of climatic variations. However, the author found that farmers wish to keep working their land, and have higher knowledge on

agricultural techniques. They call for better roads, irrigation systems and electricity. Also, farmers want flexible loans with low interest rate, and market access. These demands could be addressed if appropriate investment is done. This study found, that contract farming could be an option to regulate these short-term land leases and minimize environmental externalities. The implementation of a 2+3 contract model gives higher control and decision power to farmers over the use of their land and at the same time would have an assurance of market, while they also receive agricultural techniques. Whereas, Chinese investors will have a security on their melon supply and lower transaction costs. A successful example is seen in the border of Myanmar and Thailand, between Thai entrepreneurs and Burmese farmers in Karen state.

Chapter 8 - Conclusion

This study aimed to analyze positive and negative impacts of short-term land leases to Chinese investors on Burmese farmers' livelihoods in Chuang Kwa tract from Mandalay Region in Myanmar. The main findings from this study would be summarized in this section.

Renting land has influenced an increase on total income of 214,950 kyats (215USD) and improvement of food diversity and quality diet since farmers first rented the land. However, application of compound chemical fertilizer (15% nitrogen, 15% potash, 15% phosphate), the use of tractors, the building of wells and use of plastic sheets to cover the melon raising beds, have led to soil erosion and exploitation of ground water. These externalities may remain overlooked for a long time, given that farmers are willing to rent their land for the compensation of about 300,000kyats (300USD)/acre per season, corresponding to their average earning. Furthermore, this study stresses the fact that farmers do not search for income diversification, causing a dependence on this rental payment. Thus, since farming remains the main economic activity, the damage already caused to the soil in combination with the climatic variation in the dry zone, may negatively affect future agricultural production the village, therefore compromising livelihoods in the long term.

An assessment of the consultation process revealed that local brokers are crucial for Chinese investors to access land, despite the high influence that a Chinese agricultural expert has on field selection. In addition, it was found that during the rental period, to control land access and supervise melon cultivation, Chinese investors hire Kokang Chinese workers, whom share strong cultural ties. Also, it is required that farmers do not cultivate melons prior the rent of land, while during the rental period, farmers are prohibited to access their fields. Furthermore, farmers are also obliged to give a compensation for the tube well that was built in their fields. Thus, the set of these requirements or rules by Chinese investors to farmers, whose land is rented, make farmers lose control over their land.

In conclusion, this IAD-study found that renting land has a positive impact on farmer's income and food consumption, although this is only in the short-term. However, it negatively impacts the environment by the way Chinese investors cultivate melons. These negative environmental externalities may be also caused by the little control that farmers have on their land use. To overcome the environmental damage and to procure an economic long-term benefit on farmers livelihoods, this thesis suggest an establishment of a legal agreement that sets provisions on water use and soil management.

8.1 Limitations of the study

Given the massive media coverage of ongoing cases of land grabs in Myanmar, and the several papers published on its under-developed state and dangerous political environment, these may have led the researcher to have preconceptions about the real social situation that Burmese farmers are living under today. In addition, hearing farmers' stories makes it even more a touching topic. So, despite being pragmatic, this might have influenced the reflections of the case study, since the research was just able to assess farmers' perspective. Not being able to interview a Chinese investor may have contributed to an unbalanced view. Access to Chinese investors was not possible since they usually visit the village on March. Not having access to a household list, the respondents were pre-selected by the village chief and key respondents. It could be that valuable farmers were not interviewed. Additionally, during the interview the presence of neighbours or relatives might have influenced the responses of the interviewees. When this was the case, there was a double-check on the responses and explanation on the importance of having only interviewee's responses. Finally, food security might be over/underestimated, since caloric intake per capita was not captured. Furthermore, the field work was conducted during the rainy season, which might lead to the assumption that food consumption patterns are different throughout the year.

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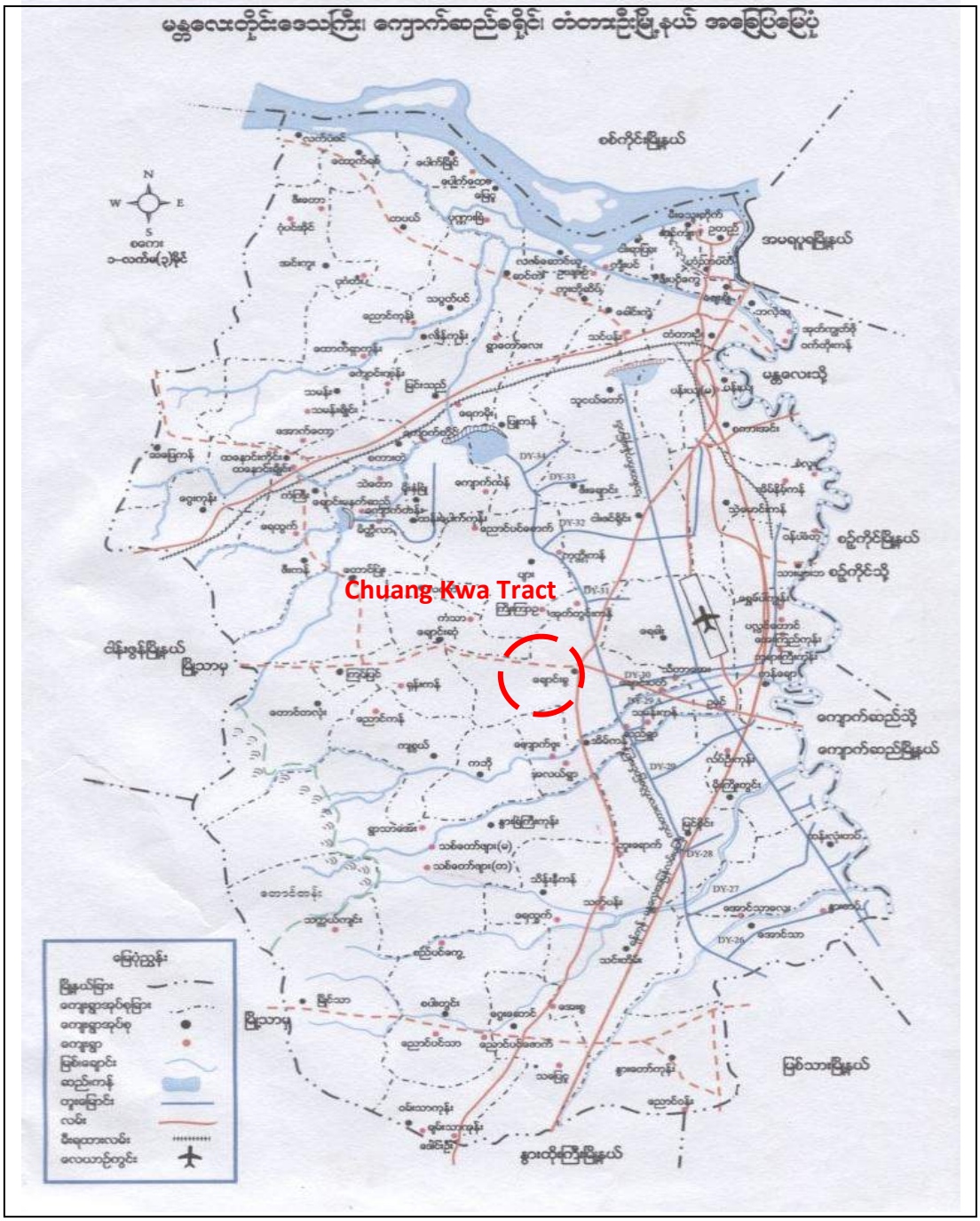
Appendices

Appendix 1: Map of Tada Oo Township



Appendix 2: Structured household questionnaire

Household Survey, 2014
(Present questionnaire was adopted and modified from the Integrated Household Living Conditions Survey in Myanmar and the Questionnaire of Food Consumption Validation from the World Food Program, 2009)

Mingalaba!

Hello, my name is Miriam Romero. I am a master student from Germany. As part of a M. Sc. Thesis Research, I will conduct interviews to households in this village. The objective of these interviews is to have a better understanding of its livelihood conditions, food security and land use. The interview would take about one hour. Your participation is valuable for this research, but is not obligatory for you to answer, but I highly appreciate your honest responses. Please feel free to interrupt or ask any question at any time.

Thank you so much for your participation in advance.

Survey No.	**Date of Visit** ____/____/2014 **dd mm**
Village:	**House number:**

Part I. General Information

1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8
Head of the household: No = 0 Yes =1	Relationship with household Head:	Gender: Female=0 Male = 1	Main Occupation	Age	Marital status:	Education of the Household Head:	Number of Family members: a) Male b) Female
							a) **b)**

Code:
Question 1.2 & 2.1.1: Spouse = 1; Daughter = 2; Son = 3; Other: = 4; Specify
Question 1.7 & 2.1.4: Single = 0; Married = 1; Widowed = 2; Divorced = 3; Separated = 4
Question 1.9 & 2.1.5: Never attended=0; Primary (5 y) =1; Secondary (6 – 9 y) =2; Higher (10-11y) =3; University = 4; other = 5

Part II .Household Characteristics

2.1 How many people are living in this household? _____

Question code	2.1.1	2.1.2	2.1.3	2.1.4	2.1.5	2.1.6
	Relationship with the household head:	Gender: Female=0 Male=1	Age:	Marital status:	Level of education:	Main Occupation
01						
02						
03						
04						
05						
06						
07						
08						
09						
10						

2.2 Do you have any of the following physical assets? What is its value?

Asset	No = 0 Yes =1	Value (Kytas)
T.V.		
C.D. player		
Radio		
Bicycle		
Telephone/ Mobile		
Generator		
Solar Panel		
Motorbike		
Car		
Tractor		
Trawlagyi (small tractor)		
Farm Machinery		
Cattle (cows)		
Bullock cart		

Total amount: Kyats_____

Part III .Household Ownership

3.1	3.2	3.3
What is the ownership of the house? Owned = 1 Rented = 2	What is the construction material of your house? Bamboo and bricks =1 Wood=2 Cement=3	What is the main source of your drinking water? Rainwater=1 Well or pump=2 River or Stream =3 Other = 4 (specify)

3.4	3.5	3.6	3.7
How do you fetch your drinking water? (Transport) Foot=1 Bullock cart= 2 Motorbike=3 Bicycle =4	What type of toilet do you have? Bamboo with latrine = 1 Flush toilet =2 No facilities =3 Other=4 (specify)	What is your main source of energy for lighting? Candles=1 Batteries=2 Public Electricity=3 Solar panel=4	What is your main source for energy for cooking? Firewood=1 Charcoal=2

Part IV .Household Income/Expenditure:

4.1 How many kyats per day do you need to meet your basic needs of your household?

Kyats : _____

4.2 How do you earn your main income?
(Mention activities) Order according to importance

4.3 What is the income on average per month from this activity?

4.3.1	4.3.2	4.3.3	4.3.4
Agriculture (Kyats)	Livestock (Kyats)	Off-farm (Kyats)	Other (specify) (Kyats)

4.4 Who is the main income contributor for your family? Member code:

4.5	4.6	4.7	4.8	4.9	4.10
Have you borrowed any money in the last 12 months? No =0 Yes = 1	If yes, what were the reasons for borrowing? Agriculture=1 Food=2 Health care=3 Animal feed=4 Others=5	How often in the past 12 months?	From where do you borrow? MADB=1 Money lenders=2 Relatives=3 Villagers=4	Do you have savings? No =0 Yes = 1	What type of savings do you have? Cash=1 Livestock=2 Jewelry=3 Gold=4 Land =5

4.11 What is the total household expenditure on average per week: Kyats_____

4.12 How much did you spend in the last 7 days on:

4.13 Who is the responsible for buying food? Member code:_____

4.14 How much did you spend generally in the last 30 days on:

Non-food Item	Kyats
Clothes	
Transport	
Health Care	
Education	
Religious/Celebrations	
Others (specify)	

Part V a) Food Security (Variations on food consumption)

		No = 0 Yes = 1	How often did this happen? Rarely = 1 Sometimes = 2 Often = 3	What are the reasons?
5.1	In the past season, did the household change its food consumption?			
5.2	In the past season, did you worry that your household would not have enough food?			
5.3	In the past season, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?			
5.4	In the past season, did you or any household member have to eat a smaller meal than you felt you needed because there has not been enough food?			

Part V b) Food Security (Coping Strategies)

5.5 Which months did your household not have sufficient income to buy food?

Mention the main reasons

_____

_____

_____

5.6 How do you solve the problems of food during difficult times? (Coping strategies)

_____

_____

_____

_____

Part V c) Food Security (Food Consumption Score)

5.7 In the past 7 days, how many days your household has eaten the following foods?

5.8 What was it the source?

Food Item	# of days eaten last 7 days	In which portions?	What is the source? Own production = 1 Buy from market or hawker=2 Other = 3 (specify)
Rice			
Bread			
Potatoes			
Beans			
Vegetables			
Fruits			
Beef			
Goat			
Chicken (Poultry)			
Pork			
Eggs			
Fish			
Milk			
Sugar			
Oil			
Condiments			

Part VI. Agricultural Sector

Question code	Question	Response
6.1	How many members of your household work in the agricultural sector?	a)Female = b) Male=
6.2	In which plantation are they working? Own=1 Neighbor=2 Private company=3 Other=4 (Specify)	
6.3	Do you have a title of your land (Form-7)? No =0 Yes = 1	
6.4	Which activity contributes the most to your income from working on Agriculture? Land preparation =1 Transplanting=2 Harvesting=3 Selling Paddy=4 Other=5 (specify)	
6.5	How many acres of land do you own?	Acres:
6.6	From the land you own, how many acres do you use for planting for your family (own production)?	Acres:
6.7	From the land you own, how many acres do you use for planting for selling?	

6.8 What is your total average harvest and price estimation in the last season of:

Crop	Yield/acre (Baskets)	Price/unit (Kyats)
Rice		
Peanuts		
Sesame		
Chilli		
Sunflower		
Chickpeas		
Onion		
Other (specify):		

Question code	Question	Response
6.9	Have you ever sold your harvest to Muse Market? No = 0 Yes = 1	
6.10	In the last 5 years did you face any problem in planting? No = 0 Yes = 1 (specify)	
6.11	How much fertilizer/herbicide do you use per acre? Bag/acre	
6.12	What is your main water source for cultivation? Rainfall=1 Stream=2 Well=3 Dam=4	
6.13	How do you consider the soil of your land? Poor soil or slightly fertile =0 Fertile = 1	

Part VII. Land Tenure

Question code	Question	Response
7.1	Do you own land now? No = 0 Yes = 1	
7.2	How many acres did you own?	Acres:
7.3	Is there any land do you lease? No = 0 Yes = 1	
7.4	If yes, how many acres did you lease last year?	Acres:
7.5	and, how many acres did you lease this year?	Acres:
7.6	To whom did you lease your land?	
7.10	How did you get to know the person who rents your land?	
7.11	How much have you receive for compensation? (per season)	Kyats:
7.12	What is the duration of the rent? (Months)	
7.13	Who is working on the land?	
7.14	How did you agree? By oral agreement=1 By written agreement=2	
7.15	If written, do you have a copy of the contract? No = 0 Yes = 1	

Part VIII - Impact on leasing land

Question code	Question	Response
8.1	After leasing your land, do you need to apply any fertilizer? (No =0; Yes = 1)	
8.2	Has your income increased, after leasing your land? (No =0; Yes = 1)	
8.3	Could you mention three things that you are able to afford now but you could not afford before?	
8.4	After leasing your land, have your savings changed? (No =0; Yes = 1)	
8.5	After leasing your land, have your expenditure changed? (No =0; Yes = 1)	
8.6	Are you producing a new crop that you did not produce before, after leasing your land? (No =0; Yes = 1)	
8.7	If yes, which crops?	
8.8	Has your irrigation system improved? (No =0; Yes = 1)	
8.9	Are you using new agricultural techniques? (No =0; Yes = 1)	
8.10	If yes, please describe the techniques	
8.11	From whom do you receive these techniques?	
8.12	Do you have knowledge about what are the plans for your land? (No =0; Yes = 1)	
8.13	After leasing your land, did your food production change? (No =0; Yes = 1)	
8.14	If there is a change, please describe?	
8.15	What is your (watermelon) harvest estimation now per acre, after leasing your land? tones/acre	
8.16	Do you have new machinery tools? (No =0; Yes = 1)	

8.17 Could you mention your experience/opinion what are the benefits/drawbacks for leasing your land for agricultural production?

Benefits:

Drawbacks:

Appendix 3: Stata output

Logistic Regression

```
dprobit rentofland hhhead_age gender education hh_size assets_agriculture livestock_ownership loans_last_season landsize cc_production_ratio
  water_acces soil_quality
Iteration 3:   log likelihood = -90.536586
Iteration 4:   log likelihood = -90.536362

Probit regression, reporting marginal effects           Number of obs =     192
                                                        LR chi2(11)   =   81.00
                                                        Prob > chi2   =  0.0000
Log likelihood = -90.536362                             Pseudo R2     =  0.3091
```

rentof~d	dF/dx	Std. Err.	z	P>|z|	x-bar	[95% C.I.]	
hhhead~e	-.0001892	.0036248	-0.05	0.958	46.5573	-.007294	.006915
gender*	-.1120741	.1561748	-0.73	0.468	.895833	-.418171	.194023
educat~n*	.2441418	.1301538	1.47	0.142	.947917	-.010955	.499239
hh_size	.0465444	.032025	1.45	0.146	4.21875	-.016223	.109312
asset~re	1.76e-08	1.96e-08	0.90	0.369	2.7e+06	-2.1e-08	5.6e-08
lives~ip*	.3444964	.0939543	2.48	0.013	.859375	.160349	.528644
loans_~n*	.1977914	.0973237	1.88	0.059	.744792	.00704	.388542
landsize	.0280018	.0085036	3.31	0.001	8.39844	.011335	.044669
cc_pro~o	.0489309	.0370107	1.32	0.188	1.10792	-.023609	.121471
water_~s	.059341	.0370293	1.60	0.109	3.08333	-.013235	.131917
soil_q~y*	.5024564	.0721596	6.01	0.000	.458333	.361026	.643887
obs. P	.4270833						
pred. P	.3921544	(at x-bar)					

```
(*) dF/dx is for discrete change of dummy variable from 0 to 1
    z and P>|z| correspond to the test of the underlying coefficient being 0
```

Correlation test

```
. corr hhhead_age gender education hh_size assets_agriculture livestock_ownership loans_last_season landsize cc_production_ratio water_acces
> soil_quality
(obs=192)
```

	hhhead~e	gender	educat~n	hh_size	asset~re	lives~ip	loans_~n	landsize	cc_pro~o	water_~s	soil_q~y
hhhead_age	1.0000										
gender	-0.1332	1.0000									
education	0.1313	0.0735	1.0000								
hh_size	-0.0369	0.0925	-0.0313	1.0000							
assets_agr~e	-0.0123	-0.0886	0.0550	0.1998	1.0000						
livestock~ip	-0.1550	0.1073	-0.0274	0.0210	0.2018	1.0000					
loans_last~n	0.0697	-0.0041	0.0241	0.0590	-0.2052	0.0725	1.0000				
landsize	0.1110	-0.0436	0.0634	-0.0502	0.3026	0.0852	-0.3086	1.0000			
cc_product~o	-0.0301	-0.0533	-0.0351	-0.0419	-0.0489	-0.1314	-0.1408	0.1475	1.0000		
water_access	-0.0902	-0.0473	-0.0033	-0.0686	-0.0988	0.1279	0.1003	-0.0291	0.1296	1.0000	
soil_quality	-0.0863	0.0741	-0.0196	-0.0865	0.0398	0.1616	-0.0609	0.0379	-0.1293	-0.0116	1.0000

```
. lstat

Probit model for rentofland

                 True
Classified |      D            ~D      |     Total
-----------+--------------------------+-----------
     +     |     59            22      |        81
     -     |     23            88      |       111
-----------+--------------------------+-----------
   Total   |     82           110      |       192

Classified + if predicted Pr(D) >= .5
True D defined as rentofland != 0
--------------------------------------------------
Sensitivity                     Pr( +| D)   71.95%
Specificity                     Pr( -|~D)   80.00%
Positive predictive value       Pr( D| +)   72.84%
Negative predictive value       Pr(~D| -)   79.28%
--------------------------------------------------
False + rate for true ~D        Pr( +|~D)   20.00%
False - rate for true D         Pr( -| D)   28.05%
False + rate for classified +   Pr(~D| +)   27.16%
False - rate for classified -   Pr( D| -)   20.72%
--------------------------------------------------
Correctly classified                        76.56%
--------------------------------------------------
```

Goodness of fit test

```
. linktest

Iteration 0:   log likelihood = -131.03529
Iteration 1:   log likelihood = -93.037558
Iteration 2:   log likelihood =  -90.17298
Iteration 3:   log likelihood = -90.111911
Iteration 4:   log likelihood = -90.111848

Probit regression, reporting marginal effects           Number of obs =    192
                                                        LR chi2(2)    =  81.85
                                                        Prob > chi2   = 0.0000
Log likelihood = -90.111848                             Pseudo R2     = 0.3123

------------------------------------------------------------------------------
rentof~d |      dF/dx   Std. Err.      z    P>|z|     x-bar  [    95% C.I.   ]
---------+--------------------------------------------------------------------
    _hat |    .4122949   .0619213     6.95   0.000  -.273708    .290931   .533658
  _hatsq |    .0460982   .0499047     0.93   0.350   1.1924    -.051713    .14391
---------+--------------------------------------------------------------------
  obs. P |    .4270833
 pred. P |    .4134674  (at x-bar)
------------------------------------------------------------------------------
    z and P>|z| correspond to the test of the underlying coefficient being 0
```

```
.
. estat gof

Probit model for rentofland, goodness-of-fit test

       number of observations =       192
 number of covariate patterns =       192
           Pearson chi2(180) =    183.56
                 Prob > chi2 =    0.4124

.
. predict propensity
(option pr assumed; Pr(rentofland))
```

```
. tabstat propensity, stat(mean median sd) by(rentofland)

Summary for variables: propensity
     by categories of: rentofland (RENT OF LAND)
```

rentofland	mean	p50	sd
0	.2741723	.2202842	.2317708
1	.63826	.7151656	.2548875
Total	.4296681	.3718197	.3013509

Propensity Score Matching – Comparison of outcome variables

```
. psmatch2  rentofland, p(propensity) outcome(  fcs monthsnotenoughtoeat food_exp_last7days_pp total_income_pp) common radius caliper(0.075)
```

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
fcs	Unmatched	74.4207317	64.3818182	10.0389135	2.18590394	4.59
	ATT	72.8	65.7747265	7.02527355	3.21846875	2.18
monthsnotenoug~t	Unmatched	.524390244	.645454545	-.121064302	.124170248	-0.97
	ATT	.569230769	.623386324	-.054155555	.191943569	-0.28
food_exp_last7~p	Unmatched	3994.44251	4356.18182	-361.739311	269.614475	-1.34
	ATT	4036.57143	4138.39123	-101.819802	416.415062	-0.24
total_income_pp	Unmatched	917382.143	486740.073	430642.07	81179.3191	5.30
	ATT	815666.308	600716.251	214950.057	112563.683	1.91

Note: S.E. does not take into account that the propensity score is estimated.

psmatch2: Treatment assignment	psmatch2: Common support		
	Off suppo	On suppor	Total
Untreated	0	110	110
Treated	17	65	82
Total	17	175	192

Test for matching quality - Pstest

```
pstest  hhhead_age gender education hh_size  assets_agriculture livestock_ownership loans_last_season landsize cc_production_ratio  water_acces
 soil_quality, both
```

Variable	Unmatched / Matched	Mean Treated	Mean Control	%bias	%reduct |bias|	t-test t	t-test p>|t|	V(T)/ V(C)
hhhead_age	U	45.915	47.036	-9.4		-0.64	0.520	1.06
	M	44.862	44.736	1.0	88.8	0.06	0.951	1.18
gender	U	.89024	.9	-3.2		-0.22	0.828	1.09
	M	.92308	.94953	-8.6	-171.1	-0.61	0.541	1.48
education	U	.97561	.92727	22.5		1.49	0.137	0.35*
	M	.96923	.96508	1.9	91.4	0.13	0.896	0.89
hh_size	U	4.3049	4.1545	11.1		0.76	0.451	0.85
	M	4.2308	4.2783	-3.5	68.4	-0.21	0.832	0.82
assets_agriculture	U	3.3e+06	2.3e+06	37.2		2.60	0.010	1.63*
	M	2.6e+06	2.6e+06	1.0	97.4	0.08	0.936	1.04
livestock_ownership	U	.97561	.77273	63.9		4.16	0.000	0.14*
	M	.96923	.95061	5.9	90.8	0.54	0.592	0.64
loans_last_season	U	.76829	.72727	9.4		0.64	0.522	0.90
	M	.81538	.83693	-4.9	47.5	-0.32	0.748	1.10
landsize	U	10.378	6.9227	53.3		3.78	0.000	2.56*
	M	8.0462	7.9932	0.8	98.5	0.06	0.956	0.56*
cc_production_ratio	U	1.1379	1.0855	4.5		0.31	0.760	0.78
	M	1.0908	1.1237	-2.8	37.2	-0.16	0.873	0.95
water_acces	U	3.2561	2.9545	25.9		1.73	0.086	0.46*
	M	3.2	3.0586	12.1	53.1	0.72	0.472	0.54*
soil_quality	U	.70732	.27273	96.0		6.59	0.000	1.05
	M	.66154	.66714	-1.2	98.7	-0.07	0.947	1.01

* if variance ratio outside [0.64; 1.55] for U and [0.61; 1.64] for M

Sample	Ps R2	LR chi2	p>chi2	MeanBias	MedBias	B	R	%Var
Unmatched	0.309	81.00	0.000	30.6	22.5	147.2*	0.93	45
Matched	0.008	1.49	1.000	4.0	2.8	21.2	0.97	18

* if B>25%, R outside [0.5; 2]

Bootstrap Standard error

```
. bootstrap r(att), reps(250): psmatch2  rentofland, p(propensity) outcome(  fcs ) common radius caliper(0.075)
(running psmatch2 on estimation sample)

Bootstrap replications (250)
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
..................................................   50
..................................................   100
..................................................   150
..................................................   200
..................................................   250

Bootstrap results                               Number of obs      =       192
                                                Replications       =       250

      command:  psmatch2 rentofland, p(propensity) outcome( fcs ) common radius caliper(0.075)
        _bs_1:  r(att)
```

	Observed Coef.	Bootstrap Std. Err.	z	P>|z|	Normal-based [95% Conf.	Interval]
_bs_1	7.025274	2.685959	2.62	0.009	1.76089	12.28966

```
. bootstrap r(att), reps(250): psmatch2  rentofland, p(propensity) outcome(  monthsnotenoughtoeat) common radius caliper(0.075)
(running psmatch2 on estimation sample)

Bootstrap replications (250)
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
..................................................   50
..................................................   100
..................................................   150
..................................................   200
..................................................   250

Bootstrap results                               Number of obs      =       192
                                                Replications       =       250

      command:  psmatch2 rentofland, p(propensity) outcome( monthsnotenoughtoeat) common radius caliper(0.075)
        _bs_1:  r(att)
```

	Observed Coef.	Bootstrap Std. Err.	z	P>|z|	Normal-based [95% Conf.	Interval]
_bs_1	-.0541556	.1372631	-0.39	0.693	-.3231863	.2148752

```
. bootstrap r(att), reps(250): psmatch2  rentofland, p(propensity) outcome(  food_exp_last7days_pp ) common radius caliper(0.075)
(running psmatch2 on estimation sample)

Bootstrap replications (250)
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
..................................................   50
..................................................   100
..................................................   150
..................................................   200
..................................................   250

Bootstrap results                               Number of obs      =       192
                                                Replications       =       250

      command:  psmatch2 rentofland, p(propensity) outcome( food_exp_last7days_pp ) common radius caliper(0.075)
        _bs_1:  r(att)
```

	Observed Coef.	Bootstrap Std. Err.	z	P>|z|	Normal-based [95% Conf.	Interval]
_bs_1	-101.8198	299.9332	-0.34	0.734	-689.6782	486.0386

```
. bootstrap r(att), reps(250): psmatch2  rentofland, p(propensity) outcome(  total_income_pp ) common radius caliper(0.075)
(running psmatch2 on estimation sample)

Bootstrap replications (250)
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
..................................................   50
..................................................   100
..................................................   150
..................................................   200
..................................................   250

Bootstrap results                               Number of obs      =       192
                                                Replications       =       250

      command:  psmatch2 rentofland, p(propensity) outcome( total_income_pp ) common radius caliper(0.075)
        _bs_1:  r(att)
```

	Observed Coef.	Bootstrap Std. Err.	z	P>|z|	Normal-based [95% Conf.	Interval]
_bs_1	214950.1	109322.5	1.97	0.049	681.8501	429218.3

Sensitivity of analysis

```
. gen delta =  fcs- _fcs
(127 missing values generated)

.
. rbounds delta, gamma(1(0.05)2)

Rosenbaum bounds for delta (N = 65 matched pairs)

Gamma            sig+       sig-     t-hat+     t-hat-        CI+        CI-
------------------------------------------------------------------------------
    1         .000115    .000115     6.0625     6.0625    3.05682     9.7255
 1.05         .000222    .000058     5.6875    6.34167    2.83333    10.0833
  1.1           .0004    .000029      5.425      6.625    2.56522    10.4167
 1.15         .000684    .000014    5.14091    6.85909    2.34659    10.6591
  1.2         .001114    7.2e-06    4.86837    7.12772    2.07576    10.9091
 1.25          .00174    3.6e-06    4.64167    7.52206    1.86364      11.25
  1.3         .002618    1.8e-06    4.46691    7.74167    1.66667    11.4819
 1.35         .003811    8.8e-07    4.27206    7.91667        1.5    11.6859
  1.4         .005386    4.3e-07    4.09849    8.14655    1.14706    12.0833
 1.45         .007413    2.1e-07    3.98246    8.36222    .897059    12.3977
  1.5         .009963    1.1e-07    3.78473    8.64049    .729411    12.6534
 1.55         .013105    5.2e-08    3.51923    8.89416    .541667    12.9792
  1.6         .016905    2.6e-08    3.39681    9.16667     .37829    13.1667
 1.65         .021424    1.3e-08     3.3125    9.33333     .15341    13.5156
  1.7         .026716    6.2e-09    3.19608    9.44432    -.05921    13.7568
 1.75         .032829    3.0e-09    3.09524    9.61668   -.245834    13.9318
  1.8         .039798    1.5e-09          3    9.81373   -.421123    14.1375
 1.85         .047654    7.3e-10      2.875      10.05   -.530769    14.3333
  1.9         .056413    3.6e-10    2.79167    10.1477       -.675    14.5625
 1.95         .066084    1.8e-10    2.63258    10.3258   -.833333    14.7411
    2         .076665    8.6e-11    2.49568    10.4826   -1.00833    14.8466

* gamma  - log odds of differential assignment due to unobserved factors
  sig+   - upper bound significance level
  sig-   - lower bound significance level
  t-hat+ - upper bound Hodges-Lehmann point estimate
  t-hat- - lower bound Hodges-Lehmann point estimate
  CI+    - upper bound confidence interval (a=  .95)
  CI-    - lower bound confidence interval (a=  .95)
```

```
. gen delta =  total_income_pp- _total_income_pp
(127 missing values generated)

. rbounds delta, gamma(1(0.05)2)

Rosenbaum bounds for delta (N = 65 matched pairs)

Gamma            sig+       sig-     t-hat+     t-hat-        CI+        CI-
------------------------------------------------------------------------------
    1         .006216    .006216     135120     135120    27463.1     245956
 1.05          .00992    .003777     125496     142944    18525.8     254785
  1.1         .015067     .00228     113824     152678    9945.05     267514
 1.15         .021924    .001368     107661     161523    2831.91     279637
  1.2         .030728    .000817     101410     170224   -4015.27     294282
 1.25         .041673    .000486    94412.2     177194   -11337.5     307701
  1.3           .0549    .000287    87321.9     185746     -17611     315924
 1.35         .070486     .00017    78531.5     192480   -22930.8     326771
  1.4         .088447      .0001    71618.6     198869   -27992.9     335495
 1.45         .108736    .000058    65789.3     205220   -33312.5     349408
  1.5         .131249    .000034    60390.7     212997   -38178.7     356866
 1.55         .155831     .00002    53991.9     216909   -42148.7     368994
  1.6         .182286    .000012    48451.5     224575   -46767.4     380648
 1.65         .210385    6.8e-06    42075.8     229495   -50265.2     393527
  1.7         .239876    3.9e-06    37617.3     236280     -57032     399605
 1.75         .270494    2.3e-06    31790.4     240165   -65008.1     409224
  1.8         .301969    1.3e-06    24738.1     247903   -70348.2     421955
 1.85         .334031    7.6e-07    21022.9     253018     -75625     437414
  1.9         .366421    4.4e-07    16295.5     257984   -77639.3     443156
 1.95         .398892    2.5e-07    11061.9     263025   -80875.4     449453
    2         .431214    1.5e-07    7370.11     271451   -83389.3     455279

* gamma  - log odds of differential assignment due to unobserved factors
  sig+   - upper bound significance level
  sig-   - lower bound significance level
  t-hat+ - upper bound Hodges-Lehmann point estimate
  t-hat- - lower bound Hodges-Lehmann point estimate
  CI+    - upper bound confidence interval (a=  .95)
  CI-    - lower bound confidence interval (a=  .95)
```

Propensity Score Matching – Comparison of food groups consumption

```
. psmatch2  rentofland, p(propensity) outcome(  staple pulses vegetable fruits animalprotein  diary sugar oil) common radius caliper(0.075)
```

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
staple	Unmatched	7	7	0	0	.
	ATT	7	7	0	0	.
pulses	Unmatched	4.30487805	3.26363636	1.04124169	.282178332	3.69
	ATT	4.10769231	2.90385345	1.20383886	.422854878	2.85
vegetable	Unmatched	6.87804878	5.76363636	1.11441242	.2144858	5.20
	ATT	6.84615385	5.772655	1.07349884	.343910334	3.12
fruits	Unmatched	3.73170732	2.58181818	1.14988914	.326040754	3.53
	ATT	3.44615385	2.4644814	.981672441	.480747094	2.04
animalprotein	Unmatched	6.63414634	6	.634146341	.187863598	3.38
	ATT	6.56923077	5.94010025	.629130523	.29637928	2.12
diary	Unmatched	1.37804878	.645454545	.732594235	.251023134	2.92
	ATT	1.24615385	.39205513	.854098716	.354790128	2.41
sugar	Unmatched	2.40243902	2.30909091	.093348115	.393654002	0.24
	ATT	2.15384615	1.93488222	.218963937	.597031841	0.37
oil	Unmatched	7	7	0	0	.
	ATT	7	7	0	0	.

Note: S.E. does not take into account that the propensity score is estimated.

```
. psmatch2  rentofland, p(propensity) outcome(  Total_farm_inc_pp offfarm_income_pp) common radius caliper(0.075)
```

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
Total_farm_inc~p	Unmatched	635699.366	436724.673	198974.693	68768.8864	2.89
	ATT	501652.415	554485.473	-52833.0571	83907.4695	-0.63
offfarm_income~p	Unmatched	368527	103092.545	265434.455	49457.0682	5.37
	ATT	374834.954	97940.6559	276894.298	72125.3665	3.84

Note: S.E. does not take into account that the propensity score is estimated.

Independent t-test

```
. ttest     hhhead_age, by(rentofland)

Two-sample t test with equal variances
```

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	110	47.03636	1.123554	11.78393	44.80952	49.26321
1	82	45.91463	1.339102	12.12609	43.25024	48.57903
combined	192	46.55729	.8597266	11.91272	44.86151	48.25307
diff		1.121729	1.740701		-2.311852	4.555311

```
    diff = mean(0) - mean(1)                                      t =   0.6444
Ho: diff = 0                     degrees of freedom =      190

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.7400         Pr(|T| > |t|) = 0.5201          Pr(T > t) = 0.2600
```

```
. ttest     level_educ, by(rentofland)

Two-sample t test with equal variances
```

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	110	1.327273	.0754294	.7911099	1.177774	1.476771
1	82	1.512195	.081841	.741102	1.349357	1.675033
combined	192	1.40625	.0558315	.7736244	1.296124	1.516376
diff		-.1849224	.1123684		-.4065721	.0367274

```
    diff = mean(0) - mean(1)                                      t =  -1.6457
Ho: diff = 0                     degrees of freedom =      190

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0507         Pr(|T| > |t|) = 0.1015          Pr(T > t) = 0.9493
```

```
. ttest     hh_size, by(rentofland)

Two-sample t test with equal variances
```

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	110	4.154545	.1343358	1.408925	3.888296	4.420795
1	82	4.304878	.1438167	1.302315	4.018728	4.591028
combined	192	4.21875	.0983631	1.362959	4.024733	4.412767
diff		-.1503326	.1990762		-.5430159	.2423507

```
    diff = mean(0) - mean(1)                                      t =  -0.7552
Ho: diff = 0                     degrees of freedom =      190

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.2255         Pr(|T| > |t|) = 0.4511          Pr(T > t) = 0.7745
```

```
. ttest       dependencyratio, by(rentofland)

Two-sample t test with equal variances
```

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	110	.4453636	.0467152	.4899535	.3527756	.5379517
1	82	.457439	.0610435	.5527726	.3359816	.5788965
combined	192	.4505208	.037264	.5163451	.377019	.5240227
diff		-.0120754	.0755263		-.1610531	.1369023

```
    diff = mean(0) - mean(1)                                      t =  -0.1599
Ho: diff = 0                     degrees of freedom =      190

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.4366         Pr(|T| > |t|) = 0.8731          Pr(T > t) = 0.5634
```

```
. ttest   assets_value, by(rentofland)

Two-sample t test with equal variances
```

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	110	3611000	391815.9	4109400	2834434	4387566
1	82	5360948	703710.8	6372372	3960784	6761111
combined	192	4358373	379220.9	5254638	3610375	5106372
diff		-1749948	758095.8		-3245313	-254582.2

```
    diff = mean(0) - mean(1)                                      t =  -2.3083
Ho: diff = 0                     degrees of freedom =      190

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0110         Pr(|T| > |t|) = 0.0221          Pr(T > t) = 0.9890
```

```
. ttest assets_hh, by(rentofland)

Two-sample t test with equal variances
```

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	110	1338455	396779.9	4161463	552049.7	2124859
1	82	2093874	710830.8	6436847	679544.1	3508205
combined	192	1661082	379104.9	5253031	913311.8	2408852
diff		-755419.8	766460.7		-2267285	756445.4

```
    diff = mean(0) - mean(1)                                      t =  -0.9856
Ho: diff = 0                     degrees of freedom =      190

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.1628         Pr(|T| > |t|) = 0.3256          Pr(T > t) = 0.8372
```

```
. ttest    assets_agriculture, by(rentofland)

Two-sample t test with equal variances
```

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	110	2272545	222377	2332310	1831801	2713290
1	82	3267073	328812.9	2977528	2612839	3921308
combined	192	2697292	192399.6	2665967	2317791	3076793
diff		-994527.7	383247.3		-1750494	-238561.7

```
    diff = mean(0) - mean(1)                                      t =  -2.5950
Ho: diff = 0                     degrees of freedom =      190

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0051         Pr(|T| > |t|) = 0.0102          Pr(T > t) = 0.9949
```

```
. ttest  hold_form7, by(rentofland)

Two-sample t test with equal variances
```

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	110	.9454545	.0217514	.2281302	.9023441	.988565
1	82	.9390244	.0265873	.2407581	.886124	.9919247
combined	192	.9427083	.0168158	.2330067	.9095398	.9758769
diff		.0064302	.0340812		-.060796	.0736563

```
    diff = mean(0) - mean(1)                                      t =   0.1887
Ho: diff = 0                     degrees of freedom =      190

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.5747         Pr(|T| > |t|) = 0.8506          Pr(T > t) = 0.4253
```

```
. ttest    loans_last_season, by(rentofland)

Two-sample t test with equal variances
```

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	110	.7272727	.0426579	.4474001	.6427261	.8118193
1	82	.7682927	.0468803	.4245195	.6750155	.8615698
combined	192	.7447917	.0315463	.4371181	.6825678	.8070155
diff		-.04102	.0638727		-.1670106	.0849707

```
    diff = mean(0) - mean(1)                                      t =  -0.6422
Ho: diff = 0                     degrees of freedom =      190

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.2608         Pr(|T| > |t|) = 0.5215          Pr(T > t) = 0.7392
```

```
. ttest   savings, by(rentofland)

Two-sample t test with equal variances
```

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	110	.8454545	.0346226	.3631252	.7768336	.9140755
1	82	.8902439	.0347317	.3145091	.8211387	.9593491
combined	192	.8645833	.0247584	.3430626	.8157483	.9134184
diff		-.0447894	.0500782		-.1435699	.0539912

```
    diff = mean(0) - mean(1)                                      t =  -0.8944
Ho: diff = 0                     degrees of freedom =      190

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.1861         Pr(|T| > |t|) = 0.3722          Pr(T > t) = 0.8139
```

Comparison of Food items consumption

```
. by rentofland, sort : summarize staple pulses vegetable fruits animalprotein diary sugar oil
```

-> rentofland = 0

Variable	Obs	Mean	Std. Dev.	Min	Max
staple	110	7	0	7	7
pulses	110	3.263636	2.083915	0	7
vegetable	110	5.763636	1.881475	1	7
fruits	110	2.581818	2.247861	0	7
animalprot~n	110	6	1.550377	0	7
diary	110	.6454545	1.418012	0	7
sugar	110	2.309091	2.979272	0	7
oil	110	7	0	7	7

-> rentofland = 1

Variable	Obs	Mean	Std. Dev.	Min	Max
staple	82	7	0	7	7
pulses	82	4.304878	1.711898	0	7
vegetable	82	6.878049	.5531112	4	7
fruits	82	3.731707	2.216931	0	7
animalprot~n	82	6.634146	.8090872	3	7
diary	82	1.378049	2.058648	0	7
sugar	82	2.402439	2.265467	0	7
oil	82	7	0	7	7

Declaration

I,

Romero Antonio, Miriam Esmaragda

Born on 09.10.1986

Matriculation number 570899

hereby declare on my honor that the attached declaration,

Master Thesis

has been independently prepared, solely with the support of the listed literature references, and that no information has been presented that has not been officially acknowledged.

Prof. Dr. Harald Grethe

Supervisor

"Patterns of access to land by Chinese agricultural investors and their impacts on rural households in Mandalay Region, Myanmar"

5th Semester

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Sttutgart, 24.03.2015