LUND UNIVERSITY
School of Economics and Management

MASTER IN ECONOMIC DEVELOPMENT AND GROWTH

# Foreign large-scale land acquisitions in Sub-Saharan Africa: Boon or bane for domestic food security?

*Laura Baiker*
la0813ba-s@student.lu.se

**EKHS42**
Master thesis, second year (15 ECTS)
May 2018
Supervisor: Dr. Mikolaj Malinowski
Examiner: Dr. Erik Green
Word count: 15,092

**Abstract**

Since the boom in global food prices in 2008, governments and companies around the world seek to boost agricultural output and sustain internal food security through the purchase and lease of farmland in Sub-Saharan Africa. There is no consensus in the literature whether land acquisitions by foreign investors are beneficial to the livelihoods of the local people in Africa. This thesis aims to contribute to the on-going debate by providing empirical evidence on the net effects of large-scale land deals on food security in the host countries. I construct a panel dataset on Sub-Saharan Africa from 2000 to 2013 and estimate the statistical impact on daily per capita food supplies while accounting for heterogeneity across countries with random and fixed effects. I find evidence that large-scale land acquisitions improve food security significantly. However, the results should be interpreted with care due to limitations of the underlying data. The thesis stresses the importance of increased access to information on international land deals and greater transparency in negotiation and documentation processes. Only then, research can provide conclusive evidence on the implications for food security.

*Keywords*: land grab, food security, foreign investments, smallholder agriculture, large-scale farming, Africa

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# 1 Introduction

There are currently more than 815 million people in the world that are under the threat of hunger, 25 percent of these live in Sub-Saharan Africa (Food and Agriculture Organization of the United Nations (FAO), 2017b). Achieving food security and combating poverty in the developing world are the most demanding challenges of our days. These are also reflected in the first and second goals of the 2030 Agenda for Sustainable Development that was adopted by the United Nations in September 2015. According to the second goal, the ambitious aim for the next fifteen years is to "end hunger, achieve food security and improved nutrition and promote sustainable agriculture" (United Nations, 2015, p. 14). Beyond the obvious threat to human life, malnutrition is particularly harmful to economic development as it causes deficits in cognitive functions, reduced investments in health and education services, as well as a higher incidence of diseases (Caulfield, Richard, Rivera, Musgrove, & Black, 2006; Strauss & Thomas, 1998). In turn, this leads to lower labour productivity and thus, undernourished people are less able to increase household income and achieve a decent standard of living (Strauss & Thomas, 1998).

At the same time, land-scarce countries around the world seek to sustain internal food security through the acquisition of agricultural land in developing countries. Since the boom in global food prices in 2008, the purchase and lease of fertile land by foreign governments and companies has accelerated tremendously as a response to increasing prices and growing food insecurity (Deininger et al., 2011). Rising food demand caused by population growth, higher incomes, urbanization, changing dietary preferences as well as the rise of crop-based bioenergy additionally fuel into this process (Godfray et al., 2010). Between 1990 and 2007, the scope of land acquisitions was less than 1.9 million hectares per year. This amounted to 56 million hectares even before the end of 2009, whereby 70 percent of the acquisitions took place in Africa (Deininger et al., 2011). This phenomenon is widely seen as "land grab" meaning that private enterprises and state actors from both developing and advanced countries increasingly invest in agricultural land through purchases and long-term leases (Görgen et al., 2009). This thesis focuses on large-scale land acquisitions by foreign investors covering more than 200 hectares of land which is used not only for food production, but also for forestry, renewable energy, and agri-industrial crops such as cotton and palm oil.

There is no consensus in the literature whether large-scale land acquisitions by foreign investors are beneficial to the population in the host country. On the one hand, companies that acquire land tend to invest in rural infrastructure and thus provide public goods and services. Also, due to higher productivity of large-scale farms, land acquisitions might directly lead to an increase in food output, additional employment and the transfer of technology and knowledge from international firms to domestic small-scale farmers (Davis, D'Odorico, & Rulli, 2014). On the other hand, foreign companies often export food back to their home country instead of serving the domestic market and thus, food insecurity in Africa might even worse (Görgen et al., 2009). Moreover, small-scale farmers that cultivate the land might be displaced as a consequence of land concessions. The loss of land implies

that households become unable to produce income and food and thus, rural poverty and undernourishment are likely to increase (Davis et al., 2014). Land appropriations where native farmers are not adequately compensated for their loss might further lead to social conflicts and political instability (Görgen et al., 2009). Lastly, large-scale farmers are often accused of environmental degradation that leads to poor water and soil quality and reduced biodiversity that can cause rising food insecurity (Spieldoch & Murphy, 2009).

Due to low data quality and a lack of transparency as land transactions are not made public, comprehensive empirical evidence on the effects of foreign land acquisitions is scarce. Previous research studies focus on single countries and investments to evaluate potential threats and benefits of land deals for the local population but fail to provide conclusive evidence on actual food security outcomes in the host countries (see e.g. Fisseha, 2011; Milimo, Kalyalya, Machina, & Hamweene, 2011; Veldman & Lankhorst, 2011). The contribution of this thesis is to fill this gap by providing cross-country evidence on the impact of large-scale land acquisitions on food security in Sub-Saharan Africa. The question to be answered is whether the benefits of international land deals can outweigh the risks for the local population and thus result in a net improvement of food security. Based on the rare and mixed findings in the literature, two competing hypotheses are outlined that help to guide the empirical analysis throughout the paper.

In order to meet these requirements, I compile an annual panel dataset on land deals in Sub-Saharan Africa between 2000 and 2013 from two different sources. The primary data source is the Land Matrix Global Observatory (2018), which is the result of a collaboration between research institutes and civil organizations that collect information on land deals in developing countries. It is based on continuous research as well as submissions by the public which enter the database when they have been checked and confirmed. Because of many informal data sources, the reliability of results based on the Land Matrix has been criticised (see e.g. Scoones, Hall, Borras, White, & Wolford, 2013). However, the quality of the Land Matrix database has improved recently, and a lot of emphasis is put on cross-checking, updating and raising the accuracy of the land deals (Nolte, Chamberlain, & Giger, 2016).

To further improve the quality of the data, I use a second database to re-examine the overlapping entries with the Land Matrix and to expand the sample by additional land deals. The database is provided by GRAIN (2016), an international non-profit organization that works together with smallholder farmers in developing countries. There are fewer deals included in the GRAIN database since the collection has focused on contracts signed after 2006. Moreover, I further improve the quality of the econometric analysis by including only deals that have been concluded and for which a land size was specified in the contract. I identify double entries, content errors and suspended land deals with additional information from company websites and research reports.

In a second step, I make use of the underlying sample to estimate the impact of land acquisitions on food security in Sub-Saharan Africa. The daily per capita food supply in kilocalories is employed as the dependent variable to measure the *availability* of and *access* to food at the national level. It is derived from the FAOSTAT database (FAO,

2017a). Alternative variables and definitions are used for robustness tests. The panel regression is conducted using random and fixed effects to control for heterogeneity across countries. Supplemental control variables are utilized in each specification to capture country-specific characteristics as identified in the literature.

This thesis provides evidence that foreign land acquisitions have a positive, statistically significant impact on food security. The regression analysis shows that land deals increase per capita food supply on average by 8.44 kilocalories per day, which amounts to an annual gain of 3,080 kilocalories. Besides this immediate effect, the analysis yields statistically significant estimates for one-, two-, and four-year lags. For instance, four years after the investment, food supply increases on average by 12.94 kilocalories per day. Although these improvements seem to be rather limited in size, they can make a substantial difference for the physical development of children (Santangelo, 2018). Moreover, the coefficient is robust to the inclusion of various country-control variables but sensitive to the inclusion of time and fixed effects, alternative definitions of food security and first-differenced data.

Nevertheless, the results can be seen as a first indication on the outcomes of large-scale land acquisitions for national food security. Proponents of land deals seem to be right as the involvement of foreign investors appears to be beneficial for the amount of food supplied in the domestic market. Since the underlying sample tends to understate the scale of land transactions in Sub-Saharan Africa, we might interpret the estimates as the conservative bottom line. For more comprehensive and conclusive evidence, African governments have to make international land deals more transparent and improve the quality of the data in order to be able to investigate the full impact on food security. This also requires that the time horizon is extended in order to capture effects in the very long run such as environmental degradation.

The remainder of this paper is organised as follows. The next section reviews the existing literature on the opportunities and risks of land acquisitions for the local population. Few studies provide direct empirical evidence on the implications for food security. The survey includes quantitative and qualitative research on developing countries in general as well as case studies on Sub-Saharan Africa. Inspired by these findings, I further motivate this paper and outline the two competing hypotheses on the implications of land deals for food security in the host countries. Section 3 describes the data that are utilized and provides descriptive statistics of the sample. In Section 4, I explain the methodology and empirical specification. The random-effects model is applied to estimate the regression equation in the presence of heterogeneity. Although the fixed-effects model is generally preferred because it has less restrictive assumptions, the Hausman test suggests that the random-effects model is more suitable as it yields efficient results. Section 5 presents estimation results and robustness checks. Finally, Section 6 summarizes the findings, discusses the limitations of the study and concludes.

# 2 Literature review and theoretical considerations

According to FAO (2008a, p. 1), "food security exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life." This implies that the concept of food security has four crucial pillars: 1) *Availability* of food which is determined by the supply of food through production, stock levels, and net trade; 2) *Access* to food which is not automatically ensured by the availability since it depends on incomes, markets, prices, and expenditure; 3) *Utilization* of food which considers the nutritional conditions through feeding practices, diversity of the diet, distribution of food within the household and food preparation; 4) *Stability* of food intake which also includes periodic food insecurity through adverse weather events, political instability and economic factors such as unemployment and price booms (FAO, 2008a).

When considering the relationship between foreign land deals and national food security, the question that can be answered is whether the commercialization of agriculture and thus, the replacement of smallholders by large-scale farms is beneficial to the dimensions of food availability and access. Whether food supply is stable and equally distributed within the country has to be investigated in another research framework when detailed household data or at least regional data is available.

This section reviews the literature on the opportunities and risks for the local population that arise from large-scale land acquisitions. The focus lies on the direct and indirect linkages with food security through the dimensions of availability and access such as, among others, productivity and output growth, income generation, displacement of smallholders and access to resources. Empirical and anecdotal evidence from country studies is used to evaluate whether the benefits and disadvantages are actually materialized in the host countries. Based on the empirical findings of qualitative and quantitative studies and the evaluation of the opportunities and risks of large-scale land acquisitions in Sub-Saharan Africa, I will derive two competing hypotheses on the implications of foreign land deals for food security in the host countries.

## 2.1 Potential benefits of land acquisitions

The agricultural sector in many developing countries has been neglected for decades resulting in a lack of investments which are essential to foster innovation, productivity growth, and food production. According to FAO (2009), more than USD 11 billion of investments are needed annually to expand food production in Sub-Saharan Africa in order to meet the needs of a growing population. Since these countries are less able to afford the necessary capital by themselves, foreign direct investments (FDI) are a welcome source to achieve higher investment rates and thus eradicate poverty and improve food security in the host countries. The purchase and lease of agricultural land is just one form of investment and comes with slightly different implications for the livelihoods of the people.

The acquisition of agricultural land is likely to be accompanied by an additional influx of capital, know-how, and technology that can contribute to the development of the host

economy. The modernization of farming techniques and irrigation schemes will increase productivity and boost agricultural output (Hallam, 2009; Meinzen-Dick & Markelova, 2009).

However, greater food production does not necessarily translate into greater food availability for the native population when investors export the agricultural products back to their home countries instead of serving the domestic market (Görgen et al., 2009; Odhiambo, 2011; Robertson & Pinstrup-Andersen, 2010).

Food security is also deteriorated when the acquired land was formerly utilized for food production and now serves to plant industrial crops and produce biofuels (Hall, 2011). Some studies stress that the cultivation of crops to produce bioenergy results in rising food prices since it undermines the production of traditional food crops (Cotula, Dyer, & Vermeulen, 2008; FAO, 2008b; Matondi, Havnevik, & Beyene, 2011).

An important contribution for economic development and food security can be made if there are positive spillovers from large foreign producers to local small-scale farmers in terms of technology and knowledge. This includes the education of workers and farmers, forward and backward linkages with local suppliers as well as demonstration effects with respect to the utilization of technology, organizational practices and imitation of operational techniques (Spencer, 2008). However, empirical evidence on technology and knowledge transfers to African farmers is rather mixed (Liu, 2014). Whereas Cotula, Vermeulen, Leonard, and Keeley (2009) report significant inflows of capital and know-how for five African countries, Hufe and Heuermann (2017) find that transfers only occurred in 6 percent of the surveyed projects.

Potential benefits to the smallholder sector also include improved access to markets and agricultural inputs such as seeds and fertilisers, production linkages between investors and local farmers and integration into global value chains (Görgen et al., 2009). This might contribute to rising productivity in the agricultural sector and thus higher food production. An adequate partnership between investors and local farmers can take the form of contract farming, land rental or outgrower schemes in which the investors contribute capital, technology, and markets whereas the farmers contribute labour, local knowledge and land (Deininger et al., 2011). In fact, Sulle and Nelson (2009) document substantial profits for small-scale farmers in Tanzania arising through outgrower schemes and other business relationships in biofuel projects. On the other hand, Cotula et al. (2009) notice that in general there is almost no involvement of local smallholders in Sub-Saharan Africa as most projects are run as large farms without the opportunity for contract farming.

Profits might be also distributed highly unequally among the local population since it is usually the elite that benefits from the investments since it is better educated, wealthier and more business-oriented (Odhiambo, 2011). In a case study on a large-scale investment in Rwanda, Veldman and Lankhorst (2011) show that only the farmers that were commercially oriented could benefit from the investment and work as outgrowers since they were better able to quickly adapt to the changing environment. However, even these farmers complaint about the situation since they have become dependent on a single factory that purchases their sugar cane. Also, the legal rights of the farmers are poorly defined in the

contracts. In sum, it seems that overall relatively few farmers benefit from production linkages to large-scale investors.

Furthermore, many land deals come with the promise to invest in rural infrastructure including transportation and communication, health facilities and schools which has usually been neglected for too long by the central governments. These investments help to stimulate the rural economies, increase agricultural output and incomes (Meinzen-Dick & Markelova, 2009). A large number of country studies on Sub-Saharan Africa confirm that provisions for public and social infrastructure are usually part of the deal (Hufe & Heuermann, 2017; Meinzen-Dick & Markelova, 2009; Milimo et al., 2011). However, a case study on Ethiopia reports that the investors' promises for infrastructure development have not been fulfilled (Fisseha, 2011). Furthermore, Cotula et al. (2009) conduct a legal analysis of land contracts in Africa and conclude that infrastructure promises are not specific enough to be enforceable and that it is too costly for the government to monitor and sanction the investors.

The emergence of large-scale farms can provide employment opportunities for the local population and thus increase household income and improve food intake. It might be an important income source particularly for immigrant farmers with small landholdings and the landless poor (Shete & Rutten, 2015). In fact, Cotula et al. (2009) report that employment generation is the most important advantage of land deals in Sub-Saharan Africa. Studying a large-scale project of 10,000 hectares in the province of Gambella in Ethiopia, Baumgartner, von Braun, Abebaw, and Müller (2015) estimate that income has increased by 50 percent due to the generation of additional jobs. On the other hand, some studies suggest that employment benefits are overestimated since jobs are low-paid, insecure, and only temporary due to constructional and seasonal work and because farming becomes more capital-intensive through heavy mechanization (Anseeuw, Wily, Cotula, & Taylor, 2012; Hufe & Heuermann, 2017; Liu, 2014). Deininger et al. (2011) estimate that large-scale agriculture has generated 0.005 jobs per hectare in Ethiopia and 0.351 jobs per hectare in the Democratic Republic of the Congo. This suggests that employment opportunities are rather limited and smallholder farming creates relatively more jobs per hectare than plantation farming (Shete & Rutten, 2015). In a case study on Rwanda, workers even report that they consider themselves poorer and less nourished than before since they receive low payment, work under bad conditions and are unable to grow their own food due to the loss of land (Veldman & Lankhorst, 2011).

Finally, a rather indirect link exists between government revenues arising from land deals and food security. Rent fees, tax income and export tariffs might stimulate growth and can be used to fund social services for the farmers that were displaced by the acquisitions (Robertson & Pinstrup-Andersen, 2010). However, the potential to generate revenues is not even partly exploited by the African governments. Some studies report that tax income and land fees remain low due to the use of tax holidays and other incentive schemes in order to attract foreign investors (Cotula et al., 2009; Fisseha, 2011). Moreover, formal land markets do not exist, or they are heavily underdeveloped which makes it difficult to assess land values; contracts are often negotiated to the advantage of

the investor as they do not allow a renegotiation of land taxes and thus create an artificial suppression of rents (Cotula et al., 2009; Robertson & Pinstrup-Andersen, 2010).

## 2.2 Potential risks of land acquisitions

The opponents of large-scale land acquisitions tend to emphasize the potential threats for the local population. The most harmful of these is the displacement of individuals, farmers and even whole communities. Since land rights and local interests are not sufficiently protected by the state, the native population is at risk to lose their livelihood since they become unable to produce food and generate income (Cotula et al., 2009). The usual perception of agriculture in Sub-Saharan Africa is that there is plenty of underused lands that can be sold to investors for more efficient utilization. However, even though the land is formally owned by the state, this does not mean that the area is redundant to the local population. In fact, investors seek to purchase the most fertile, well-watered and accessible land on which rural communities already till the fields for centuries under customary law (Anseeuw et al., 2012; Liu, 2014). This means that indigenous farmers use the land without legal recognition, and thus become vulnerable to dispossessions (Anseeuw et al., 2012).

According to Meinzen-Dick and Markelova (2009), up to 90 percent of the land in Africa is under customary tenure. Also, wasteland, marshland, and forests are sold without considering that they often provide important resources for farmers and households for grazing, wild foods and water access (Anseeuw et al., 2012; Spieldoch & Murphy, 2009; Sulle & Nelson, 2009; Veldman & Lankhorst, 2011). Therefore, large-scale land investments are most likely to hurt smallholders without formal land rights, pastoralists that have to move around with their livestock because of the changing climate, as well as hunters and gathers that need access to the forests (Anseeuw et al., 2012; Odhiambo, 2011).

Quantitative and qualitative case studies on Sub-Saharan Africa overwhelmingly report displacements of farmers, households and villages due to insecure land rights and the purchase of unofficially used farmland, marshland, grazing, and forests (Anseeuw et al., 2012; Cotula et al., 2009; Fisseha, 2011; Sulle & Nelson, 2009; Veldman & Lankhorst, 2011). This does not only imply the loss of land and thus, the inability to produce food and income, but also the additional revenue loss from other business transactions because households are often reallocated to disadvantaged locations and have to travel long distances to the next markets (Milimo et al., 2011). Moreover, the ever-tighter concentration of land in a few hands especially harms the rural poor since competition for fertile land is intensified and thus results in an inflation of land prices (Anseeuw et al., 2012; Liu, 2014). In sum, the displacement of farmers due to large-scale land acquisitions is most likely to deteriorate food security in the host country.

Related to this is the additional loss of resources other than land. In particular, water availability is crucial for a balanced diet; it impacts on harvest yields and thus, food security and income of the local population (Rulli, Saviori, & D'Odorico, 2013).

Investments in large-scale irrigation schemes and the use of agrochemicals can cause water stress and poor water quality for downstream farmers (The Oakland Institute, 2011). In fact, many studies find that large-scale projects negatively influence the amount and quality of water available to the local farmers (Anseeuw et al., 2012; Fisseha, 2011; Liu, 2014; The Oakland Institute, 2011). According to Rulli et al. (2013), food security in the host countries is at risk since the estimated per capita water grab associated with land acquisitions exceeds the requirements for a balanced diet. This is particularly harmful where households do not find employment that can adequately replace the loss of resources (Anseeuw et al., 2012). However, it seems unlikely that wage labour is able to compensate for the loss as Fisseha (2011) reports that among the displaced individuals, only 11 percent have family members that found employment in the project.

There is no legal mechanism that enables farmers to reclaim the loss of land and income they have suffered from the investment. Thus, most studies report that compensation is not adequate (Anseeuw et al., 2012; Cotula et al., 2009; Fisseha, 2011; Görgen et al., 2009; Hufe & Heuermann, 2017; Milimo et al., 2011). On the one hand, poorly-functioning or absent land markets due to land abundance, widespread informal market transactions, volatile prices and the lack of official documentation make it difficult to determine a fair level of compensation (Deininger et al., 2011; Sulle & Nelson, 2009). On the other hand, customary rights to land and resources are not legally protected. Thus, some farmers and communities cannot even expect to receive compensation (Anseeuw et al., 2012).

Displacements, inadequate compensation and the unequal distribution of benefits might cause social conflicts and political instability (Görgen et al., 2009; Hufe & Heuermann, 2017; Liu, 2014). However, Görgen et al. (2009) note that it is not only the lack of secure property rights that leads to unrest but also the strong ties of many African communities to their land which might be in family hands since generations. According to FAO (2017b), conflict and food security determine each other. For one thing, conflicts in rural areas destroy people's livelihoods, disrupt local markets and implement high economic costs which in turn decrease the availability of food and lead to malnutrition. Then again, food insecurity can become a multiplier of conflicts due to intensified competition for resources and unmet expectations about basic services and administration.

Finally, there is a large number of studies that report environmental consequences from large-scale land acquisitions. The shift to input-intensive commercial agriculture may lead to degradation of natural resources, water pollution, soil depletion, excessive use of freshwater, fertilisers, pesticides and fossil fuel (Montemayor, 2009; Spieldoch & Murphy, 2009). Moreover, some studies report that the clearing of forests and grasslands to make space for vast monoculture plantations reduces the biodiversity and ecosystem services (Anseeuw et al., 2012; von Braun & Meinzen-Dick, 2009). These environmental outcomes might all have negative implications for food security and the livelihoods of the local people in the long run (Spieldoch & Murphy, 2009; The Oakland Institute, 2011).

## 2.3 The net impact on food security

The discussion above reveals that the literature has identified opportunities as well as risks for the local population due to large-scale land acquisitions by foreign investors. Most of the research studies discussed so far do not try to estimate the overall implications of large-scale land acquisitions for local food security. Instead, they emphasize the *potential* effects that might lead to an improvement or worsening of internal food security. Therefore, the most urgent question to be answered is whether the benefits can actually outweigh the disadvantages of large-scale land acquisitions.

Empirical evidence on the net impact on food security is rare because of severe data limitations. One exception is Shete and Rutten (2015) that quantify the effects of a land deal of 11,700 hectares by the Indian company Karuturi Agro Products PLC in Bako Tibe District in Ethiopia. To measure local outcomes on food security and income, the authors collected data on 300 households between March and May 2012 to compare those affected by the investment to some counterfactuals with the help of propensity score matching. The authors argue that farmers have lost access to grassland because of the Karuturi investment and thus were forced to decrease their livestock which has provided a crucial income source. As a consequence, incomes of the affected households decrease by 15 to 25 percent compared to the counterfactuals. To measure food security, Shete and Rutten (2015) make use of two proxies: the coping strategy index (CSI) and consumption expenditure by each household. They estimate that the CSI is nine times higher for the treatment group and consumption expenditure is 20 to 27 percent lower compared to households not affected by the land deal. This provides explicit evidence that food security has worsened because of the investment.

Contrary to this are the findings by Hufe and Heuermann (2017) who conduct a meta-analysis of 60 case studies that investigate land deals in Sub-Saharan Africa. They summarize the outcomes for the local population along several dimensions, one dimension covers the impact on food security. In only four projects, which is equal to 3 percent of all cases reviewed, they find a reduction in local food security. From these, studies on biofuel projects provide mixed evidence as they find that there is little threat to food production when Jatropha is intercropped with traditional food crops. However, most case studies find a negative impact on local livelihoods when accounting for other dimensions such as land conflicts, employment and access to technology and markets. Therefore, the benefits of large-scale land deals are not able to outweigh the disadvantages for the local population.

Another survey is conducted by Liu (2014) which includes case studies conducted by FAO in all developing countries but with a particular emphasis on Africa. The report lacks a definite conclusion on the implications for food security since the projects evaluated were made recently and thus, it might be too early to undertake an examination. However, the case studies suggest a negative effect overall as the risks tend to outweigh the advantages, especially when land rights are unclear and insecure.

A qualitative assessment is undertaken by Cotula et al. (2009). The authors review land deal contracts and the applicable law in five African host countries: Ethiopia, Mozambique, Mali, Sudan, and Madagascar. They find that most of the sample contracts do not feature measures on food security and investors are free to either export the food or serve the domestic market. They conclude that food security is additionally threatened by displacements and environmental degradation, among others.

Finally, Santangelo (2018) provides quantitative evidence on the impact of large-scale land deals on food security in the developing world. He constructs a panel on 65 host countries between 2000 and 2011, whereby food security is measured as daily caloric intake per capita and land deals are derived from the Land Matrix database. The impact is estimated by a conditional mixed process model. Santangelo (2018) finds that land acquisitions by developed-country investors increase food security by 8.08 to 17.9 calories daily, whereas acquisitions by developing-country investors decrease food security by 0.23 to 10.27 calories daily. He explains these distinct findings by socially responsible pressure in the industrialized world as well as technology and environmental spillovers from developed-country investors in contrast to developing countries.

## 2.4 Motivation and hypothesis

The evaluation of potential outcomes of large-scale land acquisitions shows that there are benefits as well as disadvantages to the local population whereby the materialization is rather context-specific and varies from project to project. Despite some progress in the literature, the net impact of land deals on food security is still little understood and the existing empirical evidence is scarce and rather mixed. The estimated outcomes differ notably due to the use of different data, methodologies, assumptions about the underlying mechanisms and whether hypotheses were tested in a quantitative or qualitative framework. Moreover, many studies have focused on a single country or project to quantify the change in food production, availability, and consumption. However, results from case studies are hard to generalize and thus, more comprehensive empirical evidence is needed.

The contribution of this thesis is to investigate the net impact of large-scale land deals on local food security in the context of a panel analysis on Sub-Saharan Africa. The study is closest to the work of Santangelo (2018) but diverts from it in several ways. First, it makes use of more recent data on land deals and food security, and thus extends the observation period to 2013. Second, whereas Santangelo (2018) does not provide any information on how he dealt with the quality issues in the Land Matrix data, I put a particular emphasis on cross-checking the data entries. Third, my focus is on Sub-Saharan Africa since most deals are targeted towards this region, which is perceived to be land-abundant. Finally, the methodology is different as I make use of a random-effects model to account for unobserved heterogeneity across host countries.

To my knowledge, no study so far has compiled a panel dataset to investigate the impact of large-scale land deals on food security in Sub-Saharan Africa. Since prior evidence is inconclusive and theory does not provide clear guidance, I will investigate two

competing hypotheses that can be formally written as follows:

**Hypothesis 1.** The disadvantages of large-scale land acquisitions outweigh the benefits for the local population resulting in a deterioration of domestic food security overall.

**Hypothesis 2.** The benefits of large-scale land acquisitions outweigh the disadvantages for the local population resulting in an improvement of domestic food security overall.

Which of the two hypotheses will prove to be true is an empirical matter that this thesis aims to answer in the following. The net impact on domestic food supplies depends on whether the benefits of commercialized large-scale farming bear out, in contrast to the potential risks. Figure 1 summarizes the aforementioned mechanisms of the land deal-food security nexus in a simplified schematic flow chart. The green boxes denote potential advantages of foreign land deals, whereas the red boxes denote potential threats to domestic food security. Solid lines indicate effects that might be observed in the short and medium run; dashed lines indicate long-run outcomes of land acquisitions.

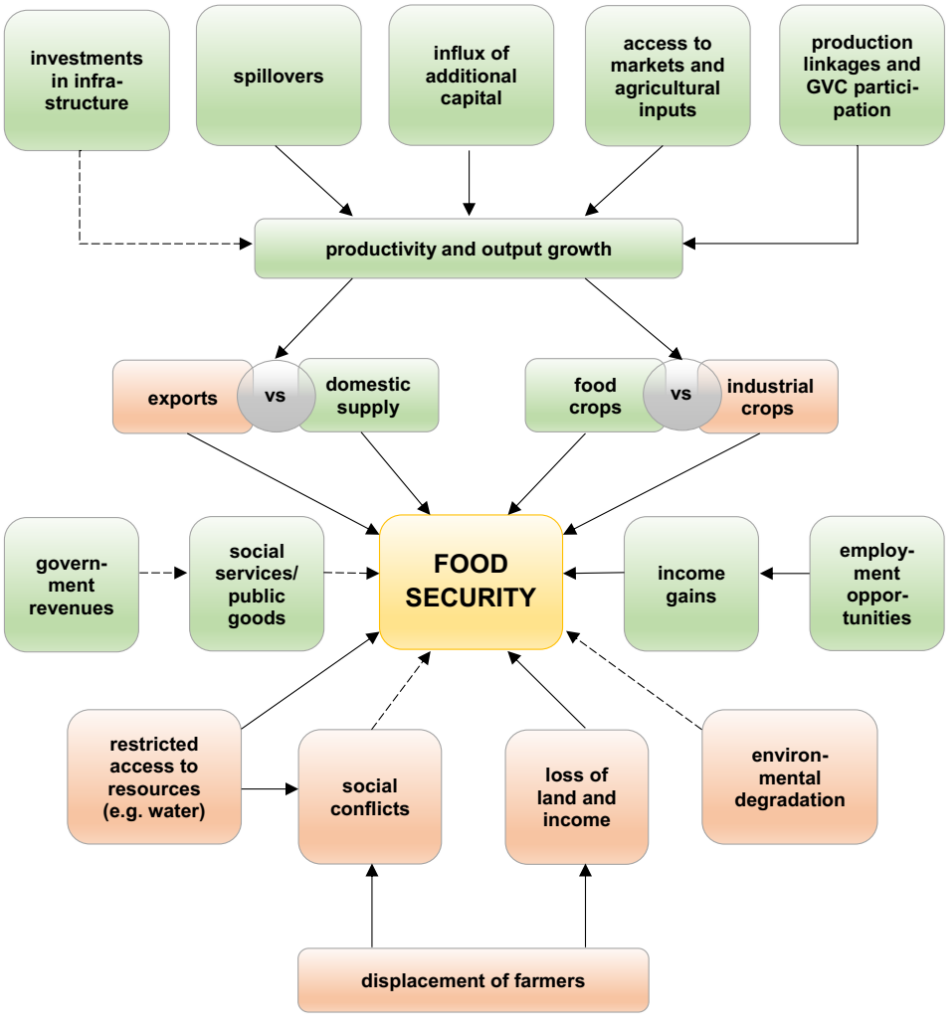
For the empirical analysis of this thesis, it is important whether the effect of large-scale investments on national food supplies is felt immediately or comes with a substantial lag. For instance, farmers are most likely displaced prior to the start of the investment project and thus, may face the loss of land, resources, and income immediately. Other mechanisms are likely to be delayed for a few years. For instance, employment generation requires that *actual* farming or construction work take place. Moreover, some agricultural large-scale projects are implemented with a substantial delay due to the lack of infrastructure, technologies, and know-how (Deininger et al., 2011). Therefore, I will examine immediate effects on food security, i.e. in the same year as the acquisition took place, as well as lagged effects of one, two and four years after.

However, environmental degradations such as soil erosion and water pollution are more likely to be felt in the long run. The time horizon of my sample from 2000 to 2013 does not allow to consider mechanisms that bear out only ten to fifteen years after the investment. Instead, when interpreting the results in the following sections, my focus lies on the short- and medium-run mediators as depicted by the solid lines in Figure 1. Note that I am unable to investigate which mediators are actually at work, however, the interpretation will be based on logical reasoning and findings in the literature as outlined above.

# 3 Data

The purpose of this thesis is to estimate the impact of large-scale land acquisitions on national food security. This section presents summary statistics and describes the underlying data that is used in the panel analysis.

**Figure 1:** Mechanisms in the land deal-food security nexus




Notes: Red boxes denote potential disadvantages and green boxes potential benefits of foreign land deals. Solid lines indicate short- and medium-term outcomes; dashed lines indicate long-term effects.

## 3.1 Food security

The FAOSTAT food balance sheets (FAO, 2017a) provide the primary source to measure the outcome variable of interest. Particularly important for the empirical analysis in this paper is daily per capita food supply in kilocalories at the country-level. It indicates the domestic food supplies that are available for human consumption, whereby "the amount of food actually consumed may be lower than the quantity shown here, depending on the degree of losses of edible food and nutrients in the household, e.g. during storage, in preparation and cooking etc" (FAO, 2017a, n.p.). Domestic food supplies per capita also include food that is produced outside the agricultural sector such as non-commercial production by subsistence farmers and kitchen gardens (FAO, 2017a).

In this respect, I follow many studies on FDI that use per capita food supply to analyse food security at the national level (see e.g. Jenkins & Scanlan, 2001; Mihalache-O'keef & Li, 2011; Wimberley & Bello, 1992). When recalling the four pillars of the food

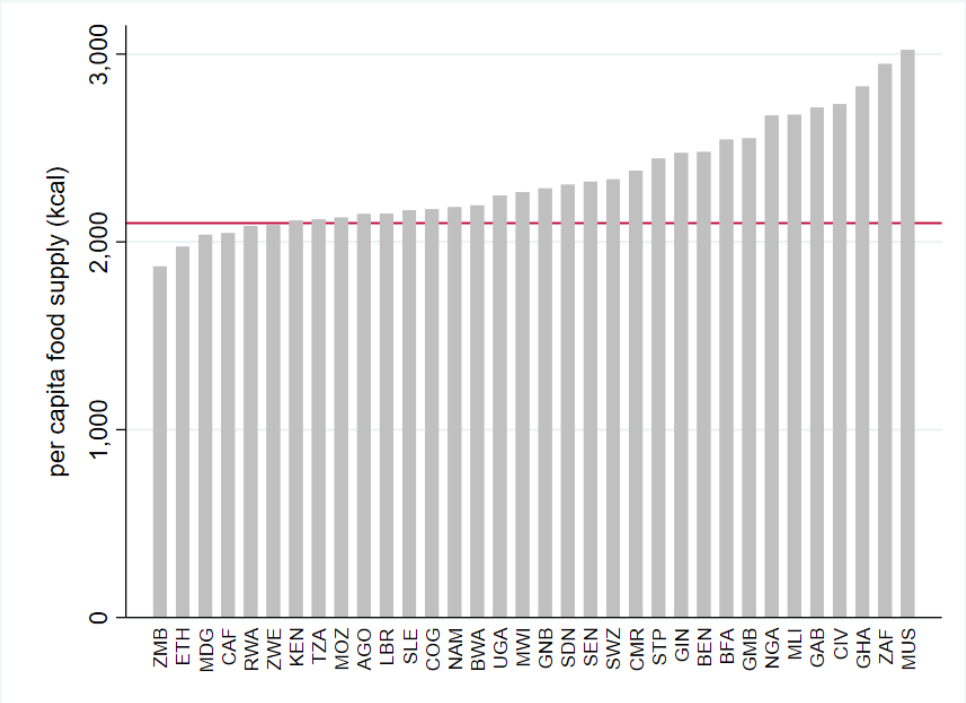
security definition, the dimensions of availability and access seem to be well captured by this measure. National food supply does not only reflect the availability of food at the aggregate level, but also the access of developing countries to global food supplies (Jenkins & Scanlan, 2001). However, it can neither provide information on the extent of food inequality within the country nor is it able to answer the question of hunger at the household level. For instance, the distribution of food is likely to be unequal because some communities are closer to the market than others, and because families may allocate more food to male working adults than to women and children. Nevertheless, food supply appears to be highly correlated with food inequality, and more direct measures of malnutrition such as the prevalence of undernourishment, child stunting, wasting, and underweight (Mihalache-O'keef & Li, 2011; Wimberley & Bello, 1992). Therefore, it can provide a good indication of food security at the national level.

Two more variables from the FAOSTAT food balance sheets are used to check the robustness of the results: daily per capita protein and fat supplies measured in grams. They additionally capture the nutritional value of food intake at the aggregate level (Mihalache-O'keef & Li, 2011; Santangelo, 2018). According to Latham (1997), proteins are indispensable for the growth and maintenance of the human body, as well as for the repair and replacement of damaged tissue and cells. Proteins are also transformed into carbohydrate available for the daily energy needs. Furthermore, a certain amount of fat in the diet is desirable because it yields more energy than carbohydrates and proteins, and thus makes the diet less bulky. It also functions as an energy storage that can be tapped in times where less food is available.

In Figure 2, daily per capita food supply is averaged over the period 2000 to 2013 for each country included in my final sample. The least caloric intake per person can be observed in Zambia, Ethiopia, Madagascar, Central African Republic, Rwanda, and Zimbabwe. The average food supply in these countries does not even reach the red horizontal line at 2,100 kilocalories, which are the daily energy requirements of a seven- to ten-year-old child with a median weight of 27 kilograms according to the World Health Organization (WHO, 1985).

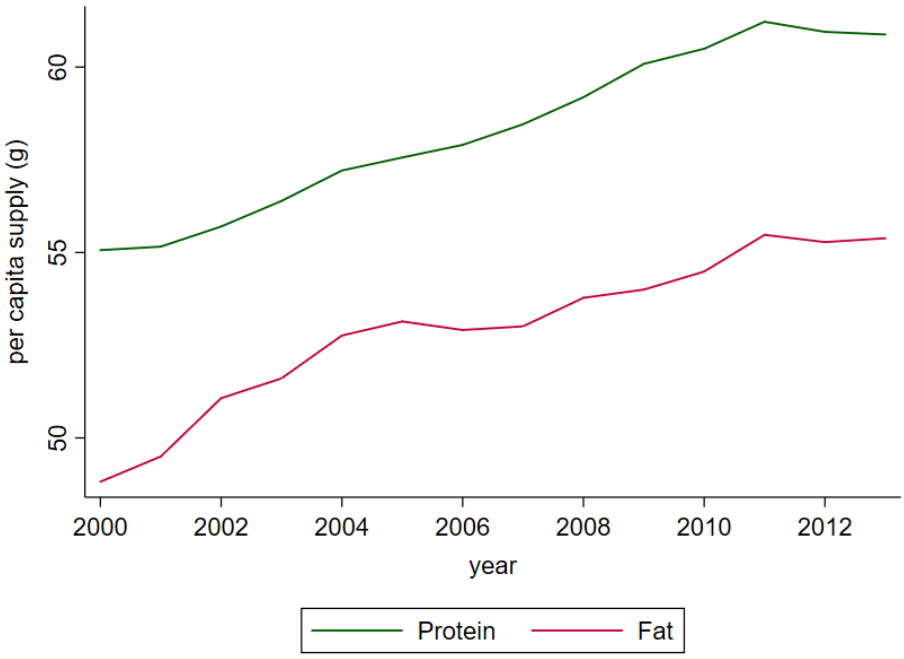
Figure 3 shows the two alternative measures of food security that are used in the sensitivity analysis in Section 5. Daily supplies of protein and fat per gram reflect the energy content of food, and thus its nutritional value. Both measures show an overall upward trend for Sub-Saharan Africa since 2000. The optimal amount of protein and fat per capita depends on the age, body weight, and specific requirements during pregnancy and lactation. For instance, the safe level of protein intake ranges from 13-17 grams for children to 60 grams for men with a weight of 80 kilograms (WHO, 1985). Therefore, the population average in Sub-Saharan Africa of 55-61 grams seems to reflect a solid nutritional value of food at the national level.

**Figure 2:** Average daily per capita food supply by country, 2000-2013




Notes: Calculated from FAOSTAT food balance sheets (FAO, 2017a). The red line denotes the daily energy requirements for children, i.e. 2,100 kilocalories. For ISO 3166-1 alpha-3 codes see Table 8 in the appendix.

**Figure 3:** Daily per capita protein and fat supplies in Sub-Saharan Africa per year, 2000-2013




Notes: Calculated from FAOSTAT food balance sheets (FAO, 2017a).

## 3.2 Land acquisitions

Because of the lack of transparency in land transactions, official data on large-scale land deals in Sub-Saharan Africa are often not sufficient for an empirical investigation. However, this thesis draws on two databases that have been made available by the collaboration of research institutes, non-governmental organizations and the public.

The primary data source is the Land Matrix Global Observatory (2018) which covers land acquisitions of domestic and foreign investors in developing countries from 2000 onwards. This includes information on deal status, acquired land size in hectares, investor and contract year. The data relies primarily on unofficial sources such as research papers and projects, company websites and media reports, as well as official government records. For a deal to enter the database it must have a land area of more than 200 hectares, entails a transfer of rights through sale, lease or concession, where land from small-scale farmers, local communities or ecosystem service provision are converted to commercial production (Nolte et al., 2016).

Some researchers have raised concerns about the reliability of databases such as the Land Matrix since the data does not only stem from official government sources, but also from media reports, personal information and company websites (see e.g. Scoones et al., 2013). However, Nolte et al. (2016) indicate that there have been made substantial improvements in the quality of the data since 2012. For instance, before land deals are included in the database, they are cross-checked by individuals from the public and private sector, and other experts. Only 6 percent of the deals were derived from media reports without providing any further source. Moreover, the database is constantly updated, and errors are corrected. Despite these improvements, the Land Matrix still suffers from the lack of transparency in land deals. This may cause statistical noise in the data since some countries are under-represented because official documentation is missing, and because media attention and research interest have shifted toward particular investor and target countries (Nolte et al., 2016). Nevertheless, to my knowledge, the Land Matrix is the best available data on land deals so far.

In a second step, I utilize the GRAIN (2016) database on foreign land acquisitions in developing countries to further improve the quality of the data. It is updated at irregular intervals and provided by the international non-profit organization, GRAIN, with the latest version available from 2016. Since the collection of land deals focuses on contracts signed by international investors after 2006, the database covers much fewer entries than the Land Matrix. However, it contains detailed information on the actual status of the deal which allows me to double-check the entries of the Land Matrix. The underlying sample is further extended by 34 land deals that were not recorded in the Land Matrix database.

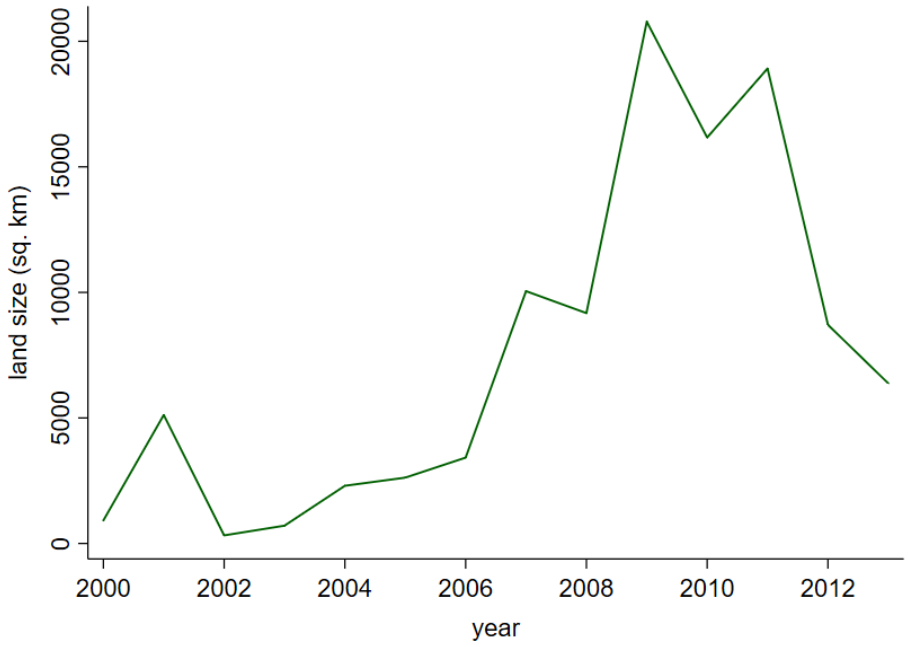
Moreover, I only include deals into the sample that were formally concluded and that specify a contract size and year. I use additional sources such as reports by international non-governmental organizations and company websites to correct for deals that have been suspended or that contain errors. Nevertheless, aggregate results should be interpreted

as the conservative bottom line since it is likely to be the case that the scale of land deals is significantly understated (Nolte et al., 2016).

After these adjustments, there is a total of 396 land acquisitions between 2000 and 2013 left. The great majority of the data is derived from the Land Matrix with only 22 percent of deals that are included in both databases and that could be used for cross-checking. The contracted land size ranges from 200 hectares to over 4,700 square kilometres. Most deals took place in Mozambique, Ethiopia, and Ghana.

The explanatory variable of interest is acquired land size by foreign investors per year, measured in square kilometres. It is aggregated at the national level to obtain a country-year panel from 2000 to 2013. Figure 4 shows the total contract size of land deals in Sub-Saharan Africa between 2000 and 2013. We can see that investments in land became more important after 2008, with substantially larger transactions from 2009 to 2011 which reflects the aforementioned rush for farmland since the boom in global food prices.

**Figure 4:** Total contract size in Sub-Saharan Africa per year, 2000-2013

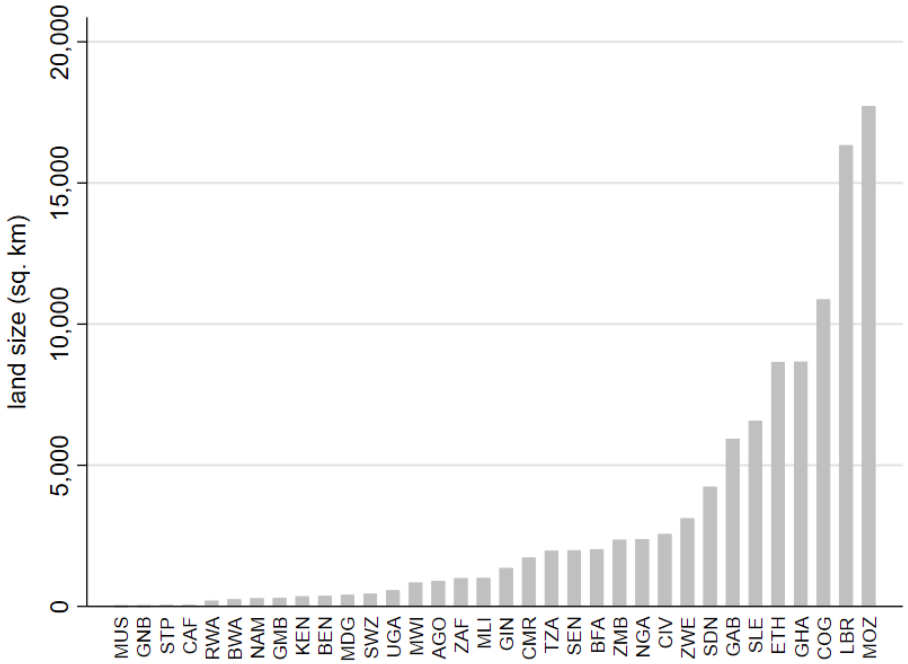



Notes: Annual sum of land size acquired by foreign investors in Sub-Saharan Africa from 2000 to 2013.

The total amount of land size that was acquired by foreign investors in each country between 2000 and 2013 is depicted in Figure 5. We can observe a great heterogeneity across the countries in my sample. More than 15,000 square kilometres were sold in Mozambique and Liberia, whereas for the majority of the countries, the total size of foreign land deals seems to be less than 5,000 square kilometres.

As previously mentioned, it is most likely to be the case that my sample understates the scope of land acquisitions in the host countries since both, the Land Matrix and GRAIN, miss many deals in their databases and largely exclude domestic investors. This

**Figure 5:** Total acquired land size by country, 2000-2013




Notes: Sum of acquired land size by foreign investors between 2000 and 2013. For ISO 3166-1 alpha-3 codes see Table 8 in the appendix.

underestimation is shown in Table 1 for selected countries. My sample is compared to estimations in the World Bank report by Deininger et al. (2011) that are based on country project inventories between 2004 and 2009.

For Liberia, the sample seems to fit the actual data well with only three deals missing. However, it is less representative when looking at the other countries as numbers are greatly underrated. For instance, Deininger et al. (2011) report 132 projects in Sudan with a total area of 39,650 square kilometres, whereas my sample only contains 6 projects covering 1,318 square kilometres between 2004 and 2009.

Surprisingly, the average land area *per* project differs substantially for the case of Ethiopia and Mozambique between the two sources. Thus, my sample might tend to overstate the actual size per land deal. Data from the Land Matrix and GRAIN may be "inflated" since they predominantly report the land area specified in the contract, and information on the actual project size during implementation and production is often missing. In addition, the sample mean is driven by outliers because public databases like the Land Matrix and GRAIN might focus on the "popular" mega-deals that dominate the media and public perceptions. Lastly, domestic investors are underrepresented in my sample. For Mozambique, Deininger et al. (2011) estimate the share of domestic investors as large as 53 percent, whereas, in my sample, they only account for 8 percent of all deals.

Due to these data limitations, estimates and aggregate numbers have to be interpreted with care. The overall picture suggests that my sample heavily underestimates the scale of land transactions since there are no official recordings, and transparency is generally low. On the other hand, the data sources suffer from an overestimation of land areas *per*

**Table 1:** Comparison of samples, 2004-2009

| | Deininger et al. (2011) | | | | My sample | | | |
|---|---|---|---|---|---|---|---|---|
| *Country* | *Deals* | *Area* | *Area per deal* | *Domestic investors* | *Deals* | *Area* | *Area per deal* | *Domestic investors* |
| Ethiopia | 406 | 11,900 | 29 | 49 | 37 | 5,256 | 142 | 32 |
| Liberia | 17 | 16,020 | 942 | 7 | 14 | 14,781 | 1056 | 18 |
| Mozambique | 405 | 26,700 | 66 | 53 | 44 | 11,863 | 270 | 8 |
| Sudan | 132 | 39,650 | 300 | 78 | 6 | 1,318 | 220 | 9 |

Notes: The aggregate numbers include domestic investors. Area of acquired land is measured in square kilometres; domestic investors are the percentage shares in total land deals.

investor. Often, the cultivated land is much less than contracted at the beginning and projects may fail at a later point (Deininger et al., 2011). Furthermore, it is not possible to compare domestic to foreign investors and thus, my theoretical and empirical analysis is restricted to international land deals. Another shortcoming is that I cannot include the Democratic Republic of the Congo and South Sudan in the analysis because food security data is not available. However, both countries appear to be very popular host countries for land acquisitions.

In addition, the Land Matrix defines the intention and the product of each deal which allows commenting on the distribution of investment purposes in the underlying sample. This has crucial consequences for the expected impact on food security. For instance, a large share of farms that produce biofuels will negatively affect domestic food supply since the occupied area cannot be used for nutritious and eatable agricultural products. Also, the land might have been taken from local small-scale farmers that planted food before.

The most striking feature of my sample is that in most deals, more than just one intention or product is specified per deal. It seems that investors seek for intercropping and mixed farming solutions on the acquired land sizes, possibly aiming to spread the risk and provide multiple agricultural products to the market. There are 85 land deals (out of 396), in which biofuels are specified as the main purpose, however, almost half of them plant sugar cane and jatropha together with maize, rice or other food crops. In fact, 60 percent of all deals aim to provide food crops, and in 28 cases, farming focuses on livestock production. In sum, the share of eatable farm output is relatively high, which eventually translates into higher food security. Unfortunately, there is no data available – except for the Land Matrix and GRAIN – that specify the agricultural intention and that can be used for comparison.

## 3.3 Country-specific control variables

In line with previous empirical studies on food security, I additionally consider country-specific characteristics that may have an influence on food security.

To measure the economic development of countries, real gross domestic product (GDP) per capita in constant 2010 USD and annual growth rates of GDP are utilized. Data is

derived from the World Development Indicators (The World Bank, 2018). Earlier studies have found positive impacts of economic development on food security and related health measures (see e.g. Firebaugh & Beck, 1994; Wimberley & Bello, 1992). However, a certain correlation between per capita GDP and national food supplies is also not surprising as GDP measures, among other things, the amount of food produced in the country.

Another line of research focuses on the economic dependency of countries. To measure export dependency, I calculate the percentage share of agricultural products in total merchandise exports. The data is retrieved from the trade statistics of the World Trade Organization (WTO, 2018). Some empirical studies show that primary export dependency reduces domestic food consumption (see e.g. Wimberley & Bello, 1992) whereas other studies yield insignificant results (see e.g. Jenkins & Scanlan, 2001). Moreover, it is often argued that FDI is much more detrimental to countries' welfare because of the repatriation of profits, weak ties with domestic producers, discouragement of domestic investments and limited employment creation (Jenkins & Scanlan, 2001). Thus, FDI stock as a percentage of GDP is used to measure foreign capital penetration. Data is derived from the United Nations Conference on Trade and Development (UNCTAD, 2017).

Furthermore, the Neo-Malthusians argue that some countries might still be stuck in the so-called "Malthusian trap" where excessive population growth reduces overall welfare. For instance, food security is under threat when countries engage in ecological over-cultivation, deforestation and irresponsible fertilizer use in response to faster population growth (Jenkins & Scanlan, 2001). Thus, population density and the age dependency ratio, which measures the proportion of people younger than 15 and older than 64 to the working-age population, are included in the analysis. The variables are derived from the World Development Indicators (The World Bank, 2018).

Besides, political and social stability is expected to have a positive impact on food security. This is mainly because of the disruptive nature of conflicts that can damage agriculture and food production systems and cause the plundering of livestock and crops. They can also cause a loss of social, human and economic capital as well as income sources (FAO, 2017b). Many countries in Sub-Saharan Africa are shaken by inner conflicts. Estimates show that they have a prevalence of undernourishment which is twice as high as in countries where conflict is largely absent (FAO, 2017b). Thus, I will include an index that measures political stability and the absence of conflict and terrorism at the national level that is derived from FAOSTAT (FAO, 2017a).

Finally, two more control variables are utilized to check the robustness of the results in the sensitivity analysis. The first one is gross domestic savings in percentages of GDP, which is equal to domestic investments under the assumption of a closed economy. It is derived from the Word Development Indicators (World Bank, 2018). In particular, investments into human and physical capital are necessary for industrialization, modernization and economic growth, which in turn determine food supply, child mortality, life expectancy and other indicators of the quality of life (Jenkins & Scanlan, 2001). The second variable is agricultural density that is measured as total agricultural employment relative to arable land. It is calculated from the labour statistics of the International

Labour Organization (ILO, 2017) and the land use statistics of FAOSTAT (FAO, 2017a). Agrarian density may also increase food supply since it is associated with lower fertility and income inequality as well as faster industrialization (Jenkins & Scanlan, 2001). The variables used in the empirical analysis are summarized in Table 9 in the appendix.

## 3.4 Sample statistics

The analysis is restricted to countries for which essential information on food security and land deals is available. The final sample contains 34 countries from 2000 to 2013. In total, there are 168 country-year observations. The panel is highly unbalanced as there are countries for which only some years are available whereas, for others, the whole observation period is covered. Table 8 in the appendix lists the countries included in my sample.

**Table 2:** Sample statistics

| *Variables* | *Obs.* | *Mean* | *Std. Dev.* | *Min.* | *Max.* |
|---|---|---|---|---|---|
| Food supply (kcal/capita/day) | 168 | 2,342 | 307 | 1,786 | 3,124 |
| Protein supply (g/capita/day) | 168 | 57.5 | 10.7 | 35.3 | 89.7 |
| Fat supply (g/capita/day) | 168 | 49.6 | 14.8 | 17.1 | 86.6 |
| Acquired land size (sq. km) | 168 | 628 | 1,178 | 2.2 | 8,706 |
| Annual number of deals | 168 | 2.36 | 2.29 | 1 | 11 |
| Real GDP per capita | 168 | 1,493 | 1,833 | 194 | 10,099 |
| Economic growth (%) | 168 | 6.08 | 4.64 | -17.7 | 33.7 |
| Export dependency (%) | 150 | 32.8 | 25.8 | 0.0329 | 91 |
| FDI penetration (%) | 168 | 47.8 | 116 | 0 | 1,070 |
| Population density (per sq. km) | 168 | 71.8 | 75 | 2.64 | 614 |
| Age dependency (%) | 168 | 88.6 | 10.6 | 42.5 | 110 |
| Stability Index | 161 | -0.616 | 0.866 | -2.65 | 0.98 |
| Savings (%) | 149 | 12 | 23.2 | -142 | 56.2 |
| Agricultural density | 168 | 104 | 58.4 | 5.48 | 355 |

Notes: See Table 9 in the appendix for information on the variables and sources.

Sample statistics of the variables that are utilized in the analysis are presented in Table 2. The dependent variable, per capita food supply ranges from 1,786 to 3,124 kilocalories with a sample average of 2,342 kilocalories. The corresponding means of protein and fat supplies per capita are equal to 57.5 and 49.6 grams, respectively. Again, it seems that the population in Sub-Saharan Africa suffers from a relative shortage in food consumption, whereas the nutritional value of food, as reflected by proteins and fats, are close to the daily requirements for adults as proposed by the WHO (1985). On average, there are 628 square kilometres of land acquired each year which corresponds to around 2.4 deals.

Moreover, the countries are characterized by a significant share of agricultural products in total exports (i.e. export dependency) of 32.8 percent, FDI stocks relative to GDP (i.e. FDI penetration) of 47.8 percent and a rather high age dependency ratio of 88.6 percent reflecting the share of people that is dependent on the working-age population, i.e. those

below 15 and above 64 years. Besides, annual economic growth was on average 6 percent between 2000 and 2013. The mean of the stability index is negative showing a high prevalence of political instability and conflict in the African countries.

# 4 Methodology

This section presents the econometric approach to determine the effects of large-scale land acquisitions by foreign investors on food security in the host countries. The compiled panel data, as described in Section 3, allows to study longitudinal and cross-sectional aspects of the underlying sample. In this regard, I will discuss the fixed- and random-effects models that are both methods widely used in the presence of unobserved heterogeneity across countries. The Hausman test is used to determine which of the two models is more appropriate. Finally, the theoretical considerations in Section 2 suggest that large-scale land acquisitions can come with a substantial delay and that the impact of the mediating forces on food supply is deferred. Thus, the empirical specification accounts for intermediate and lagged effects separately.

## 4.1 Econometric approach

In research designs where unobserved heterogeneity between individual units plays a substantial role, the use of random and fixed effects is more suitable than ordinary least squares (OLS). Both estimators allow controlling for differences across countries that are unobserved to the researcher, such as for instance, culture, government policies and climate. Consequently, a separate intercept for each country is introduced to the regression equation. For this reason, the fixed- and random-effects models are widely used by studies published in mainstream journals that analyse the impact of annual FDI inflows on countries' developmental outcomes (see e.g. Bengoa & Sanchez-Robles, 2003; Li & Liu, 2005; Mihalache-O'keef & Li, 2011).

In contrast to the fixed-effects model, the great drawback of the random-effects model is that it only yields consistent and unbiased estimates under the assumption that the unobserved country-level effects are not correlated with the explanatory variables and the error term (Baum, 2006). From a theoretical point of view, the validity of this assumption in the context of foreign acquisitions of farmland might be questioned. Instead, I can imagine several reasons why investment decisions are likely to be based on country-characteristics that are unobserved to the researcher such as topography, rainfall and business climate, among others. In this case, the assumption of strict exogeneity is violated and the within estimator must be used to obtain consistent results.

On the contrary, the random-effects model will be preferred when the assumption is valid since it produces more efficient estimates, i.e. with smaller standard errors, than the fixed-effects model. In this case, the country-level effect is treated as random, which simply adds the unit-specific disturbances to the overall error term in the model (Baum, 2006). Another great advantage of the random-effects model is the possibility to estimate

the impact of time-invariant regressors. This is not feasible with the fixed-effects model as the individual-level effects are removed from the initial model by the subtraction of time averages.

The Hausman test provides clarification as it tests whether the assumption of strict exogeneity is violated in my research sample by comparing the point estimates of both models. For each specification, the null hypothesis that the random-effects model yields consistent estimates cannot be rejected. As a consequence, my theoretical doubts regarding the correlation between country-specific effects and the regressors do not bear out and thus, the use of random effects is more appropriate in the following. For the sake of completeness, results using fixed effects are shown in the sensitivity analysis.

Furthermore, the random-effects model is preferred to the OLS estimator. Although OLS produces consistent estimates with strict exogeneity in panel settings, inefficiencies can arise when heterogeneity across countries becomes too large. In this case, too much weight is put on the variation between countries. Thus, the general least squares (GLS) method with random-effects is more efficient since it chooses optimal weights for the between estimator (Baum, 2006). In order to double check the appropriateness of the random-effects model, I run a Breusch and Pagan Lagrange multiplier test to detect random effects. The null hypothesis that there are no significant differences across countries is rejected for each specification. This suggests using the random-effects model is more efficient.

By definition, panel data comprises repeated observations per unit $i$ which may cause the error terms of each $i$ to have a common feature that is consistent over time (Adkins & Hill, 2011). For instance, we can think of a country's topography as the unobserved characteristic that is existent in each year. In this case, we run into the problems of heteroskedasticity and serial correlation meaning that the assumption of independent and identically distributed residuals is violated. In fact, group-wise heteroscedasticity was detected using a Lagrange Multiplier test statistic proposed by Greene (2003). To solve this issue and draw valid statistical inferences, I use Hubert-White robust standard errors that cluster at the country-level. This allows the disturbance terms to be correlated within clusters (i.e. countries) over time, but not between clusters (Adkins & Hill, 2011).

I am aware of the fact that clustering requires at least 30 to 40 clusters, which is more than my sample contains. This can cause the standard errors to be biased downwards resulting in an over-rejection of the null hypothesis (Cameron, Gelbach, & Miller, 2008). However, when I use the bootstrap method instead, as suggested by Cameron et al. (2008), the resulting standard errors are negligibly different and statistical inference is the same. Thus, in my particular case, it seems to be appropriate to stick with standard errors that cluster at the country-level.

## 4.2 Empirical specification

The aim of this thesis is to conduct a panel analysis on the impact of the acquired farmland by foreign investors on domestic food security and to test the competing hypotheses as outlined in Section 2.4. The baseline specification can be formally written as:

$$foodsupply_{i,t} = \alpha + \beta_1 lnland_{i,t} + \beta_2 \boldsymbol{Z_{i,t}} + \gamma_i + \epsilon_{i,t} \quad (1)$$

where $foodsupply_{i,t}$ denotes the daily caloric supply per capita in country $i$ in year $t$. The annual amount of land acquired by foreign investors is denoted by $lnland_{i,t}$. Since the distribution of the variable is highly skewed, the natural logarithmic transformation is applied to obtain an approximation to the normal distribution. The coefficient of interest is $\beta_1$ as it provides empirical evidence for one of the two competing hypotheses. The vector $\boldsymbol{Z_{i,t}}$ contains a set of regressors to control for country-specific characteristics as explained in more detail in Section 3.3. In particular, these are the log of real GDP, annual growth rates, the log of FDI stock as a percentage of GDP (i.e. FDI penetration), the share of agricultural exports in total merchandise exports (i.e. export dependency), population density, the age dependency ratio, and the stability index. Note that the subsequent inclusion of these variables has shown that multicollinearity between controls is not an issue; pairwise correlations and the variance inflation factor (VIF) are within the tolerance range. The term $\gamma_i$ denotes unobservable country-specific effects that capture the random variation across countries. It is simply added to the overall error term depicted by $\epsilon_{i,t}$. Table 9 in the appendix summarizes the variables that are used in the empirical analysis.

In a second step, I account for the likelihood that food security today is determined by land deals concluded in the past. As discussed in the theory section, the supplied amount of food in the host countries directly depends on *actual* agricultural production on the newly established commercial farms. The delay of such mega-projects can yield a significant lagged effect on domestic food security. Moreover, some of the mediating forces outlined in Figure 1 might only operate one or more years after the two parties signed the contract. For instance, the generation of employment, spillovers to and linkages with local businesses all require that production or at least construction work takes place. Since large-scale agricultural farms can come with substantial investments before the project is implemented, it is reasonable to assume the effect to be lagged by some years.

Another great advantage of using lagged explanatory variables is to control for potential endogeneity in the model, meaning that causality may not only run from land deals to food security but also the other way around, for instance, when investors deliberately choose countries for their agricultural projects that are less food insecure. In this case, we may run into the problem of reverse causality and the regression estimates will be biased. The use of lagged effects may relax this since it is less likely that *current* food supply affects land deals that were signed in the *previous* years and negotiated for even longer time.

The limited number of observations and the short time horizon of the underlying sample allow me to estimate the effect of foreign land deals with one-, two-, and four-year lags. The following specification is used:

$$foodsupply_{i,t} = \alpha + \beta_1 lnland_{i,t-m} + \beta_2 \boldsymbol{Z_{i,t}} + \gamma_i + \epsilon_{i,t} \quad (2)$$

where $m$ specifies land deals concluded one, two or four years before $t$.

# 5 Estimation results

The estimation results for the baseline specification (1) and the time lagged effects in equation (2) are presented in this section. I will further test the robustness of these results with alternative control variables, definitions of food security and estimation strategies.

## 5.1 Baseline specification

Table 3 presents estimates of the random-effects model concerning the impact of foreign land acquisitions on food security in the host countries. Columns (2) to (5) additionally control for country characteristics as identified in the literature on FDI and food security. The underlying theory and expected signs were shortly explained in Section 3.3. Robust standard errors that cluster at the country-level are reported in brackets below the coefficients. The resulting p-values of the Hausman test are shown for each specification at the bottom of the table justifying the use of the random-effects model.

Column (1) shows the unconditional impact of foreign large-scale acquisitions on food supply in the host countries. The estimated coefficient of land deals shows a positive effect that is statistically significant at the 5 percent level. A one percent rise in the size of land acquired by foreign investors increases daily food supply on average by approximately 21.47 calories per capita. However, the results are likely to be biased upward since other variables that have an influence on food security are ignored. Also, the very low R-squared suggests that the model does not adequately explain the variation in my dependent variable. This is not completely surprising since domestic food security is determined by many factors other than foreign land acquisitions – variables that have to be introduced to the specification.

Therefore, columns (2) to (5) gradually add country-specific controls. The coefficient of interest, log land size, stays positive and significant in each column, but decreases in magnitude when more variables are included. The preferred specification in column (5) shows that the point estimate is still statistically significant at the 10 percent level. On average, a one percent increase in the acquired land size leads to a rise in per capita food supply of approximately 8.44 calories daily. This translates into an annual gain of 3,080 calories per person.

At a first glance, the economic significance of the estimated effects seems to be rather small. However, Santangelo (2018) notes that for populations with a large proportion of young people, the impact can be substantial. In particular, children that are less than five

**Table 3:** Baseline regression

| *Variables* | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Log land size | 21.470** | 15.449** | 11.530* | 10.964* | 8.437* |
| | (8.600) | (6.923) | (6.367) | (5.898) | (4.397) |
| Log real GDP | | 238.068*** | 223.967*** | 177.730*** | 165.999*** |
| | | (55.394) | (63.909) | (53.063) | (57.703) |
| Economic growth | | 1.300 | 0.757 | 0.740 | 0.985 |
| | | (1.745) | (1.838) | (1.819) | (1.983) |
| Log FDI penetration | | | 19.210 | 7.465 | 4.024 |
| | | | (22.432) | (24.772) | (27.278) |
| Export dependency | | | -1.372 | -1.414 | -2.026** |
| | | | (0.954) | (0.887) | (0.821) |
| Population density | | | | 0.828 | 0.803 |
| | | | | (1.175) | (1.093) |
| Age dependency | | | | -5.591 | -8.028 |
| | | | | (5.496) | (6.222) |
| Stability Index | | | | | -39.743 |
| | | | | | (32.738) |
| Observations | 168 | 168 | 150 | 150 | 144 |
| Number of countries | 34 | 34 | 28 | 28 | 28 |
| Random effects | Yes | Yes | Yes | Yes | Yes |
| Overall R-squared | 0.0004 | 0.191 | 0.174 | 0.279 | 0.288 |
| Hausman test | 0.424 | 0.12 | 0.114 | 0.236 | 0.227 |

Notes: The dependent variable is daily food supply per capita. Robust standard errors that cluster at the country-level in parentheses. ***, **, * indicates significance at the 1%, 5%, 10% level. See Table 9 in the appendix for information on the variables and sources.

years old are affected since the energy required for the body to grow is estimated to be around five calories per gram. In one year, an average child thus can gain approximately 616 grams with an increase of 8 calories daily. Since these effects will accumulate over the years, the physical development of small children can be highly affected by foreign acquisitions of large-scale farmland.

These findings provide evidence for my second hypothesis which suggests that the benefits of foreign land deals tend to outweigh the disadvantages and thus, the net impact on domestic food security is positive. This is in line with the results by Santangelo (2018) on acquisitions by developed-country investors that lead to an increase of 8.08 to 17.9 calories per day. However, it contrasts to Shete and Rutten (2015) who estimate that in Ethiopia, food security has worsened by 20 to 27 percent for households that were affected by an Indian large-scale investment. Moreover, when it comes to FDI in the primary sector, Mihalache-O'keef and Li (2011) show that caloric intakes drop by 13.4 calories per day.

Turning to the country-specific determinants of domestic food security, columns (2) to (5) show that most control variables are statistically insignificant although increasing

the overall variation that is explained by the model. Only the coefficient of real GDP per capita is highly significant and robust throughout the specifications. In column (5), a one percent rise in per capita GDP leads to an approximate increase in daily per capita food supply by 166 calories on average. Again, the estimated correlation is not surprising as GDP, among other things, measures the amount of food produced per year. Furthermore, export dependency, measured as the share of agricultural products in total merchandise exports, appears to reduce caloric intakes by approximately 2 calories per day. This is in line with previous findings in the literature, whereas the insignificance of economic growth, FDI penetration, and political stability are rather surprising (see e.g. Jenkins & Scanlan, 2001; Mihalache-O'keef & Li, 2011; Santangelo, 2018; Wimberley & Bello, 1992).

## 5.2 Lagged effects

As aforementioned, it is reasonable to assume that the impact of land deals on internal food security comes with a substantial time lag. Thus, Table 4 gradually introduces one-, two-, and four-year lagged effects of large-scale land acquisitions. Unfortunately, the short time horizon and the limited amount of observations do not allow to account for long-term effects. All columns control for country characteristics and heteroskedasticity with robust standard errors that cluster at the country-level.

Column (1) reproduces the results in column (5) of Table 3 and represents the immediate impact of foreign land deals on food security in the host countries. In column (2), land size is lagged by one year. The coefficient is statistically significant at the 5 percent level and almost doubles in size when compared to the immediate effect. Also, the two- and four-year lags in columns (3) and (4) are significant at the 5 and 1 percent level, respectively. The coefficients are positive but slightly decrease in magnitude. Four years after the land was acquired by foreign investors, daily food supply increases on average by approximately 12.9 calories per capita. Thus, it seems that foreign land acquisitions significantly contribute to greater food supply in the host countries when taking into account that the impact might be delayed between one and four years after the deal was signed. Again, these findings are in line with my second hypothesis as outlined in Section 2.4. However, none of the control variables is constantly robust to the inclusion of lagged effects which might be attributable to the decreasing sample size and number of countries.

To sum, I have shown that land acquisitions by foreign investors significantly improve food security in Sub-Saharan Africa. The coefficient is robust when country controls are added. Besides, I have found statistically significant estimates for one- to four-year lags of land deals which suggests that the full impact of foreign investments might come into effect several years after the transactions were made.

When recalling the mediators outlined in Figure 1, it seems reasonable to suppose that the advantages of foreign land deals are at work. For instance, the additional inflow of capital, improved access to markets and production linkages could all promote productivity growth of foreign large-scale farms and local smallholders which eventually

**Table 4:** Lagged effects

| *Variables* | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Log land size | 8.437* | | | |
| | (4.397) | | | |
| Log land size, t-1 | | 16.317** | | |
| | | (7.636) | | |
| Log land size, t-2 | | | 13.671** | |
| | | | (5.721) | |
| Log land size, t-4 | | | | 12.937*** |
| | | | | (4.553) |
| Log real GDP | 165.999*** | 96.451 | 51.796 | 88.957 |
| | (57.703) | (83.738) | (75.265) | (63.462) |
| Economic growth | 0.985 | 1.498 | -0.813 | 5.951 |
| | (1.983) | (1.943) | (1.629) | (5.273) |
| FDI penetration | 4.024 | 16.255 | 49.602 | -9.400 |
| | (27.278) | (33.294) | (30.775) | (37.045) |
| export dependency | -2.026** | -1.392 | -1.838* | -3.080** |
| | (0.821) | (1.217) | (1.018) | (1.496) |
| Population density | 0.803 | 1.143 | 0.040 | -0.244 |
| | (1.093) | (1.472) | (0.789) | (1.639) |
| Age dependency | -8.028 | -7.977 | -12.350*** | -9.236* |
| | (6.222) | (5.823) | (4.032) | (4.742) |
| Stability Index | -39.743 | -66.222 | -64.545* | -98.955*** |
| | (32.738) | (44.313) | (38.251) | (33.252) |
| Observations | 144 | 77 | 72 | 63 |
| Number of countries | 28 | 20 | 20 | 20 |
| Random effects | Yes | Yes | Yes | Yes |
| Overall R-squared | 0.288 | 0.416 | 0.225 | 0.299 |
| Hausman test | 0.228 | 0.743 | 0.825 | 0.825 |

Notes: The dependent variable is daily food supply per capita. Column (1) is the same as column (5) in Table 3. Robust standard errors that cluster at the country-level in parentheses. ***, **, * indicates significance at the 1%, 5%, 10% level. See Table 9 in the appendix for information on the variables and sources.

translates into higher domestic food supplies. On the contrary, displacements might be less of a problem since the loss of land and the inability to generate income and food seem to be outweighed by higher output growth overall. An extension of the observation period would allow testing whether adverse environmental outcomes and social unrest will reverse the outcomes in the long run or whether infrastructural investments and government revenues will reinforce the positive impact on domestic food security. Again, due to data limitations, I am unable to check which mechanisms are actually at work and to what extent. Thus, the interpretation has to be based on logical reasoning and findings in the literature as presented in Section 2.

**Table 5:** Robustness checks

| *Variables* | (1) | (2) | (3) |
|---|---|---|---|
| Log land size | 9.296* | 6.770 | 4.931 |
| | (4.911) | (4.681) | (4.276) |
| Log real GDP | 169.256*** | 310.723** | 2.961 |
| | (64.501) | (129.468) | (78.812) |
| Economic growth | 1.999 | 0.079 | 1.616 |
| | (2.146) | (1.907) | (1.409) |
| FDI penetration | -2.726 | 10.558 | -32.983 |
| | (32.238) | (27.716) | (28.034) |
| Export dependency | -2.320** | -2.145** | -1.226 |
| | (0.912) | (0.814) | (1.030) |
| Population density | 1.097 | -1.810 | -1.080 |
| | (0.878) | (2.970) | (1.364) |
| Age dependency | -6.791 | -12.753 | -6.644 |
| | (7.123) | (7.495) | (4.896) |
| Stability Index | -36.989 | -35.428 | -55.378** |
| | (33.784) | (28.503) | (27.898) |
| Savings | -2.225 | | |
| | (1.633) | | |
| Agricultural density | -0.361 | | |
| | (1.032) | | |
| Observations | 127 | 144 | 144 |
| Number of countries | 27 | 28 | 28 |
| Random effects | Yes | No | Yes |
| Fixed effects | No | Yes | No |
| Time dummies | No | No | Yes |
| Overall R-squared | 0.263 | 0.145 | 0.109 |
| Hausman test | 0.1064 | 0.2276 | 0.9674 |

Notes: The dependent variable is daily food supply per capita. Robust standard errors that cluster at the country-level in parentheses. ***, **, * indicates significance at the 1%, 5%, 10% level. See Table 9 in the appendix for information on the variables and sources.

## 5.3 Robustness checks

To test the validity of the coefficients obtained in the previous subsection, I conduct various robustness checks. To start with, Table 5 shows different adjustments to equation (1). Besides the country-level variables introduced before, column (1) additionally controls for gross domestic savings as percentages of GDP and agricultural density measured as total agricultural employment relative to arable land. The explanatory power of the model decreases slightly compared to my preferred specification in column (5) of Table 3, but most importantly, the coefficient of land size appears to be robust to the inclusion of

these additional control variables. Also, real GDP per capita and export dependency are significant and have the expected signs.

In contrast, the impact of large-scale land acquisitions on food security turns out to be insignificant with the use of fixed effects in column (2) and time dummies in column (3). However, I have already argued in Section 4 that the random-effects model is more efficient than the fixed-effects model as the assumption of strict exogeneity is valid. It was statistically indicated by the Hausman test to use random effects for all specifications. The use of year dummies can be theoretically motivated by controlling for macroeconomic shocks that are common to all countries in my sample such as the Financial Crisis in 2007/08. The baseline results presented above might be driven by a general upward trend in domestic food security as acquired land size becomes insignificant when controlling for time effects.

**Table 6:** Alternative measures of food security

| *Variables* | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Log land size | 0.628*** | 0.198 | 0.318 | -0.116 |
| | (0.242) | (0.126) | (0.241) | (0.185) |
| Log real GDP | | 6.133*** | | 3.952 |
| | | (2.220) | | (3.160) |
| Economic growth | | 0.003 | | -0.011 |
| | | (0.057) | | (0.052) |
| FDI penetration | | -0.712 | | -0.123 |
| | | (0.756) | | (0.955) |
| Export dependency | | -0.071** | | -0.089** |
| | | (0.028) | | (0.043) |
| Population density | | 0.047* | | 0.015 |
| | | (0.028) | | (0.046) |
| Age dependency | | -0.291 | | -0.414* |
| | | (0.181) | | (0.226) |
| Stability Index | | -0.177 | | 1.625 |
| | | (0.761) | | (1.092) |
| Observations | 168 | 144 | 168 | 144 |
| Number of countries | 34 | 28 | 34 | 28 |
| Random effects | Yes | Yes | Yes | Yes |
| Overall R-squared | 0.00480 | 0.200 | 0.00225 | 0.315 |
| Hausman | 0.4189 | 0.9801 | 0.4773 | 0.9522 |

Notes: The dependent variable in columns (1) and (2) is daily protein supply per capita, and in columns (3) and (4) daily fat supply per capita. Robust standard errors that cluster at the country-level in parentheses. ***, **, * indicates significance at the 1%, 5%, 10% level. See Table 9 in the appendix for information on the variables and sources.

So far, the empirical analysis in this thesis has aimed to investigate the impact of foreign large-scale acquisitions on the first and second pillar of the food security definition:

availability and access. It has left out, however, the third dimension of food utilization which considers, among other things, the nutritional status and dietary habits of the population. Therefore, two alternative measures of food security are chosen in Table 6: Columns (1) and (2) employ daily per capita protein supply in grams as the dependent variable, whereas columns (3) and (4) use fat supply. We can see that only the unconditional effect of land size on protein supply is statistically significant at the 1 percent level, but as soon as I control for country characteristics, the coefficient becomes insignificant. However, also the coefficients of real GDP per capita and export dependency decrease in magnitude suggesting that the impact on nutrition is limited in general. As a consequence, it seems that foreign land deals *do* promote food supply in general, but they *do not* increase the nutritional conditions in the host countries. For instance, this might be caused by a dominance of protein-poor plantation crops in contrast to cattle breeding.

Lastly, I make use of the first-difference model that can be more efficient when serial correlation in the error terms is present. It estimates the impact of one-period country-specific changes in the explanatory variables on one-period country-specific changes in the dependent variable (Cameron & Trivedi, 2005). This is important to note as the variable on land deals is measured in annual flows of acquired land size and thus already presents the difference between the total land stock owned by foreign investors in year $t$ and $t-1$. Therefore, I take first differences of all variables except land size.

Table 7 shows the estimation results using first-differenced data. In column (1), the coefficient of the variable of interest, log land size, is positive and significant at the 10 percent level. However, it becomes insignificant in column (2) when country characteristics are added. Thus, it appears that in the context of a first-differenced panel, the impact of foreign large-scale acquisitions does not prove to be robust. One reason might be the much smaller sample size due to taking differences.

To sum, this subsection has shown various robustness checks aiming to justify the validity of the impact of foreign land deals on food security in Sub-Saharan Africa. The coefficient is robust to the inclusion of additional control variables that might have an impact on the domestic food condition. However, the results appear sensitive to the use of time and fixed effects, nutritional definitions of food security, and first-differenced data.

# 6 Conclusion

Today, one of the most urgent challenges in Sub-Saharan Africa and elsewhere in the Third World is to combat extreme poverty and hunger. In particular, this implies to ensure food security at the national level meaning that everyone at any time has access to nutritious food. Since the acceleration of food prices in 2008, foreign governments and companies increasingly acquire agricultural land in Africa, – a continent perceived to be land abundant. Opponents argue that the ever-growing foreign control over fertile farmland will lead to a deterioration of the nutritional conditions of the local people. On the other hand, the proponents claim that the inflow of capital and knowledge from

**Table 7:** First-differenced data

| *Variables* | (1) | (2) |
|---|---|---|
| Log land size | 3.338* | 4.789 |
| | (1.660) | (2.878) |
| dLog real GDP | | 164.954 |
| | | (157.412) |
| dEconomic growth | | -0.435 |
| | | (1.221) |
| dFDI penetration | | 4.325 |
| | | (20.175) |
| dExport dependency | | -0.662 |
| | | (0.641) |
| dPopulation density | | 3.102 |
| | | (4.311) |
| dAge dependency | | -7.285 |
| | | (6.146) |
| dStability Index | | -9.395 |
| | | (28.524) |
| Observations | 88 | 75 |
| Number of countries | 22 | 20 |
| Random effects | No | No |
| Adjusted R-squared | 0.010 | -0.007 |

Notes: The dependent variable is daily food supply per capita. Robust standard errors that cluster at the country-level in parentheses. ***, **, * indicates significance at the 1%, 5%, 10% level. See Table 9 in the appendix for information on the variables and sources.

abroad is a unique opportunity to foster internal food security and promote economic development.

Comprehensive empirical evidence on the potential risks and benefits of large-scale land acquisitions is scarce and researchers have not reached any consensus on the implications for food security in the host countries overall. This is mainly due to data limitations and the lack of transparency in foreign land transactions and thus, the inability to analyse large-scale land deals in a panel framework. Consequently, empirical results are mainly context- and country-specific making it hard to draw any general and meaningful conclusion for food security in Sub-Saharan Africa.

The aim of this thesis is to provide a first indication of the impact of large-scale land acquisitions on food security in Sub-Saharan Africa. My contribution to the literature is twofold. First, I construct a panel dataset on large-scale land transactions by foreign investors and food security in Sub-Saharan Africa from 2000 to 2013. Two unofficial databases, the Land Matrix and GRAIN, are used for this purpose. Although both of them are often criticized due to inaccuracy and incompleteness, they are by now the

best available sources. I further improve the quality of the data through double checking of the entries and other measures. Daily per capita food supplies are used to measure food security at the national level covering the dimensions of food availability and access. Second, I make use of the random-effects model to estimate the impact of foreign land deals on domestic food supply to account for heterogeneity across countries. Since theory does not provide any guidance and evidence is mixed, I investigate two competing hypotheses on the overall outcome for food security in the host countries.

The empirical results show that a one percent increase in large-scale land acquisitions by foreign investors boosts per capita food supply on average by approximately 8.44 calories daily. The analysis also yields significant lagged effects of land deals for one, two and four years after the contract was signed. They vary between 16.31 for one-year to 12.94 kilocalories for four-year lags. At a first glance, the daily increase in food supply appears to be of limited economic relevance. However, it was shown that even tiny improvements are particularly beneficial for the physical development of small children. With an increase of 8 calories per day, children below five years can gain 616 grams within one year. These will accumulate over the years and contribute to children's growth (Santangelo, 2018). The results are robust to the inclusion of various control variables at the country-level, but sensitive to further robustness checks with alternative econometric models and definitions of food security. This may indicate that the positive outcomes estimated in this thesis might be driven by outliers or reflect a general upward trend in food security since the 2000s.

The estimates suggest that in the short and medium run, the benefits of foreign land deals tend to outweigh the disadvantages for the local population and the overall net effect on food security is positive. Thus, this paper can contribute to the on-going debate by providing empirical evidence in favour of the proponents of large-scale land acquisitions. With respect to the mediators at work, it is reasonable to assume that foreign firms promote productivity and output growth through, for example, more advanced technologies and know-how. This makes up for the loss of income and food through the displacement of farmers and restricted access to resources. Furthermore, the potential threats of export-oriented investors and the rising interest in biofuels that may reduce the amount of food available in the domestic market do not seem to bear out.

At this point, it is important to mention the limitations of the underlying study. First and foremost, even though I was especially careful in the procedures of data collection and cleaning, the quality of the data leaves a lot to be desired due to the lack of transparency in foreign land transactions and the unavailability of official data sources. This includes the incompleteness of land deals and biases toward particular target and investor countries. Second, since the Land Matrix and the GRAIN database focus primarily on the documentation of foreign land deals, I do not include large-scale acquisitions by domestic players. However, they appear to play an important role as for instance, in Ethiopia, 49 percent of the land size between 2004 and 2009 was allocated to domestic investors (Deininger et al., 2011). Third, since the observation period only spans thirteen years, I am not able to study long-term effects of large-scale land deals such as economic degra-

dation and social conflict, but instead focus on the mediators in the short- and medium run as for instance, the displacement of farmers and the inflow of modern technologies and know-how. Thus, it cannot be assessed whether the estimated, positive effects will reverse or intensify in the long run. Fourth, Deininger et al. (2011) find that only in 21 percent of the land deals, farming has actually started which suggests that many deals were either delayed or not implemented at all due to price changes, inadequate infrastructure, technology and institutions. Fifth, investments might concentrate in the most fertile regions of a country and thus, their impact on food security might be felt only locally rather than on the national level. This would substantially underestimate the effect of land acquisitions.

Because of these limitations, the results presented in this thesis have to be interpreted with care, taking into account that the data did not allow to estimate the full impact of large-scale land acquisitions on domestic food security. Most likely, the results are biased downwards since a substantial amount of deals is missing in the sample. Consequently, the estimates can be seen as the conservative bottom line. It is particularly crucial that African governments seek to improve the transparency and documentation of land transactions. When land deals are negotiated secretly, it is neither possible for the local population to get involved and act against displacements, nor is it possible for researchers, policy-makers and non-governmental agencies to evaluate the outcomes of such investments for food security.

Taking the results at face value, it seems that food security in Sub-Saharan Africa can be improved by promoting the acquisition of agricultural land by international investors. This would imply that African governments should be open to large-scale farms from abroad as they might be more productive than domestic smallholders and thus contribute to output growth. However, research studies show that policymakers must engage in tough negotiations to ensure that potential benefits are materialized. For instance, this can include obligatory employment of native workers, supplier linkages and outgrower schemes with smallholders as well as moderate land fees and export taxes (Cotula et al., 2009; Görgen et al., 2009; Odhiambo, 2011; von Braun & Meinzen-Dick, 2009). On the other hand, both contract parties have to respect the property of local farmers and provide appropriate compensation for displaced families (Görgen et al., 2009; Meinzen-Dick & Markelova, 2009; von Braun & Meinzen-Dick, 2009). It is particularly crucial that governments – with the help of international non-governmental agencies – monitor that investors fulfil their obligations and sanction them in case of a breach of contract (Görgen et al., 2009; Meinzen-Dick & Markelova, 2009; von Braun & Meinzen-Dick, 2009).

When more and better data is available, there is substantial room for further research. It is particularly interesting to investigate the effects of different business forms that come with large-scale land acquisitions such as contract farming, outgrower schemes, and joint ventures. Most likely, close production networks with native smallholders will have a greater impact on food security since positive spillovers might occur. Moreover, it was shown that domestic investors play a substantial role in land investments in Africa. Thus, they should be included in the sample to analyse which of the two forms is more beneficial

for the local population. Lastly, microdata would allow investigating the impact of land deals at the household level. This can provide important insights about effects felt only locally, food processing and distribution inside the family as well as instabilities in the provision of food due to heavy climate effects.

In light of rapid population growth in Sub-Saharan Africa, it will be particularly important for research – at the macro as well as micro level – to highlight inefficiencies *in* and potential threats *to* the provision and distribution of food in the domestic market. Land deals are just one of many, many more factors that determine whether "all people at all times have physical and economic access to sufficient safe and nutritious food" (FAO, 2008a, p. 1), now and in future.

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# A Appendix

**Table 8:** List of countries covered in the sample

| | |
|---|---|
| Angola (AGO) | Malawi (MWI) |
| Benin (BEN) | Mali (MLI) |
| Botswana (BWA) | Mauritius (MUS) |
| Burkina Faso (BFA) | Mozambique (MOZ) |
| Cameroon (CMR) | Namibia (NAM) |
| Central African Republic (CAF) | Nigeria (NGA) |
| Congo (COG) | Rwanda (RWA) |
| Cote d'Ivoire (CIV) | Sao Tome and Principe (STP) |
| Ethiopia (ETH) | Senegal (SEN) |
| Gabon (GAB) | Sierra Leone (SLE) |
| Gambia (GMB) | South Africa (ZAF) |
| Ghana (GHA) | Sudan (SDN) |
| Guinea (GIN) | Swaziland (SWZ) |
| Guinea-Bissau (GNB) | Tanzania (TZA) |
| Kenya (KEN) | Uganda (UGA) |
| Liberia (LBR) | Zambia (ZMB) |
| Madagascar (MDG) | Zimbabwe (ZWE) |

**Table 9:** Variables used in the regression analysis

| *Variables* | *Description* | *Source* |
|---|---|---|
| Age dependency | Ratio of dependents (below 15 and above 64 years old) to the working-age population (in %) | World Bank (2018) |
| Agricultural density | Agricultural labour force divided by area of arable land in sq. km | Calculated from labour statistics of ILO (2017) and land use statistics of FAOSTAT (FAO, 2017a) |
| Economic growth | Annual GDP growth (in %) | World Bank (2018) |
| Export dependency | Share of agricultural products in total merchandise exports (in %) | Calculated from trade statistics of WTO (2018) |
| Fat supply | Average daily grams per capita | FAOSTAT Food Balance Sheets (FAO, 2017a) |
| FDI penetration | Log of FDI stock as % of GDP | UNCTAD (2017) |
| Food supply | Average daily calories per capita | FAOSTAT Food Balance Sheets (FAO, 2017a) |
| Land size | Log of sq. km acquired by foreign investors | Land Matrix (2018); GRAIN (2016) |
| Population density | People per sq. km of land area | World Bank (2018) |
| Protein supply | Average daily grams per capita | FAOSTAT Food Balance Sheets (FAO, 2017a) |
| Real GDP per capita | Log of per capita GDP (in constant 2010 USD) | World Bank (2018) |
| Savings | Gross domestic savings (% of GDP) | World Bank (2018) |
| Stability index | Political stability and absence of violence or terrorism | FAOSTAT Suite of Food Security Indicators (FAO, 2017a) |