AGRODEP
African Growth & Development Policy modeling consortium
FACILITATED BY IFPRI

AGRODEP Working Paper 0011

May 2015

The Impact of Foreign Large-Scale Land Acquisitions on Smallholder Productivity:
Evidence from Zambia

Kacana Sipangule

Jann Lay

About the Authors

Kacana Sipangule, Kiel Institute for the World Economy, University of Goettingen
Jann Lay, GIGA German Institute of Global and Area Studies, University of Goettingen

Acknowledgements

The authors are grateful to the African Growth and Development Policy (AGRODEP) Modelling Consortium for providing financial support for this project through their 2012 Gaps in Research Grant. We also would like to thank an anonymous referee, seminar participants at the 2014 World Bank Conference on Land and Poverty, the 2014 Annual Conference of the German Research Group on Development Economics and the GIGA Research Programme 3 for their valuable comments.

Table of Contents

Abstract

In light of the surge of foreign large-scale land acquisitions (LSLA) in developing countries, concerns have been raised that large-scale agricultural projects could negatively affect smallholder livelihoods. There is, however, very little evidence beyond case studies that support these claims. Drawing on nationally representative household datasets from 2000 and 2010, as well as an inventory of foreign LSLA from Zambia, this study investigates the impacts of foreign LSLA on the productivity, fertilizer use, and wage-employment opportunities of smallholders. Using a difference-in-difference approach, we find that smallholders located in districts with foreign LSLA are not worse off than smallholders in districts without foreign LSLA. Instead, we find consistent evidence of a convergence in the productivity levels of smallholders in districts with and without foreign LSLA. Our results allow for the careful conclusion that LSLA, despite being of considerable magnitude in Zambia, have not had any disruptive effects on the smallholder economy at the district level.

Résumé

La vague d'acquisitions de terres à grande échelle (LSLA) par des investisseurs étrangers dans les pays en développement a soulevé des préoccupations concernant des répercussions négatives que ces opérations foncières à grande échelle pourraient avoir sur les moyens de subsistance des petits exploitants agricoles. Il y a, cependant, très peu de preuves au-delà des études de cas qui soutiennent ces revendications. S'appuyant sur des ensembles de données de ménages représentatifs au niveau national entre 2000 et 2010, ainsi que sur un inventaire de l'accaparement foncier étranger en Zambie, cette étude examine les impacts de l'accaparement étranger sur la productivité, l'utilisation des engrais et les possibilités de salaire et d'emploi des petits agriculteurs. En utilisant une approche différences-de-différences, nous constatons que les petits producteurs dans les régions avec accaparement étranger ne sont pas plus pauvres que les petits exploitants dans les régions sans accaparement étranger. Au contraire, nous constatons que les niveaux de productivité des petits agriculteurs dans les deux régions convergent. Nos résultats nous permettent de conclure, bien que prudemment, que l'acquisition des terres en Zambie, bien que considérable, n'a pas eu des effets perturbateurs sur l'économie des petits exploitants au niveau régional.

1. Introduction

The recent wave of foreign large-scale land acquisitions (LSLA) in developing countries has received considerable attention in the international media as well as from NGOs and civil society. There has also been an increasing number of scientific studies addressing this issue; see for instance, Cotula, (2009); De Schutter, (2011); Deininger, (2011) and Schoneveld (2014). While more is known about the patterns and the dynamics of large-scale land deals and the associated agricultural projects, the evidence on impacts on smallholders relies to a large extent on regional case studies (Cotula, 2009; Anseeuw et al., 2012; Land Matrix, 2013); and yet, it is the impact on local populations and their livelihoods that is at the core of the critique against foreign large-scale projects. Thus this study seeks to contribute to this debate by investigating the impact of foreign LSLA on smallholder agricultural production using data from smallholders in Zambia.

One major reason behind the lack of evidence is simply that the foreign large-scale projects of the new "land rush" are very recent, and have often as of yet only been partially implemented (Land Matrix, 2013). In addition, the data requirements for such a rigorous impact study are demanding. For instance, one would need precise information on the geographical locations of both the smallholders and the foreign LSLA. Better still, longitudinal information on the smallholders would allow for a more detailed analysis of these effects over time and for a comparison of their productivity levels before and after the onset of foreign LSLA. While information on smallholder location can typically be obtained from household or farm survey data, information on foreign LSLA are normally inaccurately recorded; and official data– regardless of whether it is sourced from Foreign Direct Investment (FDI) statistics or from national land registries – is often difficult if not impossible to obtain. This lack of data and transparency hints at the secrecy surrounding these transactions. As a result, a large part of the existing data on foreign LSLA has relied heavily on online inventories that source information from the mass media, civil society reports, and grey literature as well as websites of companies acquiring land in developing countries. It is plausible that this data runs the risk of being outdated or inconsistent as it may include cases that were reported in the media but did not materialise as well as intentional underestimations of the sizes of land acquired by foreign LSLA to avoid public scrutiny. This data may also exaggerate the number of operational foreign LSLA cases as it typically does not distinguish between investments that are planned, under negotiation, or are known to have failed (Schoneveld, 2014).

Despite the technical challenges and caveats associated with obtaining accurate information on foreign LSLA, it is clear that their scale has increased in the last years. The rising trend of foreign LSLA in developing countries is mirrored throughout the literature. It is very likely that the area covered by foreign LSLA in Sub Saharan Africa alone goes into the two digit millions of hectares. Schoneveld (2014) states that numbers ranging from 15-20 million hectares to 56-230 million hectares million hectares have been

reported. The scale of foreign LSLA is indeed alarming, especially if one considers that 57.3 percent of the labour force in Sub Saharan Africa consists of smallholder agricultural producers (Dercon and Gollin, 2014) that are dependent on the same land resources as their main source of livelihood. This is why analysing the potential implications of foreign LSLA on smallholder agricultural production is an important exercise in understanding whether foreign LSLA will have beneficial or detrimental impacts on local livelihoods.

There are good reasons to believe that foreign LSLA may be harmful for local populations and for smallholders in particular; yet, there may also be positive local effects. Foreign LSLA may facilitate much needed development in rural areas through the infusion of capital and through the creation of wage-employment opportunities and infrastructure (von Braun and Meinzen-Dick, 2009). Other potential benefits associated with foreign LSLA include technological spill-overs and the stabilization of global food prices (von Braun and Meinzen-Dick, 2009). However, opponents of foreign LSLA argue that these benefits may be marginal as host countries usually lack the capacity to govern these investments in a way that leads to rural development and poverty reduction (De Schutter, 2011). They point out that a number of foreign LSLA have already had undesirable consequences such as displacement and increased water constraints that have threatened food security levels in regions that were already prone to food shortages (von Braun and Meinzen-Dick, 2009).

While these diverging views both make very strong cases in favour and against foreign LSLA, their empirical bases are often relatively weak. They are typically based on case studies whose results may be difficult to generalize beyond their study regions due to external validity concerns. Two recent papers by Kleemann and Thiele (2014) and Dessy et al. (2012) have presented theoretical models that propose various scenarios in which the welfare of local populations can be affected by LSLA. These studies also note, however, that more empirical research needs to be conducted to validate these theories.

To the best of our knowledge the present study is one of the first to undertake a country-wide empirical analysis of these effects. We combine nationally representative household datasets from 2000 and 2010 with an inventory of foreign large-scale agricultural projects that went into operation between these two points in time in Zambia. Using a difference-in-difference approach we examine the impact of the presence of a foreign LSLA in a district on smallholder productivity and on agricultural input use. In addition, we investigate the emergence of wage-employment opportunities.

Zambia makes a particularly interesting case study. Its relative land abundance, stable political situation, and attractive incentives for its nationals and foreigners to invest into the agricultural sector have made the country an important target country for foreign LSLA in the past decade (GRZ, 2004; Deininger 2011; Oakland Institute, 2011). In addition, the share of projects that actually come into operation is larger than in other parts of Sub-Saharan Africa. Out of the 95 cases reported in our study, 79 cases (83 percent) are currently operational. This high rate of operationalization may be a result of the country's already well-

established commercial agricultural sector, which makes it less risky for foreign LSLA to invest in Zambia. Moreover, the country has a comprehensive registry of pledged foreign investments that is collected by the Zambian Development Agency (ZDA). This registry provides us with a good starting point for the identification of foreign LSLA in Zambia. In addition, household-level data are available that can be linked to the locations of foreign LSLA at the district level. All these factors imply that the country is well suited for our study on the impacts of foreign LSLA on smallholders in comparison to many other Sub Saharan African countries.

Districts in Zambia are relatively large geographical units[1], and if spillovers are localized then farmers within the same district may not be affected by some large-scale farming operations. Since more continuous disaggregated data is not available, we are unable to explore these effects at smaller geographical units. As such, these results should be interpreted as a first attempt to quantify the spill-over effects associated with having a foreign LSLA in a district. More research and better data is needed to establish clearer links between foreign LSLA and smallholder production.

The remainder of this paper is structured as follows: the second section presents the different transmission channels through which foreign LSLA may affect smallholder production. The subsequent section provides an overview of the agricultural sector in Zambia. The fourth section introduces the dataset and provides descriptive statistics. This is followed by a description of the empirical framework and estimation strategy. We then present and discuss the results of the empirical analysis. The final section concludes.

2. Transmission Channels and Previous Evidence

2.1 Spillovers

The empirical literature on FDI considers spillovers as one of the main transmission channels of FDI on domestic firms (Javorcik, 2004; Görg and Greenaway, 2004). This literature, however, builds almost entirely on firm data, and it is not obvious that spillovers are equally important in agriculture. In addition, technological spillovers through knowledge and skill transfer between foreign LSLA and smallholders may be limited because of large technological discrepancies between these two groups. It is more likely that within agricultural settings spillovers will take the form of improvements in infrastructure, in particular new and better roads, and the provision of agricultural facilities, such as fertilizer depots and warehouses for storage.

Currently, the levels of infrastructure provision/improvement offered by foreign LSLA vary across countries and depend to a broad extent on the countries' land governance and investment policies. Some countries, such as Zambia, stipulate that investors are required to develop their properties and provide basic

[1] The average size of a district in Zambia is estimated at 10, 378 square kilometers.

infrastructure within a stated period to avoid repossession of their properties, but the enforcement of these laws is very weak (Nolte, 2014). For the most part, developing countries have very lax legislation on infrastructure provision by foreign investors as they are eager to encourage investments into their countries.

Infrastructure may be productive (e.g. roads, irrigation, storage facilities, fertilizer depots, and processing plants) or social (e.g. schools and health facilities). Several case studies show that LSLA have made significant contributions in developing and improving both productive and social infrastructure at their localities (Mujenja and Wonani, 2012; FAO, 2012). However, Vorley et al. (2012) warns that the provision of infrastructure by LSLA may also result in undesirable effects such as the creation of islands of excellence in regions with generally poor infrastructure; this is often the case with horticultural LSLA. The formation of infrastructure enclaves could widen the inequality gap, particularly in health and education, between smallholders that cultivate on their own holdings and wage labourers that work on LSLA with access to better infrastructure. Contrary to anecdotal evidence that foreign LSLA are generally located on idle lands with no or very little infrastructure, there is growing evidence that shows that LSLA are located in regions that already have relatively good infrastructure facilities in place (Cotula, 2012). In these cases, foreign LSLA may not be required to make any infrastructural investments.

Smallholders may also benefit from foreign LSLA through knowledge transfers and increased access to agricultural technologies (Kleemann et al., 2013). Foreign LSLA may directly transfer knowledge to smallholders through the provision of technical assistance, training, and agricultural services, and indirectly through learning-by-doing methods (Rakotoarisa, 2011). This form of transfer has been particularly successful in the cases where foreign LSLA have engaged in contract farming arrangements with smallholders (De Schutter, 2011; Munjenja and Wonani, 2012).

While there are a number of ways in which positive spillovers can be transmitted to smallholders, one must not rule out the effects of negative spillovers on smallholders. Foreign LSLA have been criticised for their detrimental effects on the environment. In their case study, Mujenja and Wonani (2012) show that LSLA are responsible for the emission of toxic substances into the air, water, and soil. In addition, they show that LSLA are responsible for the contamination of ground water through seepage caused by the excessive use of chemical fertilisers and aerial pesticide sprays. Similarly, German et al. (2013) show that LSLA are responsible for large tracts of deforestation in the Miombo woodlands in the north of Zambia.

2.2 Creation or Destruction of Markets?

The destruction of local smallholder markets is conceivable if foreign LSLA cultivate the same crops as smallholders and compete for opportunities in the local market; however, several studies have dispelled this effect (De Schutter; 2011; Anseew et al, 2012). Foreign LSLA normally target the high value export market, which is inaccessible for most smallholders due to the strict quality control measures demanded from Western countries.

If well regulated, foreign LSLA have the potential to create or strengthen local commodity markets. There is a huge scope for market creation if foreign LSLA and smallholders are able to co-exist through contract farming agreements that are organised as a nucleus and plasma scheme where the foreign LSLA buys produce from smallholders or out-growers within its vicinity and provides them with a reliable market for their output (Vermeulen, 2012). This type of agriculture has already proved successful in the cultivation of oil palm in Indonesian plantations (Feintrenie et al., 2010), and it is also the basis for the new farming blocks in Zambia that consist of a core venture and smallholder farmers who supply their produce to the core venture (Mujenja and Wonani, 2012; Oakland Institute, 2011; Nolte, 2014).

2.3 Changes in Food Prices

While various studies have documented that the 2008 food crisis partly fuelled the recent surge in foreign LSLA in developing countries by causing an increase in land speculation, the evidence on the subsequent effects of foreign LSLA on food prices is limited.

The effects of foreign LSLA on food prices could go in two directions. On the one hand, if the arrival of foreign LSLA increases the pressure for agricultural land, as shown by some media reports, heightened pressure on agricultural land may spike agricultural commodity prices upwards. On the other hand, if foreign LSLA supply their agricultural output to the same markets as smallholders, food prices could decline due to increased supply. Due to their scales of operation, foreign LSLA may lower food prices and dump their produce onto the market until smallholders are driven out of the market.

There is insufficient evidence to conclude which effect of foreign LSLA on food prices will dominate. Based on focus group discussion conducted near the Mkushi farm block in Zambia, Nolte (2014) reports that smallholders criticise foreign LSLA for having "flooded their markets" and driving down the prices of agricultural produce. In contrast, Anseeuw et al. (2012) provide evidence that foreign LSLA generally do *not* target local markets but instead specialise in the production of commercial and high value crops that are targeted for urban and export markets. Studies that have analysed the effects of changes in food prices on smallholders such as Ivanic and Martin (2008) find that this effect is diverse and depends largely on whether the smallholders are net buyers or sellers. The authors show that net-sellers are better off with a price increase, whereas net food buyers are worse off. Since the empirical evidence on foreign LSLA and price changes is limited, it is difficult to predict the direction and impact of these changes on smallholders. Clearly, further research is needed to establish these links.

2.4 Additional Employment and Wage Opportunities

Many developing country governments are adopting policies that encourage foreign LSLA as a means of generating much needed employment opportunities (Cotula, 2009). By providing wage employment,

foreign LSLA have the potential of fostering rural development in regions with populations that would otherwise be dependent on subsistence and other low productive activities.

Studies that have analysed wage employment opportunities offered by foreign LSLA show that these impacts vary and are dependent to a large extent on the nature and type of crop cultivated by the foreign LSLA. Foreign LSLA can offer a large number of wage employment opportunities for local populations if they engage in the cultivation of labour intensive crops such as sugar cane (see Munjenja and Wonani, 2012) and perennials such as oil palm and rubber (see Li, 2011). Thus, the employment intensities for the cultivated crops matter when determining the wage employment effects of foreign LSLA (Deininger, 2011; Li, 2011; Woodhouse 2012, Kleemann et al., 2013). Deininger (2011) reveals that cereal and soybean cultivation generate less than 20 jobs per 1000 hectares, while tree crop and perennial cultivation generate 400 jobs per 1000 hectares on average. This discrepancy is a result of the different levels of mechanisation employed on these farms. Since the majority of foreign LSLA that have been set up in recent years rely on mechanised agriculture, it can be inferred that the number of jobs that have been created are limited. Even when foreign LSLA engage in the cultivation of crops that are not labour intensive, foreign LSLA are still able to provide off-farm wage opportunities for local communities within their vicinities. Mujenja and Wonani (2012) show that while ETC BioEnergy a large-scale operation in Northern Zambia is mostly engaged in mechanised agriculture it is still one of the largest employer in Mpongwe district.

3. The Agricultural Sector in Zambia

3.1 A Historical Account of Land Acquisitions in Zambia

Similar to many African societies, land in Zambia was held under customary tenure prior to the arrival of colonialists in 1890 (Malambo, 2013; Ngombe and Keivani, 2013). Under this system, the chief is the primary custodian of the land and one is granted the right to use and occupy land free of charge by the virtue of belonging to a chiefdom (Mujenja and Wonani, 2012). The sale and purchase of land is prohibited and only the chief or headman is charged with the granting of usufruct rights (Sitko and Jayne, 2014). The advent of European settlers in Zambia resulted in a change from the traditional customary system to a dual tenure system that maintained traditional tenure systems and introduced a system of tenure for European settlements that was governed under British constitutional laws. In 1928, the Northern Rhodesian Council separated land into two parts: *Crown Lands* and *Native Reserves*, with the former being administered under freehold tenure that was reserved for European settlers and the latter being reserved for indigenous peoples and governed by traditional authorities (Adams, 2003; Sitko et al., 2014). European settlements were located along the railway line from Southern Rhodesia (now Zimbabwe) through Broken Hill (Kabwe) to Belgian-Congo (DRC Congo) (Simunchembu, 1989). This land included some of the best agricultural lands in Zambia and continues to offer good access to the major urban markets (Smith and Wood, 1984). In 1947, a

third category of land was added. *Native Trust Land*; this consisted of formerly unassigned lands, forest and game lands, previously unutilised lands and excess land from the Crown Lands since the anticipated number of European settlers never materialised (Adams, 2003). This tenure system was maintained until the country attained its independence in 1964.

The post independence period was marked by several land reforms and policy changes, one of the most significant being the *The Land (Conversion of Titles) Act of 1975* that amongst other changes, vested all land in the power of the president (Adams, 2003; Malambo, 2013). Another equally important reform, *The Lands Act of 1995,* was introduced alongside a package of other policies that promoted market liberalisation and reform. The *Lands Act of 1995* facilitated the conversion of customary land to leasehold by authorizing the chief to recommend individuals that had expressed their interest in land within their chiefdoms to the commissioner within the Ministry of Lands. This Land Act also made it easier for non-Zambians to acquire leaseholds by stipulating that the president is allowed to alienate land to non-Zambians, provided that they are permanent residents or a registered company with 75 percent of their shareholders Zambian and adhering to other requirements of the Investment Act (see Adams, 2003; Oakland Institute 2011).

This pro-investments Lands Act has continued to facilitate agricultural investments in Zambia, particularly in areas previously demarcated as Crown Lands because of the favorable agro-ecological conditions in these regions. Till this day, commercial farming in Zambia continues to be clustered areas along the line of rail from Livingstone to Ndola (Adams, 2003). Following the abolishment of apartheid in South Africa in the early 1990s and invitations extended by the Zambian government (Chu, 2013), as well as the adoption of fast track land reforms in Zimbabwe in 2000, the country experienced a sharp increase in commercial agricultural investments from Zimbabwean and South African farmers who found the political environment in Zambia more favourable for commercial agriculture (Spiegel Online, 2004; Brown, 2005; Hall, 2011; Oakland Institute, 2011).

More recently, in the aftermath of the 2008 food, fuel and financial crises, the country has once again found itself at the centre of attention from foreign agricultural investors (Deininger, 2011; Nolte, 2014). Recognising the country's agricultural potential and in its quest to diversify away from its dependence on copper exports, the Zambian government has taken an active role in promoting foreign investment. In 2008, the government announced its intentions to set up farm block developments averaging 100,000 hectares in each of the country's nine provinces (Oakland Institute, 2011).[2] The government acquired this land after a series of negotiations with chiefs and other traditional authorities (Sitko and Jayne, 2014; Nolte, 2014). The concept of farm blocks in Zambia is not new and was previously used to develop areas with good agricultural potential that were located away from the line of rail and markets, such as the Mkushi farm block that was

[2] In 2011, Muchinga Province was separated from the Northern Province, Zambia now has 10 provinces.

opened by the colonial government in 1950 (Simunchembu, 1989; Chu, 2013). Unlike the previous farm blocks, the intention is for the new farm blocks to be equipped with basic infrastructure such as feeder roads, electricity, irrigation, and communication facilities prior to the investments (Oakland Institute, 2011; Sitko and Jayne, 2014). Each farm block is designed to have at least one core large-scale farm (core venture) of approximately 10,000 hectares, several commercial farms of 1,000 to 5,000 hectares and small farm holdings of between 30 to 3000 hectares preferably under out grower arrangements (ZDA, 2011; Sitko and Jayne, 2014). The core venture is expected to develop agro-processing infrastructure within the farm block and to support the small and medium holdings in the production and marketing of output through an outgrower scheme (ZDA, 2011; Oakland Institute, 2011; Nolte, 2014). In 2012, the first farm block was completed in Nansanga, Serenje district; at the time of this writing, however, the project is still not yet operational as the investors previously granted the core venture withdrew from the project and the government is re-advertising this core farm. Upon the completion of the Nansanga farm block, the government intends to develop the Kalumwange farm block in the Western Province and the Luena farm block in Luapula Province (Oakland Institute, 2011).

Negotiating and purchasing customary land from chiefs to be converted to leasehold and purchasing land within the farm blocks are some of the main ways in which foreign LSLA may acquire land in Zambia (Nolte, 2014). Foreign LSLA may also purchase land directly from sitting tenants through the Ministry of Lands, and this is usually the preferred option as it reduces the red tape associated with the conversion of customary lands and the waiting times associated with the purchase of land within the new system of farm blocks. Another deterrent that works against the purchase of new land and in favor of acquiring existing farms are the high costs of clearing virgin land. Munjanji and Wonani (2012) estimate that one requires US$ 900 to clear one hectare of land in some parts of Zambia, this start-up cost is clearly too high for and profit maximising foreign LSLA interested in acquiring thousands of hectares.

3.2 Smallholders and Large Scale Land Acquistions in Zambia

Despite the reports of increasing numbers of foreign large scale farming operations, the agricultural sector in Zambia is still dominated by smallholder production. The smallholder farming sector numbers approximately 1.1 million households, over 20 per cent of which are headed by women. These households cultivate an average 1.5 hectares of land, generally using low-input, hand hoe technology and relying primarily upon family labour (IFAD, 2011). Traditionally, smallholders in Zambia are dependent on rain-fed agriculture and are engaged in staple crop cultivation, with maize taking the highest priority. Other staple crops grown include cassava and wheat (Chapoto et al., 2011).

In recent years, smallholders have experienced an increase in agricultural productivity levels; this increase has been partially attributed to the expansion of the farm input subsidy program, the favourable climatic conditions, and the expansion of under-cultivated areas. Despite the increase in production, however, there

has been no accompanying reductions in rural poverty. Sitko and Jayne (2014) show that rural poverty levels actually increased by 0.4 percent between 2004 and 2010. This is another reason why analysing the impacts of foreign LSLA on smallholder productivity is vital in understanding the welfare implication on smallholders, who currently account for part of the poorest groups in Zambia with a poverty incidence of 79 percent (with 66 percent being extremely poor) (Neubert et al., 2011). Studies by the Oakland Institute (2011) and Nolte (2014) have set the stage for understanding foreign LSLA in Zambia by presenting detailed narratives of the land acquisition processes in Zambia. The Oakland Institute (2011) provide an overview of the country setting, the characteristics of the foreign LSLA and their possible impacts. While Nolte (2014) examines how the Zambian land governance system determines whether investments should be viewed as development opportunities. Using a conceptual framework proposed by Williamson, she finds that the current land governance system that was adopted after the 1995 Lands Act paved the way for foreign LSLA. This reform placed higher bargaining power in the hands of investors, local authorities and government officials and reduced the role of local land users.

Regional case studies also provide important insights into the potential impacts of foreign LSLA on local livelihoods in Zambia. Chu (2013) adopts an ethnographic approach to explore the implications of Chayton Farm, a foreign LSLA that has been operating in the Mkushi district of Zambia since 2011. Chayton Africa is a division of a London-based private equity fund; the company received insurance support from the World Bank's Multi-lateral Investment Guarantee Agency (MIGA) and the backing of the Zambian government. According to commerial farmers interviewed by the author, their interaction with smallholders is inevitable, even when smallholders are not employed on commercial large scale farms, since smallholders interact with large scale farms through their widespread networks. Chu (2013) does not find any evidence that supports persistent claims that foreign LSLA displace local communities on customary land since agricultural land in the Mkushi farm block was originally designated as commercial farmland and new entrants into the farm block such as Chayton acquire land in brownfield sites that include pre-existing and "underperforming" commercial farms.

Mujenja and Wonani (2012) analyse the long term impacts of the Kaleya Smallholders Company (KASCOL) in Mazabuka district and the Mpongwe Development Company and its successors ETC BioEnergy and Zambeef in Mpongwe districts. The two companies are large scale agricultural investments that were set up as joint ventures between the government of Zambia and the Commonwealth Development Corporation (CDC) in the 1970s and 1980s. KASCOL is an agri-business that cultivates sugar cane in smallholder outgrower schemes, it holds about 4314.9 hectares of land out of which more than half are fully developed and under cultivation. The ETC Bioenergy plantations cover an area of 46, 874 hectares, a quarter

of this land has been developed and 3000 hectares are under irrigation.3 While the authors are careful to point out that these two large scale farming operations differ from the new wave of foreign LSLA, they also highlight some contributions to the direct livelihoods of local communities in the vicinities of these operations. They show that both KASCOL and ETC have had positive wage employment effects and are among the largest employers within their respective regions. KASCOL uses labour-intensive production methods, and the bulk of its staff are seasonal workers employed by the outgrowers, while labour at ETC is mostly mechanised, and the bulk of their wage employment is engaged in service provision. The authors also find that KASCOL outgrowers benefit from trainings on cane agronomics that cover areas such as land preparation, planting, irrigation, weed management and fertilisation, but cannot quantify the impacts on food security due to data constraints.

Others studies that analyse foreign LSLA in Zambia include German et al., (2013a) who analyse several scenarios in which farmers practicising the chitemene system of shifting cultivation in northern Zambia may be affected by foreign LSLA. German et al. (2013b) draw on four case studies from Ghana, Mozambique, Tanzania and Zambia (in the last of which, research involved interviews with customary land owners in Isoka, Mpika and Mpongwe districts). They document the land acquisition processes for foreign LSLA in each of these four countries and find that all but one of the projects in Zambia involved a negotiated process over land that was allocated in the customary domain.

While studies presented in this section document the various possible channels in which foreign LSLA can affect smallholders, they do not provide any insights on the magnitudes of these effects. This paper aims to address this gap by quantifying the effect of the presence of foreign LSLA on smallholder productivity at the district level.

4. Data and Descriptive Statistics

4.1 Data Sources

This study draws on a unique combination of household data and an inventory of foreign LSLA in Zambia for its analysis. The rural household data is sourced from the 1999/2000 and 2010/2011 Post-Harvest Surveys (PHS). The PHS are nationally representative cross sectional surveys collected by the Zambian Central Statistical Office (CSO) between August and September, after the harvest periods in rural areas. The PHS collect information on households' demographics and characteristics, areas planted for individual crops, production quantities, access to agricultural price information and loans, and information on the accessibility and use of agricultural extension services and loans.

[3] In December 2010, Zambeef, a locally owned agri-business purchased the entire ETC BioEnergy estate in Mpongwe. The company intends to use this land for the cultivation of Soya and Wheat. More information on this acquisition is available at the following link http://ir.zambeefplc.com/profiles/investor/ResLibraryView.asp?BzID=1988&ResLibraryID=43387&Category=1789

The 1999/2000 PHS was complemented with data from the 2001 Supplemental Survey (2001 SS) of the Zambia Food Security Research Project (FSRP). The 2001 SS revisited all the households that were surveyed in the 1999/2000 and collected information on their demographics, off-farm income activities and earnings, land holdings, actual estimates of crop sales and purchases, fertilizer purchases, cotton production, services offered by farmer organizations, farmer adoption of conservation farming practices, milk and egg production/sales, asset holding and current crop forecasting estimates. This information was previously missing in the 1999/2000 PHS (CSO, 2001).

Although the PHS collects nationally representative household data, the sample used for these studies is updated approximately every third to fifth year. This prevents us from doing our analysis at a more disaggregated level i.e. Standard Enumeration Area (SEA) and Census Sampling Area (CSA), since these smaller geographical sampling units change during our study period. Wards, which are the next administrative level unit after districts, remain relatively constant over time; however, ward information for the PHS was only included in 2003 and is not available for the start date of our study period, thus we restrict our analysis to district level effects. Accordingly, we obtain detailed agricultural information on 2,068 and 6,387 rural households in 1999/2000 and 2010/2011, respectively. Using this data we allocate households into a treatment and control group. The treatment group is comprised of households located in a district where a foreign LSLA was set up between 2001 (the baseline wave) and 2010, while the control group consists of households located in districts that have not had any foreign LSLA before, during, or after the study periods. (This means that we do not consider households that had foreign LSLA before the baseline or after the last wave of data collection in our analysis.) This results in a total of 759 and 1309 households in the treatment and control groups in 2000, and 1,887 and 4,500 households in the treatment and control groups in 2010/2011, respectively. Tables A.1 and A.2 provide summary statistics of the treatment and control groups in the baseline and last study waves.

In addition to post harvest agricultural data from rural households, the PHS also has a section on large-scale agricultural holdings. It classifies large-scale agricultural holdings as plots of land that are equal to or larger than 20 hectares. The PHS section on large-scale agricultural holdings collects actual estimates of area under crops, production, and sales realised from crops; but it does not provide information on the countries of origin of the large-scale agricultural holders, the dates of commencement of production, or on the dates the investment contracts were signed, and this information is vital in the construction of our inventory on foreign LSLA. To address this issue, we draw on various additional sources of data that contain information on the locations, countries of origin, crops grown, and magnitudes, as well as the dates of contract signing and commencement of production. One of the main sources of information used in this paper is the Land Matrix Global Observatory, a global and independent land monitoring initiative that uses open sourcing tools to record information on the names and countries of investors, the sizes of investments (both contract size and

intended size), and the status of investment projects (Anseeuw et al., 2013). Additional information on LSLA was sourced from a list of pledged investments compiled by the Zambia Development Agency (ZDA) between 1992 and 2011. The ZDA list is a useful add-on to the PHS dataset on large-scale agricultural holdings as it contains information on the countries of origin of investors and the dates of registration with ZDA (which is a prerequisite of most investment contracts). However, the ZDA list only represents pledged investments and provides no indication on whether these investments were actualised and/or are currently operational. Notwithstanding, the list allows us to match the cases that are present in both the PHS and ZDA list dataset by name and address. Lastly, we supplement our data with information on foreign LSLA obtained from online databases as well as from manual searches of the media and company websites.

Altogether, we collect information on 95 LSLA in 26 out of the 72 districts in Zambia; these LSLA cover approximately 562, 312 hectares of land.[4] We then employ a verification process that ensures that only foreign owned projects that are currently operational and that begun their operations between the study period specified above. This results in a total of 28 foreign LSLA in 19 districts that cover an area of 334, 660 hectares. Table A.3 in the Appendix presents summary statistics of the foreign LSLA at the district level.

4.2 Descriptive Statistics

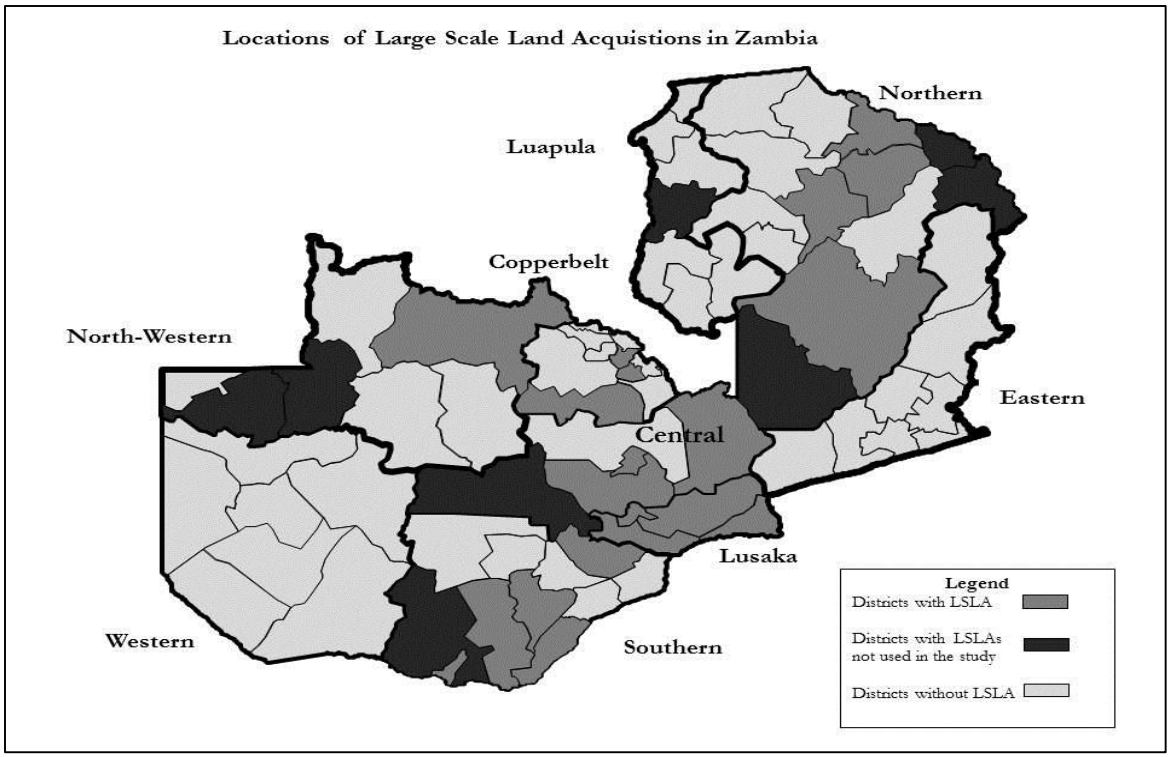
4.2.1 Locations of Foreign LSLA

Figure 1 illustrates districts that have foreign LSLA in Zambia. We observe that foreign LSLA are located in districts in the Central, Copperbelt, Northern, Northwestern, Luapula and Southern provinces. The districts in the Eastern and Western Provinces do not have any foreign LSLA cases that occurred between 2000 and 2010; the districts that are shaded darkly in the map on the next page (Fig. 1) have LSLA that started either before or after the study period and are thus excluded from the analysis.

Evidently, foreign LSLA appear to be clustered in districts along the line of rail that are traditionally associated with commercial agriculture. Note that since commercial farms are also engaged in large-scale mechanised farming operations, one should be careful when distinguishing between these two types of farms as foreign LSLA are simply a subset of commercial farms. In this study, our emphasis is on foreign owned LSLA; however we also control for the presence of commercial farms that were present in a district before and during the periods of study.

[4] The districts analyzed in this study refer to the old districts in Zambia and not the new ones created in 2011 and 2012.

Figure 1: Locations of foreign large-scale land acquisitions per district



Source: Authors

4.2.2 Correlates of Foreign LSLA

The clusters of foreign LSLA along the line of rail observed in Figure 1 hint at a possible correlation between the levels of infrastructure and the locations of foreign LSLA. To analyse this further, we employ a Binomial Probit model that enables us to examine the determinants of foreign LSLA at the district level. More specifically, we analyse the likelihood of a foreign LSLA occurring in a district based on its population density, transport infrastructure, area, its agro-ecological conditions, the presence of commercial farms, and land tenure security at the baseline survey year (2000/2001). These factors are often identified as major determinants of foreign LSLA in the LSLA literature (Deininger et al., 2011; Arezki et al., 2011).

The marginal effects are reported in Table 1. Our results confirm that districts with railway and road infrastructure have high and significant probability of attracting foreign LSLA. Having a rail line or main road increases the probability of having a foreign LSLA by 0.38. This is in line with the findings from our literature review (see for instance, Oakland Institute, 2011) and our inference from Figure 1. Our results also reveal that population density, district area, and the presence of commercial farms prior to the study period all increase the chances that a district will have a foreign LSLA, but none of these appears to be significant. Surprisingly, having a fertilizer depot or a region that is suitable for high input crop production *reduces* the chances of having a foreign LSLA in a district by 0.03 and 0.07, respectively. This could be indicative of the nature of crops cultivated by foreign LSLA that normally rely on mechanized and irrigational agricultural systems. The two variables that proxy land tenure security-- the percentage share of

households that had forcefully been evicted from their lands and those that do not have formal land rights--both seem to discourage foreign LSLA from investing in land at the district level. In particular, we find that a one-unit change in the percentage of households that report that they have no land rights significantly reduces the probability of a district having foreign LSLA by 0.18. This reaffirms earlier reports that foreign LSLA appear to acquire brownfield sites that have secure titles and were already cultivated by commercial farmers (see Chu, 2013 for a case study in Mkushi district). The marginal effect of the presence of a commercial farm also supports this point, although the result is not significant.

Table 1: Determinants of foreign large-scale land acquisitions

Dependent Variable: Districts with or without foreign LSLA		
	Coefficients	**Standard Errors**
Population density per hectare (in logs)	0.0178	0.120
District has railway line or main road	0.379**	0.158
District area in hectares (in logs)	0.142	0.125
Agro-ecological conditions suitable for high input crop production	-0.0740	0.114
% households evicted from land (in logs)	-0.0282	0.0489
% households evicted with no land rights (in logs)	-0.175***	0.0611
District has a fertilizer depot	-0.0303	0.176
Presence of commercial farm prior to foreign LSLA	0.166	0.143
Observations	70	

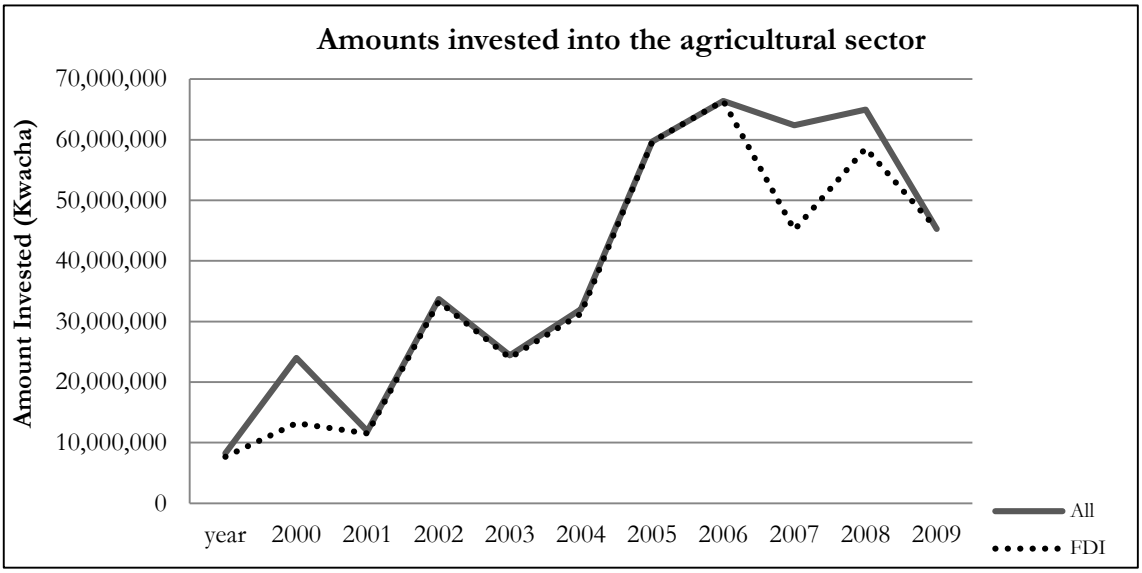
The table reports marginal effects for a one standard deviation increase in the independent variables
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4.2.3 Trends in Pledged Agricultural FDI

The rapid pace at which foreign LSLA have grown in developing countries have led a lot of critics to refer to the phenomenon as land grab or land speculation. Figure 2 maps the amount of pledged investments into the agricultural sector in Zambia between 2000 and 2009 using figures from the ZDA list of pledged investments.[5] The dotted line depicts foreign direct investment (FDI), whereas the full line depicts both FDI and domestic investment. In the early 2000s, most pledged investments in the agricultural sector are FDI, which can be linked to a boom in regional investments following the fast track land reforms in neighbouring Zimbabwe. This boom continues until the end of 2006 when it sharply contracts; this period coincides with the global crises. Agricultural FDI begins to rise again in the following years, but it does not reach its pre-2007 levels. Interestingly, the pledged level of domestic investments do not seem to be dented by the crisis and remain relatively high in the last part of the study period.

[5] Note that this refers to the entire amount invested in the agricultural sector within the study period and does not distinguish between investments into agricultural equipment, agricultural land or agro-processing plants.

Figure 2: Amounts of investments pledged into the agricultural sector between 2000 and 2010



Source: Authors (data from the Zambia Development Agency).

4.3 Origins of LSLA

To get a better picture of who is investing in the Zambian agricultural sector, we tabulate the countries of origin of the foreign LSLA against the number of foreign LSLA from that country and report the data in Table A4. We find that the top five investor countries with LSLA in Zambia are the United Kingdom (31 percent), Zimbabwe (15 percent), China (10 percent), South Africa (9 percent). and Germany (6 percent). The strong presence of British LSLA could be as a result of the countries' historical ties, but the Land Matrix portal also shows that the United Kingdom is by far the leading investor in agricultural land acquisitions; the high number of LSLA could also be indicative of the country's general interest in off-shore agriculture. The proximity to Zimbabwe and South Africa, which have substantial expertise in large-scale commercial farming, also draws a higher number of LSLA from these countries. Other countries such as India, Singapore, Denmark, Sweden, the United States, and Russia account for less than five percent of total investments.

Table A4 also reports joint ventures with foreign investors. Foreign LSLA typically operate in joint ventures to ease bureaucratic procedures and formalities. These ventures involve a range of international players including lenders, insurers, contractors and suppliers (Cotula, 2012). For instance, Illovo Sugar, the South African sugar company operating in Zambia and other Southern African countries, is partly owned by a leading British food and retail conglomerate (Cotula, 2012).

5. Empirical Framework and Hypotheses

In this section, we present an empirical framework that explains how foreign LSLA can affect the productivity levels of smallholders in their vicinities. We draw on models that analyse the welfare

implications of foreign LSLA on local populations proposed by Kleemann and Thiele (2014) and Dessy et al. (2012) while adjusting them to suit our study on smallholders in Zambia.

Our starting point is to assume a dual tenure system that consists of state land (Z_s) that is administered by the state and customary land (Z_c) that is governed by traditional authorities. Land (Z) is fixed and the government can allocate state land to foreign LSLA (L) while rural households hold customary land under the commons (H). This implies that $Z = Z_s + Z_c$. Foreign LSLA may also acquire customary land from chiefs and other traditional authorities, which may result in increased pressure on land for smallholders. Rural households can engage in either smallholder cultivation or wage employment. Smallholders produce agricultural output (y_h) using available land (z_{ch}) and inputs(i_h).

$$y_h = z_{ch}^{\alpha} i_h^{\gamma} \qquad [1]$$

where $\alpha + \gamma = 1$ with $\alpha, \gamma \epsilon (0,1)$. Smallholder agricultural output is also dependent on characteristics (x_h), the district level agro-ecological conditions (a_d), the presence of commercial farms in the district prior to the study period (κ_d) as well as the presence of a foreign LSLA at the district level (l_d).

$$y_h = (z_{ch}, i_h, x_h, a_{hd}, \kappa_{hd}, l_{hd}) \qquad [2]$$

The variables used are standard in agricultural production analyses, except for the last two which are included for the purpose of our study. Against this background, we hypothesize that spillovers caused by the presence of foreign LSLA can affect smallholder agricultural output in four main ways:

Hypothesis 1: Foreign LSLA increases the use of inputs for smallholders located in the vicinity.

The presence of foreign LSLA increases the supply of agricultural technologies and makes them more accessible for smallholders in the vicinity. Theoretically, this occurs because spillovers reduce the prices of inputs as shown by Kleemann and Thiele (2014). In order to test for these effects at the district level, we examine whether households located in districts with foreign LSLA use higher amounts of agricultural inputs compared to households in districts without foreign LSLA. To reiterate, our treatment group (τ) consists of households that are located in a district that had a foreign LSLA that was operationalised in the periods between 2000 and 2010, whereas the control group (ς) represents households that are located in districts that have not had an LSLA before, during, or after the study periods. If the hypothesis holds, we expect to find higher use of inputs for the treatment group.

$$\left(\frac{i}{z_c}\right)_{hdt}^{\tau} > \left(\frac{i}{z_c}\right)_{hdt}^{\varsigma} \qquad [3]$$

Hypothesis 2: Foreign LSLA increase land productivity of smallholders located in their vicinities.

This occurs as a corollary of the first hypothesis; increased input use raises land productivity (Kleemann and Thiele, 2014). Measuring productivity as the value of agricultural output per hectare, we hypothesize

that the output per hectare for the treatment group $\left(\frac{Y_h}{z_c}\right)^{\tau}_{hdt}$ is greater than the output per unit of land for the control group $\left(\frac{Y_h}{z_c}\right)^{\varsigma}_{hdt}$.

Hypothesis 3: Foreign LSLA affects the landholdings of smallholders located in their vicinities, and the overall impact of LSLA is ambiguous.

While the positive spillovers of LSLA can lead to higher output on the same area of land, land available for smallholder cultivation may decrease. Dessy et al. (2012) show that the presence of foreign LSLA may increase farm size of local populations. This is plausible if smallholders engage in off-farm activities, thereby reducing pressure; however, off-farm wages may also increase household cultivation activities by providing capital necessary for the purchase of inputs. More empirical analysis is needed to determine these effects on farm size. We compare land holdings of smallholders in the treatment and control group and report the results in subsequent sections.

Hypothesis 4: Foreign LSLA increases wage employment opportunities for smallholders located in their vicinities.

The literature shows that foreign LSLA have the potential to develop rural areas through the provision of additional wage opportunities in the off-farm and farm sectors. This implies that households living in districts with foreign LSLA will be engaged in more wage-employment than households living in districts without foreign LSLA. NW_{hdt} denotes the number of households engaged in farm wage employment (or other forms of off-farm employment).

$$NW^{\tau}_{hdt} > NW^{\varsigma}_{hdt} \qquad [4]$$

6. Estimation Strategy

We adopt a difference-in-difference (DiD) strategy to assess the impact of the occurrence of a LSLA on smallholder performance. Performance is measured at the household-level while treatment is operationalized at the district-level. As we do not have panel data but have to rely instead on two cross-sections, we cannot control for household-level fixed effects. Note again that treatment corresponds to the occurrence of a foreign LSLA between 2001 and 2010 in the district of residence of the household baseline. To avoid contamination of baseline information, we only consider foreign LSLA that began after the first survey. Although differences still exist between the two groups since some districts in the treatment group already had commercial farms prior to the study period, we control for these differences by including a dummy variable that indicates whether the district had a commercial farm or not.

Recalling that agricultural output of smallholders is dependent on a number of factors:

$$y_h = (z_h, i_h, x_h, a_{hd}, c_{hd}, l_{hd}) \qquad [2]$$

We rewrite this reduced form as the following linear function

$$\frac{Y}{Z_{chdt}} = \beta_0 + \beta_1 T + \beta_2 L_d + \beta_3 L_d * T + \beta_4 X_h + \beta_5 Z_{ch} + \beta_6 I_h + \beta_7 A_d + \beta_8 \kappa_d + \varepsilon_{hdt} \qquad [5]$$

In addition to the variables specified above, eq. (5introduces a dummy T for the second time period (0 for 2001, 1 for 2010). It captures the changes in $\frac{Y}{Z_{chdt}}$ even in the absence of treatment. L_d captures possible differences between the treatment and control group prior to foreign LSLA. The treatment effect is given by $L_d *$ T , which is an interaction of the time effect and treatment variable. $\beta_0, \beta_1 \ldots \beta_8$, are the parameters to be estimated and ε_{hdt} represents the error term. It is assumed that the error term is independently, identically, and normally distributed with zero mean (Wooldridge, 2007).

We transform (4) to its natural logarithmic form:

$$ln\left(\frac{Y}{Z}\right)_{chdt} = \beta_0 + \beta_1 T_t + \beta_2 L_d + \beta_3 L_t * T_t + \beta_4 ln(X)_{hd} + \beta_5\, ln(Z)_{cht} + \beta_6 I_{ht} + \beta_7 A_d + \beta_7 \kappa_d + \varepsilon_{hdt} \qquad [6]$$

Before proceeding with our estimation, we consider several econometric challenges that may distort our results. One of the major concerns associated with DiD analysis is serial correlation that arises from multiple cross-sectional analysis (Betrand et al, 2004). Serial correlation arises when unobserved determinants of the outcome are correlated within clusters. If serial correlation is positive, it results in the underestimation of standard errors and an overestimation of t-statistics; this may lead to regression coefficients appearing significant when this is in fact not the case. To control for serial correlation, we adopt robust clustered standard errors at the district level. This allows us to adjust the standard errors to correct for the fact that the errors maybe correlated due to the common group effect (Donald and Lang, 2007). As our results below show, we can difference out significant time-invariant differences between the treatment and the control group. Unfortunately, these considerable differences make it likely that our results are suffering from time-variant selection bias. We will come back to the direction of the likely biases in our discussion of the results below.

7. Results

7.1 Foreign LSLA and Smallholder Land Productivity

Table A5 reports the results of our analysis on the impact of foreign LSLA on smallholder agricultural output per hectare. We first compare the impact of foreign LSLA on households total agricultural output per hectare, this is followed by an analysis of the impacts of foreign LSLA on the value of maize yields, Zambia's main staple crop.

We find very strong time effects for the change in output per hectare in the periods between 2001 and 2010 which result in 78 and 42 percentage increments shown in the restricted and full models (columns 1 and 2),

respectively. This result is in line with studies that reported that smallholders experienced record bumper harvests in the years preceding our study; see for instance Burke et al., (2010), Nkonde et al., (2011) and Gilbert et al., (2013). We may hence partly capture a special seasonal, not a structural effect.

Another main result shown in Table A5 is that the treatment group has higher levels of output per hectare than the control group at the district level. Models 1 and 2 show that output per worker is initially 26 and 51 percent higher for the treatment group in the baseline. Over time, we find that households in the treatment group experience reductions in their output per yield when compared to the control group. The restricted model shows a significant reduction of 31 percent in the output per hectare of the treatment group, this reduces to 26 percent and becomes insignificant when we include other control variables. Hence, we observe a pattern of convergence between treatment and control groups as the output per hectare of the control group seems to rise until it reaches a level that is similar to the treatment group. As expected, we find high rainfall patterns and the fertiliser use significantly increase smallholder output per hectare in the full model (column 2) by 70 and 17 percentage points, respectively. In addition, we observe that households with female household heads have 11 percent lower output per hectare than those with male household heads. Surprisingly, we find that the presence of a commercial farm in the district prior to our study significantly reduces output per hectare by 13 percent. Asset holdings also seem to significantly reduce output per hectare, by 0.03 percent. The negative relation obtained between commercial farming and the presence of LSLA could signify that farm households engage in more off-farm and wage employment, which reduces the output per hectare.

Analysing the effects of the presence of foreign LSLA on maize, the country's staple crop, (Models 3 and 4) yields similar results; we find that maize output per hectare significantly increases by 43 and 23 percent over time and that fertilizer and rainfall positively and significantly affect maize output per hectare in the districts. Like the previous results, we find that maize harvested per hectare is initially significantly higher in the treatment group by 31 percent but over time, it is 11 percent lower than the control group. However, these results are not significant. This time we observe that maize output per hectare is 15 percent lower in districts that have commercial farming activities.

7.2 Foreign LSLA and Smallholder Total Agricultural Output

We find that the time effects reported in Table A5 persist when we analyse the impact of the presence of foreign LSLA in a district on total smallholder agricultural output. Our results are reported in Table A6. Here agricultural output significantly increases by 51 percent over time in the restricted model and by 17 percent in the unrestricted model. Maize output of the household increases by 123 percent and 20 percent, with both results significant at the 1 and 10 percent levels. Considering that a large part of the households in this study are dependent on agriculture for their livelihoods, this increment is expected to have a huge impact on their food security levels. Again, we find that the values of agricultural and maize output are

higher in the treatment groups by 23 and 20 percent respectively as can be seen from the models with controls. Over time, the treatment effect shows that households in districts with foreign LSLA have 0.08 and 0.05 percent lower agricultural and maize output when compared to the control group. This supports earlier results that hinted at a convergence in the levels of output per hectare of smallholders in the control and treatment groups.

Furthermore, we find positive and significant effects of fertiliser and rainfall as well as asset and land holdings on both agricultural and maize output. While education and the number of adult members positively increase output, this result is not significant. Households with a female head have 12 and 0.06 percent less output than those with male household heads. Once more, we find a significant and negative impact for the presence of commercial farms in a district prior to the study period. In this case, we observe 13 and 13 percentage reductions in output for households located in districts with old commercial farms when compared to households in districts without commercial farms.

7.3 Foreign LSLA and Smallholder Land Holdings

To examine the extent to which the size of household land holdings account for the results presented in Table A6, we analyse the impact of the presence of a foreign LSLA on the land cultivated by households. The results of this analysis are shown in Table A7.

We find evidence for a 23 percent significant reduction in cultivated land (per household) for both groups over time in the mode with controls (column 2). Since this reduction affects both the treatment and control groups, it is likely that it occurs as a result of population pressures and not because of the presence of a foreign LSLA. In fact, we find that households in the treatment group have 17 percent more land holdings than households in the control group. Initially these households had 10 percent less cultivated land than the control group. This implies that the control group experiences a greater reduction in cultivated hectarage compared to the treatment group. From these findings, we infer that the reduction in cultivated area is probably driving the results presented in Table A5 that show significant differences in output per hectare between the treatment and control group over time. Consequently, this implies that the presence of a foreign LSLA may not necessarily drive the differences observed in Table A5 and that land policy or demographic changes may be behind the changes in output per hectare.

7.4 Foreign LSLA and Smallholders Agricultural Input Use

To determine whether smallholders in the treatment group have increased access to inputs through technological spillover effects, we examine the impact of the presence of foreign LSLA in a district on smallholder fertilizer use. As shown in Table A8, fertilizer use significantly increases by over 37 percent for smallholders between 2001 and 2010/2011. Households in the treatment group initially use 14 percent more fertilizer than the control group, but this is not significant. Over time, households in the treatment

group are found to use lower amounts of fertiliser-- in the restricted model we find that they use at least 13 percent less fertiliser than the control group-- but this result is not significant. This causes us to reject our null hypothesis that households in the treatment group have higher input usage levels. Similar to the previous sections we find patterns of "catching-up" with the initial gap in fertilizer use between treated and non-treated districts diminishing over time. Other results show that having an educated household head increases fertiliser use by 20 percent. We also find that households with radios use 16 percent more fertilise per hectare. Some radio channels include agricultural programmes such as 'Lima Time' that inform households how to apply agricultural inputs and when they are ready for collection. Having a commercial farm reduces fertiliser use per hectare by 0.06 percent, but this result is insignificant.

We should note, however, that our empirical specification is able to capture only a small fraction of the variance in fertilizer use and that the results should hence be treated with caution.

7.5 Foreign LSLA and smallholders wage-employment opportunities at the district level

Finally, we analyse the relationship between the presence of a foreign LSLA at the district level and wage opportunities. The results are reported in Table A9 included in the Appendix. Here again, the very low R-squared casts doubts on the validity of the specification. With this caveat in mind, the models suggest a reduction in the number of wage labourers over time. The numbers of workers engaged in off-farm employment significantly reduces by 0.04 percent while those engaged in commercial farm employment reduces by 0.005 percent. Overall, there is a 0.09 significant reduction in all jobs. The treatment group (LSLA) initially has a significantly higher number of wage labourers in all models: 21 percent more households in the treatment group were involved in a form of wage employment. Over time, the treatment effect shows that an equal reduction in all the numbers of jobs undertaken by households in the treatment group. Again, we appear to observe convergence with the number of wage labourers declining faster in treated districts. Note however that this does not imply that overall wage employment has fallen over time; it has only fallen per household.

8. Discussion and Conclusion

In recent years, a vast amount of literature has emerged that documents the potential impacts of foreign LSLA on host countries, yet the empirical evidence on the effects of foreign LSLA on smallholder productivity is scant. Since smallholders account for the majority of agricultural producers in many developing countries, it is important that the potential implications of foreign LSLA on their levels of productivity are taken into consideration in the ongoing debate on foreign LSLA. This type of analysis is particularly pertinent in light of the ongoing food crisis that has affected many rural agricultural households in Sub Saharan Africa. To address this research gap, this paper analyses the impact of the presence of foreign LSLA on smallholder agricultural production at the district level. Specifically, we applied a difference-in-

difference approach to test whether we observe differences in smallholder performance comparing Zambian districts that have received a foreign LSLA between 2001 and 2010 to those that have not.

Our analyses reveal a consistent pattern of convergence or catching-up: The districts that have received LSLA initially exhibited higher output per unit of land, higher output, higher use of fertilizer, and somewhat smaller farm sizes. These differences from non-treated districts become smaller or even seem to disappear over the first decade of the 2000s. In fact, decreasing farm sizes in non-treated districts and the necessity to increase output on a given parcel of land fits into this picture.

Since these results are at the district level, however, we are not certain that a similar trend would be observed at a more disaggregated level of analysis. Longitudinal data at smaller geographical units is not available since ward information– the next administrative unit after districts-- was only recorded after the start date of our study period. Furthermore, the Census Sampling Units (CSA) and Standard Enumeration Areas (SEA) used by the Post-Harvest Surveys within this ten-year study period also change considerably. A detailed analysis at a disaggregated scale would have been possible had these sampling units remained constant.

The data used in this analysis is collected at the micro-level and is only able to capture the local effects of the presence of a foreign LSLA. Although we cannot estimate the general equilibrium effects associated with the presence of foreign LSLA, it is very likely that the presence of foreign LSLA may influence factor prices. For instance, if foreign LSLA are engaged in labour intensive production, increased demand for labour may result in the reallocation of labour from less productive sectors. Factor and output prices would rise if the returns from foreign LSLA exceed those from other sectors that also rely on unskilled labour. Das (2012) has conducted a detailed study of the general equilibrium scenarios associated with outsourced farmland (foreign LSLA). One of the key results of this paper is that an increase in prices leads to the contraction of other sectors such as manufacturing, innovation and subsistence; this makes them more vulnerable to price changes in the agricultural sector. The scale of our analysis prevents us from identifying these sector wide effects.

This does not imply that our empirical exercise does not allow for some more careful conclusions. From our results, we conclude that LSLA – albeit being of considerable magnitude in Zambia – have not had any disruptive effects on the smallholder economy at the district level. If foreign LSLA had negative implications on smallholders, we would have been able to detect these effects. This would equally have been the case if foreign LSLA had positive spillovers through local labor markets, technological spillovers, or an increased availability of agricultural inputs. We cannot find any evidence for these spillovers at the district level. Even with time-variant selection bias because of catching-up processes in non-treated districts, such spillovers – if present at all – must have been smaller than the effects of catching-up.

We also have to note that even with the observed productivity increases, most farm households in Zambia are still very poor. This is particularly astonishing, since the general time trends suggest that smallholder agricultural output per unit of land has increased by nearly 40 percent in the periods between 2001 and 2010/2011. Although this increment of change is observable for smallholders both in the treatment and control groups, it is not pro-poor. Our results corroborate recent studies that show that smallholder experienced increased output levels (bumper harvests) in the years preceding the survey (Burke et al., 2010; Nkonde et al., 2011 and Gilbert et al., 2013). While the reasons behind this change in output remain unclear, several possible explanations have been put forward, such as favourable climatic conditions and the effectiveness of the FISP program (Burke et al., 2010). We also find a very positive time trend for fertilizer use. This trend hints at the effectiveness of the Farm Input Subsidy Program (FISP) that provided fertilizer subsidies to smallholder producers during part of the study period (Mason et al., 2011). Our analysis shows that smallholders increase their fertilizer use by approximately 50 percent regardless of whether foreign LSLA are present in their districts or not.

The present paper also provides a detailed within-country, district-level analysis of the determinants of foreign LSLA. Our results suggest that foreign LSLA are more likely to be located in districts that already have infrastructure in place. Additionally, we find that foreign LSLA are deterred from investing in districts without insecure land tenure. This adds to the growing literature on the determinants of the locations of foreign LSLA (Arezki, 2011).

While our paper has provided first empirical insights on a topic that has so far received very little empirical attention, we propose that further research is required to more rigorously establish the possible causal links between foreign LSLA and smallholder agricultural production. In particular, more work is required in the identification of foreign LSLA and smallholder locations to ensure that the impacts are accurately analysed. Further research should take advantage of new household agricultural datasets that collect GPS information as well as satellite image databases to obtain more detailed information on the commencement dates of agricultural operations and on the spatial distances between foreign LSLA and smallholders. Moreover, increased transparency in the recording and documentation of land deals is a prerequisite for an analysis of their potential impacts.

References

Adams, M. 2003. Land Tenure Policy and Practice in Zambia: Issues Relating to the Development of the Agricultural Sector. Oxford, UK: Mokoro Ltd.

African Development Bank. 2011. African Economic Outlook 2011. Special Theme: Africa and its emerging partners. Tunis: AfDB/ OECD /UNDP/UNECA.

Anseeuw, W. et al. 2012. *Transnational Land Deals for Agriculture in the Global South: Analytical Report based on the Land Matrix Database*. Bern, Montpellier and Hamburg: CDE/CIRAD/GIGA.

Anseeuw, W. et al. 2013. "Creating a Public Tool to Assess and Promote Transparency in Global Land Deals: The Experience of the Land Matrix." *The Journal of Peasant Studies* 40(3): 521-530.

Arezki, R., K. Deininger, and H. Selod. 2013. "What Drives the Global 'Land Rush?" *The World Bank Economic Review, lht034.*

Bertrand, M., E. Duflo, and S. Mullainathan. 2004. "How Much Should We Trust Differences-in-Differences Estimates?" *The Quarterly Journal of Economics* 119 (1): 249-275.

Brown, T. 2005. "Contestation, Confusion and Corruption: Market-based Land Reform in Zambia." In *Competing Jurisdictions: Settling Land Claims in Africa* edited by S. Evers, M. Spierenburg and H. Wels, 79-102. Leiden and Boston: Brill.

Burke, W. J., T. S. Jayne, and A. Chapoto. 2010. *Factors Contributing to Zambia's 2010 Maize Bumper Harvest.* Food Security Research Project Working Paper No. 48.

Chapoto, A. et al. 2010. *Staple food prices in Zambia.* Prepared for the COMESA policy seminar "Variation in staple food prices: Causes, consequence, and policy options." Maputo, Mozambique (25-26).

Chu, J. M. 2013. *Creating a Zambian Breadbasket: 'Land Grabs' and Foreign Investments in Agriculture in Mkushi District, Zambia.* The Land Deal Politics Initiative Working Paper. The Hague, The Netherlands.

Cotula, L. 2009. *Land Grab or Development Opportunity? Agricultural Investment and International Land Deals in Africa.* International Institute for Environment and Development, London and Rome: IIED/FAO/IFAD.

Cotula, L. 2012. "The International Political Economy of the Global Land Rush: A Critical Appraisal of Trends, Scale, Geography and Drivers." *The Journal of Peasant Studies* 39(3-4): 649-680.

Das, G. 2012. Trans-border Land Acquisitions: A New Guise of Outsourcing and Host Country Effects. UNU-WIDER Working Paper No. 43.

Deininger, K. et al. 2011. *Rising Global Interest in Farmland: Can it Yield Sustainable and Equitable Benefits?* Washington DC: World Bank Publications.

Deininger, K. 2011. "Challenges Posed by the New Wave of Farmland Investment." *The Journal of Peasant Studies* 38(2): 217-247.

Dercon, S. and D. Gollin. 2014. "Agriculture in African Development: Theories and Strategies." *Annual Review of Resource Economics* 6: 471-492.

De Schutter, O. 2011. How Not to Think of Land-Grabbing: Three Critiques of Large-Scale Investments in Farmland. *The Journal of Peasant Studies* 38(2): 249-279.

Dessy, S., G. Gohou, and D. Vencatachellum. 2013. *On the Welfare Effects of Export-Oriented FDIs in African Farmland.* AfDB Working Paper.

Dodge, D. J. 1977. *Agricultural Policy and Performance in Zambia: History, Prospects, and Proposals for Change.* Institute of International Studies, University of California, Berkeley. California.

Donald, S. G., and K. Lang. 2007. "Inference with Difference-in-Differences and Other Panel Data." *The Review of Economics and Statistics, 89*(2), 221-233.

FAO. 2012. Trends and Impacts of Foreign Investment in Developing Country Agriculture. Rome: FAO.

FAOSTAT. 2014. Agriculture Organization of the United Nations. Agricultural Statistical database. Accessed from http://faostat.fao.org/site/377/DesktopDefault.aspx?PageID=377#ancor.

Feintrenie, L., W. K. Chong, and P. Levang. 2010. "Why do Farmers Prefer Oil Palm? Lessons Learnt from Bungo District, Indonesia." *Small-Scale Forestry* 9(3): 379-396

German, L., G. Schoneveld, and E. Mwangi. 2013a. "Contemporary Processes of Large-Scale Land Acquisition in Sub-Saharan Africa: Legal Deficiency or Elite Capture of the Rule of Law?" *World Development* 48: 1-18.

German, L., D. Gumbo, and G. Schoneveld. 2013b. "Large-Scale Investments in Chitemene Farmland: Exploring the Marginal Lands Narrative in Zambia's Northern Province." *QA-Rivista dell'Associazione Rossi-Doria* 2: 27.

Görg, H., and D. Greenaway. 2004. "Much Ado About Nothing? Do Domestic Firms Really Benefit from Foreign Direct Investment?" *The World Bank Research Observer, 19*(2), 171-197

GRZ. 2004. Zambia National Agriculture Policy (2004-2015). Lusaka: Government Printers.

Haskel, J. E., S. C. Pereira, and M. J. Slaughter. 2007. "Does Inward Foreign Direct Investment Boost the Productivity of Domestic Firms?" *The Review of Economics and Statistics* 89(3): 482-496.

Hella, J. P., R. Haug, and I. M. Kamile. 2011. "High Global Food Prices–Crisis or Opportunity for Smallholder Farmers in Tanzania?" *Development in Practice* 21(4-5): 652-665.

IFAD. 2011. *Republic of Zambia Smallholder Productivity Promotion Programme (S3P). Programme Design Report. Volume 1-Main Report.* International Fund for Agricultural Development. East and Southern Africa Division Programme Management Department. Rome: IFAD.

Ivanic, M., and W. Martin. 2008. "Implications of Higher Global Food Prices for Poverty in Low-Income Countries." *Agricultural Economics* 39(s1): 405-416.

Javorcik, B. S. 2004. "Does Foreign Direct Investment Increase The Productivity of Domestic Firms? In Search of Spillovers through Backward Linkages." *The American Economic Review* 94(3): 605-627.

Kleemann, L. et al. 2013. *Economic and Ethical Challenges of "Land Grabs" In Sub-Saharan Africa*. Kiel Policy Brief, No. 67.

Kleemann, L., and R. Thiele. 2014. Rural Welfare Implications of Large-Scale Land Acquisitions in Africa: A Theoretical Framework. Kiel Working Paper No. 1921.

Land Matrix. 2013. *The Land Matrix Newsletter, June 2013*. The Land Matrix Database. Hamburg: GIGA

Li, T. M. 2011. "Centering Labor in the Land Grab Debate." *The Journal of Peasant Studies* 38(2): 281-298.

Malambo, A. H. 2014. "Land Administration in Zambia After 1991: History, Opportunities and Challenges From the 1995 Lands Act." *Journal of Geography and Geology*, 6(1): 139.

Mason, N. M. et al. 2011. The 2011 Surplus in Smallholder Maize Production in Zambia: Drivers, Beneficiaries, & Implications for Agricultural & Poverty Reduction Policies. Food Security Research Project, Working Paper No. 58.

Mujenja, F., and C. Wonani. 2012. *Long-Term Outcomes of Agricultural Investments: Lessons from Zambia*. International Institute for Environment and Development. London: IIED.

Neubert, S. et al. 2011. Agricultural Development in a Changing Climate in Zambia: Increasing Resilience to Climate Change and Economic Shocks in Crop Production. Studies/Deutsches Institut für Entwicklungspolitik: Vol. 57.

Ng'ombe, A., and R. Keivani. 2013. "Customary Land Reform to Facilitate Private Investment in Zambia: Achievements, Potential and Limitations." *Urban Forum* 24: 33-48

Nkonde, C. et al. 2011. *Who Gained and Who Lost from Zambia's 2010 Maize Marketing Policies?* Food Security Research Project, Working Paper No. 49

Nolte, K. 2014. "Large-Scale Agricultural Investments under Poor Land Governance in Zambia." *Land Use Policy* 38: 698-706.

Oakland Institute 2011. Understanding Land Investment Deals in Africa. Country Report: Zambia. California: Oakland Institute.

Rakotoarisoa, M. A. 2011. A Contribution to the Analysis of the Effects of Foreign Agricultural Investment on the Food Sector and Trade in Sub-Saharan Africa. Paper presented at the 14th Annual Conference on Global Economic Analysis. Venice, Italy, June 16-18, 2011.

Ricker-Gilbert, J. et al. 2013. "What are the Effects of Input Subsidy Programs on Maize Prices? Evidence from Malawi and Zambia." *Agricultural Economics* 44(6), 671-686.

Schoneveld, G. C. 2014. "The Geographic and Sectoral Patterns of Large-Scale Farmland Investments in Sub-Saharan Africa." *Food Policy* 48: 34–50.

Simunchembu, C. M. 1989. *Commercial Farming and Social Change in Mkushi District, 1945-1975*. Master Thesis handed in at the University of Zambia. Lusaka: UNZA

Sitko, N. J., and T. S. Jayne. 2014. "Structural Transformation or Elite Land Capture? The Growth of 'Emergent' Farmers in Zambia." *Food Policy* 48: 194-202.

Sitko, N. J., J. Chamberlin, and M. Hichaambwa. 2014. "Does Smallholder Land Titling Facilitate Agricultural Growth? An Analysis of the Determinants and Effects of Smallholder Land Titling in Zambia." *World Development* 64: 791-802.

Smith, W., and A. Wood. 1984. "Patterns of Agricultural Development and Foreign Aid to Zambia." *Development and Change* 15(3): 405-434.

Spiegel Online. 2004. "Settling in Zambia: Zimbabwe's Displaced Farmers Find a New Home." Accessed on 28.17.2013 from http://www.spiegel.de/international/spiegel/settling-in-zambia-zimbabwe-s-displaced-farmers-find-a-new-home-a-334756.html.

Vermeulen, S., and L. Cotula. 2010. *Making the Most of Agricultural Investment: A Survey of Business Models that Provide Opportunities for Smallholders*. International Institute for Environment and Development, London and Rome: IIED/FAO/IFAD.

von Braun, J., and R. S. Meinzen-Dick. 2009. *Land Grabbing by Foreign Investors in Developing Countries: Risks and Opportunities*. International Food Policy Research Institute, Policy Brief. Washington, DC: IFPRI.

Vorley, B., L. Cotula, and M. K. Chan. 2012. *Tipping the Balance: Policies to Shape Agricultural Investments and Markets in Favour of Small-Scale Farmers.* Oxfam Research Report, December 2012. London: IIED/OXFAM.

ZDA. 2011. Agriculture, Livestock and Fisheries. Sector Profile. Lusaka: Zambia Development Agency.

APPENDIX

Table A1: Summary statistics of smallholders at the baseline

Variable	Description	Control		Treated		
		Mean		Mean	Difference	P-Value
Sex	Sex of household head (Female=1, Male=0)	0.18		0.13	0.05	0.00
Age	Age of household head	45.20		45.16	0.04	0.96
Household members	Number of household members	3.60		3.67	-0.06	0.48
Educated members	Number of educated household members	3.12		3.16	-0.04	0.67
Male adults	Number of male household members	1.66		1.69	-0.03	0.63
Female adults	Number of female household members	1.64		1.67	-0.03	0.53
Asset index	Household asset index	0.09		0.12	-0.02	0.00
Yield	Value of agricultural output per hectare	311,732		377,986	-66,253.40	0.00
Maize yield	Value of maize output per hectare	390,233		398,198	-7,965.10	0.53
Agricultural output	Value of agricultural output*	489,029		537,443	-48,414.60	0.08
Maize output	Value of maize output*	312,456		370,849	-58,393.10	0.01
Hectares cultivated	Total hectares cultivated per household	1.62		1.57	0.05	0.42
Maize hectares	Total hectares cultivated for maize per household	0.83		0.99	-0.16	0.00
Basal fertilizer	Total amount of basal fertilizer used per household	35.92		62.43	-26.51	0.00
Top dressing fertilizer	Total amount of top dressing fertilizer used per household	35.18		60.48	-25.30	0.00
Total Fertilizer	Total amount of fertilizer used per household	58.83		93.51	-34.68	0.00
Bike	Household owns a bike	0.51		0.45	0.06	0.01
Radio	Household owns a radio	0.39		0.48	-0.09	0.00
Livestock	Household owns livestock	0.29		0.35	-0.07	0.00
Poultry	Household owns poultry	0.71		0.69	0.02	0.45
Distance to town	Distance to nearest town from centre of SEA	34.37		34.24	0.14	0.86
Fertilizer depot	Household lives in a district with a fertilizer depot	0.25		0.63	-0.38	0.00
Rail	Household lives in a district with a rail line	0.39		0.58	-0.19	0.00
Percent available land	Percentage of households that believe land is available	58.31		41.14	17.17	0.00
Percent forced from land	Percentage of households that have been forced away from land	6.81		4.31	2.50	0.00
*All values are in Kwacha. The US Dollar exchange: Zambian Kwacha exchange rate in 2000 was equivalent to 1:3289.						

Table A2: Summary statistics of smallholders at last survey year

Variable	Description	Control		Treated			
		Mean		Mean		Difference	P-Value
Sex	Sex of household head(Female=1, Male=0)	0.05		0.04		0.01	0.14
Age	Age of household head	45.66		46.36		-0.69	0.09
Household members	Number of household members	6.34		6.30		0.04	0.58
Educated members	Number of educated household members	3.99		4.15		-0.16	0.01
Male adults	Number of male household members	1.74		1.74		0.00	0.99
Female adults	Number of female household members	1.69		1.71		-0.02	0.55
Asset index	Household asset index	0.15		0.19		-0.04	0.00
Yield	Value of agricultural output per hectare	537,273		490,282		46,991.10	0.00
Maize yield	Value of maize output per hectare	577,286		515,437		61,849.40	0.00
Agricultural output	Value of agricultural output*	968,823		1,199,113		-230,290.50	0.00
Maize output	Value of maize output*	821,840		1,003,727		-181,887.30	0.00
Hectares cultivated	Total hectares cultivated per household	1.58		2		-0.42	0.00
Maize hectares	Total hectares cultivated for maize per household	1.16		1.39		-0.23	0.00
Basal fertilizer	Total amount of basal fertilizer used per household	109.15		116.76		-7.61	0.08
Top dressing fertilizer	Total amount of top dressing fertilizer used per household	109.57		123.22		-13.64	0.00
Total Fertilizer	Total amount of fertilizer used per household	198.29		206.56		-8.27	0.25
Bike	Household owns a bike	0.65		0.64		0.02	0.21
Radio	Household owns a radio	0.63		0.65		-0.02	0.07
Livestock	Household owns livestock	0.38		0.49		-0.11	0.00
Poultry	Household owns poultry	0.67		0.70		-0.03	0.03
Distance to town	Distance to nearest town from centre of SEA	35.70		34.26		1.45	0.00
Fertilizer depot	Household lives in a district with a fertilizer depot	0.21		0.51		-0.30	0.00
Rail	Household lives in a district with a rail line	0.30		0.55		-0.25	0.00
Percent available land	Percentage of households that believe land is available	57.86		41.87		15.99	0.00
Percent forced from land	Percentage of households that have been forced away from land	7.56		4.69		-2.88	0.00
*Note that output values are reported in Kwacha and are based on 2000 prices. *The US Dollar exchange: Zambian Kwacha exchange rate in 2000 was equivalent to 1:3289.							

Table A3: Summary statistics of large-scale land acquisitions

District	Number of LSLA	LSLA employees	Total area cultivated(ha)	Total district area(ha)*	% of total district area
Chibombo	12	3511	54,381	1,258,340	4.32
Kabwe	12	708	27,017	159,188	16.97
Mkushi	13	1586	15,305	1,745,490	0.88
Mumbwa	1	.	30,000	2,172,000	1.38
Serenje	1	.	10,000	2,335,100	0.43
Kitwe	2	.	4,000	84,140	4.75
Mpongwe	3	.	54,244	1,108,230	4.89
Mwense	1	.	300	682,468	0.04
Chongwe	3	397	51,400	1,090,690	4.71
Kafue	7	677	10,677	558,431	1.91
Luangwa	1	.	2,160	408,790	0.53
Lusaka	2	.	480	106,961	0.45
Isoka	1	.	40,000	984,962	4.06
Kasama	3	10	16,783	1,056,800	1.59
Mbala	1	230	2,461	900,115	0.27
Mpika	2	.	123,000	4,111,890	2.99
Mungwi	1	125	536	1,029,460	0.05
Nakonde	1	.	38,000	468,750	8.11
Kabompo	1	.	0	1,460,060	0.00
Solwezi	4	.	5,625	3,030,190	0.19
Zambezi	1	.	0	1,372,204	0.00
Choma	8	1258	26,249	694,561	3.78
Kalomo	3	219	5,662	1,340,580	0.42
Kazungula	1	.	15,000	1,703,504	0.88
Livingstone	3	227	1,275	68,602	1.86
Mazabuka	6	328	25,798	620,233	4.16
Sinazongwe	1	.	1,959	466,814	0.42
Total	95	9,276	562,312	31,018,554	70.05

*Note that district totals do not indicate the amounts of arable land.

Table A4: Countries of origin of LSLA

Country of origin	Number of LSLA	Percentage
United Kingdom	31	31.31
Zimbabwe	15	15.15
China	10	10.10
South Africa	9	9.09
Germany	6	6.06
India	4	4.04
Greece	3	3.03
Singapore	3	3.03
United States of America	3	3.03
Canada	2	2.02
Denmark	2	2.02
Russia	2	2.02
Australia	1	1.01
Gibraltar	1	1.01
Hungary	1	1.01
Jamaica	1	1.01
Netherlands	1	1.01
Saudi Arabia	1	1.01
Spain	1	1.01
Sweden	1	1.01
Total	99	99.97

Source: Authors' own calculation.

Note that the total number is larger than the number of LSLA reported in this study (95) this is because a number of LSLA operate as joint ventures between different countries.

Table A5: Regression results for foreign LSLA and smallholder output per hectare

	(1)	(2)	(3)	(4)
VARIABLES	**ln_yield**	**ln_yield**	**ln_yield_mz**	**ln_yield_mz**
year_2011	0.576***	0.347***	0.357***	0.210**
	(0.115)	(0.117)	(0.0770)	(0.0993)
LSLA_2011	-0.377*	-0.307	-0.165	-0.119
	(0.194)	(0.222)	(0.180)	(0.211)
LSLA	0.227*	0.417**	-0.00242	0.271*
	(0.113)	(0.182)	(0.110)	(0.154)
fhh_head		-0.113**		-0.0505
		(0.0525)		(0.0584)
ln_educ		0.0657		0.0868
		(0.0462)		(0.0671)
ln_adult		-0.0445		-0.0529
		(0.0435)		(0.0691)
ln_totfert		0.170***		0.176***
		(0.0186)		(0.0234)
ln_asset		-0.0289*		-0.0332
		(0.0164)		(0.0276)
rain_high		0.531***		0.499***
		(0.104)		(0.110)
old_cfarm		-0.145**		-0.173**
		(0.0719)		(0.0850)
Constant	12.36***	11.36***	12.61***	11.54***
	(0.0731)	(0.185)	(0.0557)	(0.175)
Observations	8,056	3,923	5,373	2,500
R-squared	0.061	0.171	0.033	0.142

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A6: Regression results for foreign LSLA and total smallholder agricultural output

	(1)	(2)	(3)	(4)
VARIABLES	**ln_output**	**ln_output**	**ln_maize_out**	**ln_maize_out**
year_2011	0.414***	0.154	0.804***	0.187*
	(0.0971)	(0.111)	(0.121)	(0.0970)
LSLA_2011	0.00633	-0.0814	-0.153	-0.0518
	(0.150)	(0.175)	(0.212)	(0.185)
LSLA	0.105	0.214	0.243	0.190
	(0.136)	(0.151)	(0.166)	(0.144)
ln_adult		0.0399		0.0351
		(0.0422)		(0.0599)
fhh_head		-0.113**		-0.0668
		(0.0524)		(0.0642)
ln_hect_cult_hh		0.858***		
		(0.0619)		
ln_educ		0.0349		0.0514
		(0.0385)		(0.0501)
ln_totfert		0.432***		0.506***
		(0.0246)		(0.0274)
ln_asset		0.135***		0.122***
		(0.0212)		(0.0267)
rain_high		0.451***		0.334***
		(0.0950)		(0.101)
old_cfarm		-0.136**		-0.118*
		(0.0589)		(0.0671)
ln_hect_maize				0.891***
				(0.0688)
Constant	12.59***	10.02***	12.02***	9.482***
	(0.0936)	(0.192)	(0.109)	(0.200)
Observations	8,485	4,190	7,898	2,683
R-squared	0.021	0.526	0.065	0.517

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A7: Regression results for foreign LSLA and smallholder land size

	(1)	(2)	(3)	(4)
VARIABLES	**ln_hect_cult_hh**	**ln_hect_cult_hh**	**ln_hect_maize**	**ln_hect_maize**
year_2011	-0.0798	-0.267***	0.122***	-0.0166
	(0.0490)	(0.0458)	(0.0386)	(0.0338)
LSLA_2011	0.168**	0.156**	0.00387	-0.00854
	(0.0703)	(0.0684)	(0.0522)	(0.0469)
LSLA	-0.0448	-0.107	0.0807	0.0155
	(0.0521)	(0.0658)	(0.0598)	(0.0417)
ln_age_hh		0.0574**		0.0478*
		(0.0237)		(0.0250)
fhh_head		-0.0376*		-0.0263
		(0.0218)		(0.0244)
ln_educ		0.109***		0.0800***
		(0.0138)		(0.0165)
radio		0.0447***		0.0422**
		(0.0148)		(0.0166)
ln_asset		0.284***		0.229***
		(0.0174)		(0.0196)
old_cfarm		0.0424		0.0704
		(0.0496)		(0.0420)
Constant	0.872***	1.271***	0.522***	0.825***
	(0.0279)	(0.0980)	(0.0397)	(0.125)
Observations	8,507	7,396	5,670	4,859
R-squared	0.010	0.206	0.025	0.205

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A8: Regression results for foreign LSLA and smallholder fertilizer use

	(1)	(2)
VARIABLES	**ln_totfert**	**ln_totfert**
year_2011	0.312***	0.158
	(0.110)	(0.103)
LSLA_2011	0.135	0.0561
	(0.142)	(0.132)
LSLA	-0.0702	-0.0553
	(0.114)	(0.102)
fhh_head		-0.00409
		(0.0758)
ln_educ		0.208***
		(0.0217)
radio		0.185***
		(0.0284)
ln_asset		0.269***
		(0.0248)
old_cfarm		-0.00560
		(0.0646)
Constant	5.132***	5.431***
	(0.0888)	(0.127)
Observations	4,515	4,196
R-squared	0.024	0.123

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A9: Regression results for foreign LSLA and wage employment opportunities

	(1)	(2)	(3)
VARIABLES	**nwg_all_hh**	**nwg_off_farm**	**n_wg_cfarm**
year_2011	-0.0940***	-0.0424**	-0.00541
	(0.0308)	(0.0210)	(0.00649)
LSLA_2011	-0.187**	-0.0846*	-0.0975*
	(0.0760)	(0.0479)	(0.0516)
LSLA	0.192**	0.0824*	0.108**
	(0.0872)	(0.0430)	(0.0476)
old_cfarm	0.0452	0.0212	0.0257**
	(0.0390)	(0.0261)	(0.0101)
Constant	0.235***	0.168***	0.00261
	(0.0351)	(0.0192)	(0.00759)
Observations	8,513	8,513	8,513
R-squared	0.033	0.009	0.043

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1