Engagement dynamics in large-scale investments in farmland and implications for smallholder farmers – evidence from Zambia

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Abstract

The recent increase in farmland investments in developing countries by private equity funds, large multinationals and sometimes foreign governments has attracted widespread attention and strong emotions from various interest groups. A major criticism of such investments is how they often marginalise smallholder farmers, as it is often not part of the investment plans to engage with these farmers. There is, however, little empirical evidence to support such claims. Using evidence from three large-scale farmland investors in Zambia, this paper provides an in-depth analysis of different types of engagement dynamics and linkages between large-scale farmland investors and smallholder farmers, and employs the propensity score-matching method to estimate the impact of such engagement on the production outcomes of smallholder farmers. The results indicate that farmers who are deliberately engaged by investors perform better in terms of hybrid seed and fertiliser usage, and subsequently have a higher gross value per hectare of crops than those who are not.

Key words: large-scale investments; farmland; engagement dynamics; smallholder farmers; impact assessment

1. Introduction and background

The past few years have seen increased investment in farmland in developing countries by private equity funds, large multinationals and sometimes foreign governments. In 2012, it was estimated that an area equal to eight times the size of the United Kingdom (241 930 sq. km), or 24.361 million hectares, was involved (Anseeuw *et al.* 2012). By 2016, that area had increased to about 630 times the size of Nairobi[1] (Land Matrix 2016), at about 43 million hectares. At the same time, there have also been investments in farmland by nationals using private sector and civil service income. This phenomenon, commonly referred to as "land grabs", has attracted widespread attention from various interest groups. A major criticism of such investments is that these large-scale[2] (and medium-scale[3]) investors often marginalise smallholder farmers by crowding them out of markets, displacing them off their land and leaving them worse off than before (Borras & Franco 2010; Robertson & Pinstrup-Andersen 2010; De Schutter 2011). In the process of land acquisition, investors neglect to consult with local land users, who are often displaced and rarely compensated (Nolte 2014). Investment contracts are also entered into hastily and in secrecy (Cotula 2011).

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[1] Nairobi is 69 600 ha
[2] Those with a farm size of 200 ha and above
[3] Those with a farm size between 21 ha and 199 ha

For some, these large-scale investments (LSI) in farmland are a form of neo-colonialism (Robertson & Pinstrup-Andersen 2010), yet for others (Food and Agricultural Organization [FAO] 2009), these LSI help bring the much needed investment in African agriculture. Proponents of LSI in farmland, such as the FAO (2009), note that it is possible to have deals that mutually benefit both parties when the investors' interests are matched with the objectives of the developing country.

Despite the range of emotions this phenomenon has evoked, the reality is that these LSI in farmland are on-going and are unlikely to stop any time soon. About 10 years ago, Cotula and Vermeulen (2009) noted an increase in direct investment in agricultural land due to several factors, ranging from food security concerns emanating from the food price crises of 2008 to the global financial crises. This phenomenon seemed to have peaked around 2010, before slowing down from 2011 onwards (United Nations Economic Commission for Africa [UNECA] 2013). This slowing down could have been due to the stabilisation of food prices or increased publicity on the phenomenon, leading to both recipient governments and investors being more wary (UNECA 2013). Although the rate of acquisition of large-scale farmland has slowed down, it is envisaged that this phenomenon will continue on an upward trend in the wake of failing global financial markets. With this background, there is increasing concern that such LSI in farmland will not only compromise the food security situation of the local smallholder farmers, but will eventually destroy their whole livelihoods.

Despite the frequency of such strong sentiments expressed by various critics, there is little empirical evidence to support such claims. A few quantitative studies (Schoneveld *et al*. 2011; Ahlerup & Tengstam 2015; Baumgartner *et al*. 2015; Sipangule & Lay 2015; Ali *et al*. 2016; Khadjavi *et al*. 2017) have endeavoured to analyse the impact that large-scale land investments have on smallholder farmers, although none of them analysed the impact of inclusion of the smallholder farmers in the farming operations of the LSI in farmland. For example, Khadjavi *et al*. (2017) investigated changes in the social capital of smallholder farmers as a result of the presence of large-scale farmers in their vicinity. Although their investigation revealed that those villages closer to the large-scale farmers had greater social capital, they did not, however, analyse whether these farmers were included in the large-scale farmers' operations or not. The study by Ali *et al*. (2016) analyses the nature and magnitude of spillovers from large farm establishments in Ethiopia using intertemporal changes in the closeness and exposure of the smallholders to large farms. Their findings reveal that there were positive spillovers on fertiliser use, yields and improved seed usage for maize farms with closer proximity to large commercial farms, mostly within a 25 km radius. This study similarly did not analyse the impact of the inclusion of smallholder farmers in the farming operations of the investor.

Therefore, little is known about the engagements and linkages between these LSI in farmland and the smallholder farmers, as well as the impact – whether negative or positive – on the agricultural production of these smallholder farmers. It still remains unclear whether or not there is intentional engagement by the investors with smallholder farmers in the neighbourhood of their investments. It could be that, without any formal engagement, there could be negative or positive spillovers affecting the smallholder farmers.

Large-scale investors in farmland all seem to have been painted by the same paintbrush, but the question remains: *Does all LSI in farmland disadvantage smallholder farmers, and do they all operate in a "vacuum", minding their own business without giving any consideration to their smallholder neighbours?* Are smallholder farmers eventually going to be wiped off the radar by the LSI in farmland, as suggested by some authors (De Schutter 2009; Borras & Franco 2010; Deininger & Byerlee 2011)? Or is it possible that smallholder farmers could in fact benefit from the investments through improved roads, and better access to finance, inputs and markets? Although these LSIs in farmland may have some positive aspects, it is not clear how these investors engage with smallholder farmers and what impact this has on smallholder agricultural production. In this study, we use the term "engagement" to define the interaction that LSI in farmland has with smallholder farmers, and

their inclusion or exclusion in the former's investment operations. This interaction may include input, market, credit and training support.

2. Engagements between large-scale investors in farmland and the smallholder farmer

Since the colonial era, engagements and relationships between large-scale agricultural land investors and smallholder farmers have always been treated with suspicion. During the colonial period, colonial governments encouraged settlers to drive local smallholder farmers off their land. They redrew boundaries and many were forced into marginal lands unsuitable for agricultural production. Due to the loss of livelihoods, many involuntarily become farm labourers for the very same colonial masters who drove them off their land. A similarity is painted by some scholars (Kugelman & Levenstein 2009; Smaller & Mann 2009) between the forcible dispossession of land in the colonial era and the current wave of LSI in farmland.

With this comparison given in the literature between colonial-era farmland investments and current LSI in farmland, there is increasing concern that these investments are more detrimental than beneficial to the smallholder farming communities in Africa. Nolte and Subakanya (2016) note that the degree of involvement or inclusion of smallholder farmers in the investor's farming operations has implications for the former's agricultural performance. These authors identified four points of contact necessary for the inclusion of smallholder farmers in the investor's operations. White *et al.* (2012) further note that the terms of inclusion will determine whether the smallholder farmers will be included or not and, if included, whether this inclusion will affect them positively or negatively. A look at the history of engagement dynamics in Zambia compares closely with the present-day scenario.

Since the colonial period, engagement between the LSI in farmland and smallholder farmers has largely been through four different types of farming models, namely plantations, individual large-scale commercial farming, contract farming and out-grower schemes. Under the plantation farming model, the investor usually grew one main cash crop and engaged with local communities through the provision of wage employment. In such a model, grazing land as well as land used by women and new immigrants in a community was vulnerable to takeover by plantations (Smalley 2013). Similarly, in the independent large-scale commercial farming system, the relationship between the investor and the smallholder farmer was mainly that of employer and worker, in terms of which smallholder farmers would seek seasonal or permanent employment at the large-scale farming entity to augment their incomes. However, independent large-scale commercial farms created more local linkages than plantations (Smalley 2013). With contract farming, the investor entered into an agreement, either verbal or written, with the local farmers to grow a particular crop and to supply produce to a buyer. Contract farming had a couple of variants, such as the nucleus-plasma models, with several out-grower farmers augmenting production at the central estate. In the contract farming model, the investor usually provided inputs and services on credit to the contracted farmers.

3. Objectives and scope

The main objective of this paper was to analyse the nature and type of linkages that LSI in farmland have with smallholder farmers and to measure the impact on smallholder agricultural production. Based on a study undertaken in Zambia in 2014 and 2015, and using evidence drawn from three LSIs in farmland, the paper provides an in-depth analysis of the different types of engagements and linkages between LSI in farmland and smallholder farmers, and explores the potential of such investments to unlock smallholder agricultural production.

4. Methodology and data sources

The study gathered evidence from three case studies in Zambia, namely Africa Crops Limited (ACL) in Choma district, Amatheon Agri Zambia Limited (AAZL) in Mumbwa district, and Central Africa Farming (CENAFARM) in Mkushi district. Interviews with investors and managers of investment operations were conducted in order to understand the operations of these investors and their relations with smallholder farmers. Zambia is one of the countries that has been in the limelight in terms of LSI in farmland due to its investor-friendly policies, and this made it an interesting case to study. The existence of a nationally representative household survey also made it easier to choose Zambia as place of study, as reliable data is not easily available in many African countries.

Qualitative primary data was collected through unstructured interviews with key informants such as farmer leaders, extension workers, local authorities, various government officials, and district agricultural coordinators of the Zambia National Farmers' Union (ZNFU). These interviews were meant to solicit insights into the farming operations of LSI in farmland and to report on relations between these and the smallholder farmers. Government officials, including those from the Zambia Development Agency, were able to provide insights into the general agricultural investment process and land tenure issues. Unstructured interviews were also held with investors and these were meant to solicit information on their farms and general farming activities; farm establishment and land acquisition; production models and linkages with smallholder farmers; marketing activities and employment; and corporate social responsibility activities. Focus group discussions (FGDs) were held with groups of farmers in each of the study areas to gather their opinions regarding the presence of the investors. These were assembled through the ZNFU coordinators, and each group had between six and 12 participants. These participants were drawn from the smallholder farmers within the vicinity of the investors.

For secondary data, the study utilised data from the Rural Agricultural Livelihoods Survey (RALS) for 2015. The RALS is a nationally representative survey conducted by the Ministry of Agriculture and Livestock (MAL) in collaboration with the Central Statistical Office (CSO), with technical support from the Indaba Agricultural Policy Research Institute (IAPRI) and Michigan State University. The RALS sample comprised 442 standard enumeration areas (SEAs) with 20 households drawn randomly from each SEA, making a total of close to 9 000 households.

4.1 Analytical methodology

Using the 2015 Rural Agricultural Livelihoods Surveys dataset, the study made use of propensity score matching (PSM), using the nearest neighbour approach, to estimate the treatment effect of the LSI on smallholder farmers. A comparison was drawn between two similar groups of smallholder farmers, one group who were included in the investor's farming operations (engaged) and the other who were not included. We first identified those districts that had LSIs in farmland and, from these, isolated the ones in which these investors deliberately involved the smallholder farmers in their farming operations (engaged), as well as those that did not. Smallholder farmers who were deliberately engaged thus serve as the treatment group and those who were not engaged are the control group. An analysis of the performance of the smallholder farmers was then made between these two groups of smallholder farmers. In identifying the engaged and non-engaged farmers, we made the assumption that, if the investor includes the smallholder farmers in the district in his farming operations through the out-grower scheme, this implies that the farmers in that district are engaged. However, this does not necessarily mean that all smallholder farming households are included, as the investors have certain criteria when choosing whom to include in their out-grower schemes. From the interviews with the investors, we knew that two of the three investors (AAZL and CENAFARM) included smallholder farmers through the out-grower schemes. For the purpose of this study, we

adopted the definition of smallholder farmers used by the government of Zambia as those farmers cultivating between 1 ha and 20 ha of land.

4.2 The propensity scoring method

In non-experimental research designs, assignment to programme participation (treatment) is often non-random (Winters *et al*. 2010), and this can lead to biased estimates of programme impact due to self-selection bias. Apart from treatment status, it is possible that the treated and non-treated may differ in other characteristics that affect both participation and the outcome variable of interest (Winters *et al*. 2010). This means that the treated and non-treated do not have the same probability of participation. There thus is a need to employ certain techniques to ensure that the correct counterfactual is identified.

Propensity score matching (PSM) is identified in the literature as one such method that can be used to overcome the problem of the missing counterfactual (control group). This is because it enables us to create conditions similar to a randomised study. PSM uses the probability of participating in the treatment, based on observed different characteristics, to construct a counterfactual. This probability (score) is then used to match participants to non-participants, and a comparison of the average difference in desired outcomes between the two groups is then made in order to calculate the treatment effect. In its computational work, PSM drops some observations that fall outside the region of common support (the area where the probability score distribution for the participants and non-participants overlap) to ensure that only those with similar scores are matched. This increases the prospect of having sensible comparisons, thereby curtailing bias in the programme impact (Khandker *et al*. 2010). PSM therefore allows the selection of a counterfactual that looks like the treatment group in every way except for programme participation (Ravallion 2003). This makes it possible to measure the treatment effect using PSM in non-randomised studies (Ravallion 2003) as if it were in a randomised study.

Theoretically, the probability, P, of participating in the programme based on observed characteristics, X, is calculated as follows:

$$P(X_i) = \text{Pr}(T_i = 1|X_i)\ 0 < P(X_i) < 1, \tag{1}$$

where X is a vector of pre-intervention covariates and T denotes the treatment status, taking a value of 1 with treatment and 0 with no treatment.

In order to estimate the average treatment effect on the treated (ATT), we first calculated the propensity score P(X) on all observed covariates that jointly affect participation and the desired outcome, gross value per hectare of crops. Gross value per hectare of maize was also calculated to check for consistency in the results. Maize is the staple crop of Zambia and is predominantly grown by smallholder farmers. Once the propensity scores were calculated, the region of common support was identified. The statistical software used (Stata) easily calculates this and drops all those observations that fall outside the region of common support. The treatment and control groups were thus matched on the basis of the P scores, using the nearest neighbour technique.

We then estimated the ATT estimator to find the impact of engagement on the smallholder farmers who were engaged. According to Ravallion (2003), the generic PSM estimator for ATT is presented as:

$$\Delta \bar{Y} \sum_{j=1}^{T} \omega_j (Y_{j1} - \sum_{i=1}^{C} W_{ij}\ Y_{ij0}), \tag{2}$$

where Y_{j1} is the post-treatment outcome variable for the jth observation/household, Y_{ij0} is the outcome indicator of the ith non-treated matched to the jth treated, T is the total number of treatments, C is the total number of non-treated households, ω_j are the sampling weights used to construct the mean impact estimator, and W_{ij} are the weights applied in calculating the average outcome variable of the matched non-participants.

ATT gives the average effect (impact) of the treatment on the group that was exposed to treatment. With this estimator, it is possible to see by how much the investors affected the gross value per hectare of the crops of the smallholder farmers who were engaged.

5. Results and discussion

We noted earlier that, historically, smallholder farmers have been engaged by LSI in farmland through four models (plantations, individual large-scale commercial farming, contract farming and out-grower schemes). The results from our study indicate that these are still applied by contemporary LSI in farmland, as depicted in the subsequent section.

5.1 Dynamics of engagement by the investors

Africa Crops Limited (ACL), located in Choma district in the southern province of Zambia, started its farming operations in 2008. Its farm model incorporates tenant farming. It has joint ventures with tenant farmers (large-scale commercial farmers) of different nationalities, many of whom are former Zimbabwean farmers who migrated to Zambia following the controversial fast-track land reform programme in Zimbabwe (Chu 2012). Interviews with ACL management revealed that the investor does not have a deliberate strategy for engaging with smallholder farmers. Interaction with them is only through the provision of permanent and seasonal labour. Although this is the case, management advised that the company does have some social corporate responsibility programmes that are benefitting smallholder farmers. ACL has established a sister company, Green Solutions, a buying-and-selling company that buys farm inputs and shares the sales discounts with the farmers. This, however, is different from what emerged from the focus group discussions. The smallholder farmers said that they did not get any direct benefit from ACL or Green Solutions, although they could get seasonal employment with the investor.

According to ACL, at the time of the study the investor employed about 1 700 people from local communities on all its farms (including those in two other districts), and up to about 3 000 people in peak season. There is a strong emphasis on social responsibility, with each farm supporting up to 100 people and providing schools, health centres and living quarters. In addition, ACL management also pointed out that the company maintains the roads in their area throughout the year, a role which it has taken over from the local district council. This model is a stark contrast to that of CENAFARM.

CENAFARM, established in 2009, is located within the 77 000 ha Mkushi farm block, in Mkushi district in Zambia's central province. This farm block was established in the 1950s by the then colonial government for European tobacco farmers (Woode *et al.*, in Chu 2013). CENAFARM has built a vertically integrated platform comprising core commercial farming–processing hubs, surrounded by smallholder out-grower schemes. This model is based on skills transfer and market and/or service provision to the surrounding smallholder farmers. By pursuing this model, CENAFARM hopes to be able to tackle the bottlenecks that impede smallholder agricultural production.

Interviews with CENAFARM management revealed that the investor engages with smallholder farmers through its subsidiary company, called Agri-enable. According to Selby (2011), Agri-enable seeks to integrate smallholder agriculture into the formal marketplace. By fostering the creation of

commercial hubs that will help unlock bottlenecks, such as poor access to input and output markets, technologies, credit and extension services, and reduce inefficient production techniques, which keep smallholder farmers locked in a vicious cycle of poverty, Agri-enable seeks to improve the condition of the smallholder farmers in its vicinity. At the time of the interview, Agri-enable had established an out-grower and service-provision scheme for smallholder farmers that included the sale of farm inputs, processing and purchasing, including the purchasing of smallholder output for cash or exchanging it for inputs of an equivalent value, and the provision of technical assistance. Agri-enable also has demonstration plots where lead farmers are trained and they, in turn, train other follower farmers. CENAFARM partners with established experts in this regard. For example, it has partnered with the Conservation Farming Unit (CFU) in transferring conservation agriculture techniques to small-scale farming communities in Zambia. This was also confirmed by the districted agricultural coordinator for ZNFU. This model is similar to that of Amatheon Agri Zambia Limited (AAZL).

Amatheon Agri Zambia Limited (AAZL) is located in Mumbwa district, which lies in the central province, about 150 km west of Zambia's capital city of Lusaka. AAZL was established in 2012 and is a commercial, large-scale irrigated farming investment that directly manages its own farming operations. Its business strategy is based on a nucleus-plasma model. It has established an out-grower scheme, targeting to engage 10 000 smallholder farmers in its vicinity. According to the company management, the company's unique out-grower scheme involves four parties, namely AAZL, a local bank called ZANACO, a local nongovernmental organisation (NGO) called Musika, and the smallholder farmers themselves. In this quartet arrangement, each of these four parties has a critical role to play in the out-grower scheme.

The local NGO, Musika, which focuses on stimulating private sector investment in the smallholder market, provides the lead in training the smallholder farmers in different production skills. Smallholder farmers are also trained in business management in general, as well as in farming as a business. The training programme is rolled out through field facilitators and lead farmers, who are trained and who, in turn, train other farmers. AAZL also partners with the CFU in providing training to its local farmers on conservation-farming techniques.

The management of AAZL revealed that another important role played by the company is facilitating access to credit and to input and output markets. The investor offers marketing contracts to smallholder farmers and has a partnership with ZANACO, which provides credit to the smallholder farmers. In this contract-farming arrangement, AAZL plays a brokering role for finance and takes 50% of the risk, which it shares with ZANACO.

Mobile selling units established by AAZL, where local farmers can buy inputs, ease the drudgery of having to travel to and from markets in the nearest town, which is Mumbwa (more than 50 km away). There are also some fixed and semi-mobile output market depots, where contract farmers can sell their produce. Like the input-selling units, these depots are open to anyone and not restricted to the out-grower farmers.

AAZL offers competitive, market-related prices. It uses a pricing system that takes into account the distance between the nucleus farm and the collection point. For example, as of mid-2016, the company would buy a 50 kg bag of maize for 100 Zambian Kwacha (ZMK) if sold at the parent depot. The price reduces to 95 ZMK for sales at a 30 km radius and 90 ZMK for sales at a 70 km radius. Table 1 below provides a comparison of the prices of maize and soya (the two major crops that AAZL buys from smallholder farmers) in Mumbwa district. For soya, AAZL buys a 50 kg bag for 240 ZMK.

Table 1: Wheat and maize prices (ZMK) in Mumbwa district, June 2016

Commodity	Average market price in ZMK/ton	AAZL price in ZMK/ton
Maize	1 700	2 000
Soya (Kabwe)[4]	4 600	4 800

Source: Zambia National Farmers Union and interview with AAZL management

5.2 Impact of engagement on smallholder farmers

One of the major arguments presented by proponents of LSI in farmland is that these investors help to unlock bottlenecks in smallholder agricultural production by improving access to input, output and credit markets, as well as improving access to extension services through the diffusion of technical know-how. In this regard, the impact is likely to be greater and positive if the smallholder farmers are deliberately engaged and included in the investor's farming operations. A look at the mean statistics of key production variables gives some insight into the characteristics of the treatment and control households (Table 2).

5.2.1 Characteristics of sampled households by investment district

The results in Table 2 indicate that the sampled households in the three investment districts had only small differences in demographic characteristics (household size, education level of household head, age of household head and percentage of male household headship). However, there were large differences in most of the production variables, with households in the Mkushi and Mumbwa districts showing higher crop gross value, maize gross value, maize yield and mean basal and top fertiliser usage per hectare of land. When these descriptive characteristics are aggregated by treatment (Table 3), some of these differences are insignificant.

Table 2: Descriptive characteristics of sampled households by district

	Investment district		
Variable description	Choma	Mkushi	Mumbwa
Household size	7	6	7
Head of household education level (years)	7.6	6.2	6.6
Age of head of household (years)	49.85	47.2	49.43
% male-headed households	82.8	83.6	85
Crop gross value (ZMK/ha)	8 123.23	9 574.97	11 139.97
Maize gross value (ZMK/ha)	6 486.54	7 364.35	7 935.67
Maize yield (kg/ha)	2 117.35	2 996.4	2 472.94
% using hybrid maize seed	75	90.77	89.13
Mean maize seed (kg/ha)	21.76	24.14	23.36
Mean basal fertiliser (kg/ha)	90.2	204.93	108.82
Mean top fertiliser (kg/ha)	91.62	201.37	114.91

Source: Author's own computations from RALS database, 2015

5.2.2 Descriptive statistics of key production variables by treatment

The results of the t-tests for comparison of means (Table 3) indicate that, overall, smallholder farmers who were engaged in the farming operations of LSI in farmland had higher gross value per hectare of crop, higher gross value per hectare of maize, higher mean yield of maize, higher usage of hybrid maize seed and higher mean fertiliser usage than their counterparts who were not engaged by the investor. Mean maize yield, usage of hybrid maize seed and mean basal fertiliser usage were highly significant at the 1% level of significance, whilst mean maize seed and mean top fertiliser per hectare were significant at 5%. However, gross value per hectare of crop and gross value per hectare of maize were statistically insignificant.

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[4] The price for Mumbwa was not available, hence the district price was estimated based on the price in the neighbouring district, Kabwe.

Table 3: Mean statistic of key variables between engaged and non-engaged farmers in investment and non-investment districts

Variable	Variable mean			
	No engagement	Engagement	Difference (engagement - no engagement)	t-value
N = 244	N = 87	N = 157		
Crop gross value (ZMK/ha)	8 196.75	11 035.68	2 838.94	1.4223 (0.1562)
Maize gross value (ZMK/ha)	6 636.76	8 411.23	1 774.47	0.9671 (0.3345)
Maize yield (kg/ha)***	2 089.25	2 670.56	581.31	2.6873 (0.0077)
% of farmers using hybrid seed***	75.10	89.84	14.74	90.2840 (0.0000)
Mean maize seed (kg/ha)	21.76	23.69	1.93	2.5003 (0.0131)
Mean basal fertiliser (kg/ha)***	98.09	153.50	55.41	2.6881 (0.0077)
Mean top dressing fertiliser (kg/ha)**	102.19	155.66	53.47	2.5898 (0.0102)

Source: Author's computations from RALS (2015)
*** significant at 1%, ** significant at 5%, * significant at 10%, P values in parenthesis

The higher usage of hybrid seed and fertilisers by the engaged smallholder farmers could be because the investor facilitates ease of access to these inputs through the provision of input packages or simply by creating input markets, as was the case with AAZL and CENAFARM. This would then explain the subsequent higher maize yield recorded by farmers who are engaged. The higher mean maize yield could also be because the farmers are using better farming techniques, in which they are trained by the investor. We noted in preceding sections of this paper that both CENAFARM and AAZL provide training to their farmers in certain agricultural production techniques.

5.3 Impact on crop production

The results noted above, based on the t-tests, paint an interesting picture about the two groups of farmers and indicate that farmers who are engaged have better agricultural performance than those who are not engaged. These results, however, do not imply causality. A quantitative estimation of the impact of engagement on crop production as well as on the production of maize by the smallholder farmers helped to check for a causal relationship. A binomial logit model was used to estimate the average treatment effect on the treated (ATT), using the nearest neighbour technique of the propensity score-matching method.

The results (Table 4) indicate that the logit model used to generate propensity scores was correctly specified, as indicated by the insignificant Hosmer-Lemeshow (H-L) test for goodness of fit. The model chi-squared test is also significant, as indicated by a p-value of 0.04. The estimated propensity scores also met the region of the common support condition, as shown in Figure A1 in the appendix, which illustrates significant overlaps between the treated and control groups. Figure A2 (also in the appendix) also shows the distribution of the propensity scores. Table 5 shows the results of the estimation of impact.

Table 4: Logit regression results

Variable description	Parameter estimates	Marginal effects
Intercept	1.0058*** (0.3801)	
Farm size (ha)	-0.0991*** (0.0384)	-0.0219*** (0.0081)
Household size	0.0121 (0.0444)	0.0027 (0.0098)
Head of household education level (years)	-0.0199 (0.0244)	-0.0044 (0.0045)
Model chi square	8.31 (p = 0.0401) Log-likelihood -152.87838	
Hosmer-Lemeshow chi square	5.42 (p = 0.7120)	
Pseudo R²	0.0264	
N = 241		

Source: Author's computations from the RALS 2015 database
*** significant at 1%, ** significant at 5%, * significant at 10%, standard errors in parenthesis

Table 5: Average treatment effect on the treated

ATT estimation with nearest neighbour matching method (random draw version) Bootstrapped standard errors					
Outcome variable	**n. Treatment**	**n. Control**	**ATT**	**Standard error**	**t-value**
Crops gross value (ZMK/ha)	155	61	0.003	0.001	2.937
Maize gross value (ZMK/ha)	155	61	0.002	0.001	3.148

Source: Author's own computations from the RALS 2015 database

Contrary to our *a priori* assumptions, the results indicate that there was almost no change (0.3%) in the gross value per hectare of crop for those farmers who were engaged. This is inconsistent with what the results from the t-tests indicated. Although the results from the comparison of means showed that those farmers who were engaged have better agricultural performance than those who were not engaged, the results from the estimation of impact indicate that there was no difference in crop production between these two groups of farmers. The same is also true when we look at the impact in terms of maize production. The impact, at 0.2%, is quite negligible. This could be due to the fact that smallholders in Zambia mostly grow maize, a staple food crop that receives support from the government to boost its production. As such, whether or not farmers are engaged by the investor makes no difference.

6. Conclusion

We have seen that not all investors "mind their own business", but there are some who do engage with smallholder farmers in their farming operations. We noted that those smallholder farmers who are engaged by LSI in farmland show significantly higher usage of hybrid seed, and basal and top dressing fertiliser per hectare, and consequently have a higher gross value per hectare of crop and per hectare of maize, along with higher maize yields. The impact of the engagement is that farmers have 0.3% more gross value per hectare than those who are not engaged, which can be considered to be negligible. These results are inconsistent with our *a priori* assumptions, namely that smallholder farmers who are engaged perform better than those who are not engaged by the investor in their farming activities. Although we noted earlier in this paper that the LSI in farmland that involves smallholder farmers in its farming activities facilitates the unlocking of the bottlenecks faced by the latter by diffusing knowledge, facilitating access to credit and improving access to input and output markets, this does not translate into improved crop production. We therefore conclude that engaging smallholder farmers has no disruptive effects on their farming activities.

7. Recommendations

We have seen that LSI in farmland facilitates better access to inputs, credit and knowledge, and that there is a positive, albeit negligible, impact on smallholder crop production for those smallholder farmers who are engaged. In this regard, recipient governments may wish to put in place farming support programmes that complement whatever little positive externality may be emanating from the inclusion of smallholder farmers in the investor's farming operations. Even though LSI in farmland may contribute to unlocking bottlenecks in smallholder farming activities by facilitating improved access to markets and technical knowledge, the prerogative still lies with recipient governments, and they should not relegate this responsibility to LSI in farmland.
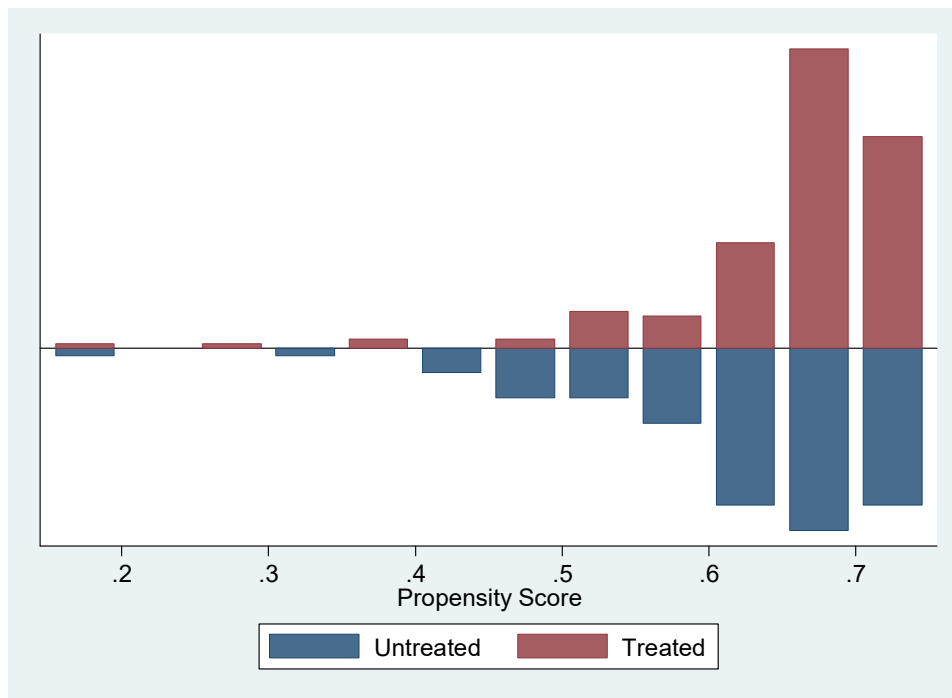
Whilst this study has tried to estimate the impact of the nature of engagement and the inclusion of smallholder farmers by LSI in farmland in its farming activities, there still remains a need for further studies to see if this positive impact translates into increased incomes and poverty reduction. It would also be important to estimate the impact over a long period of time to pick out any inter-temporal effects. The impact of the investors' activities on local economic development will also need to be quantified for policy advice.

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Appendix

Figure A1: Propensity score distribution and region of common support
Source: Author's computation from the RALS 2015 database
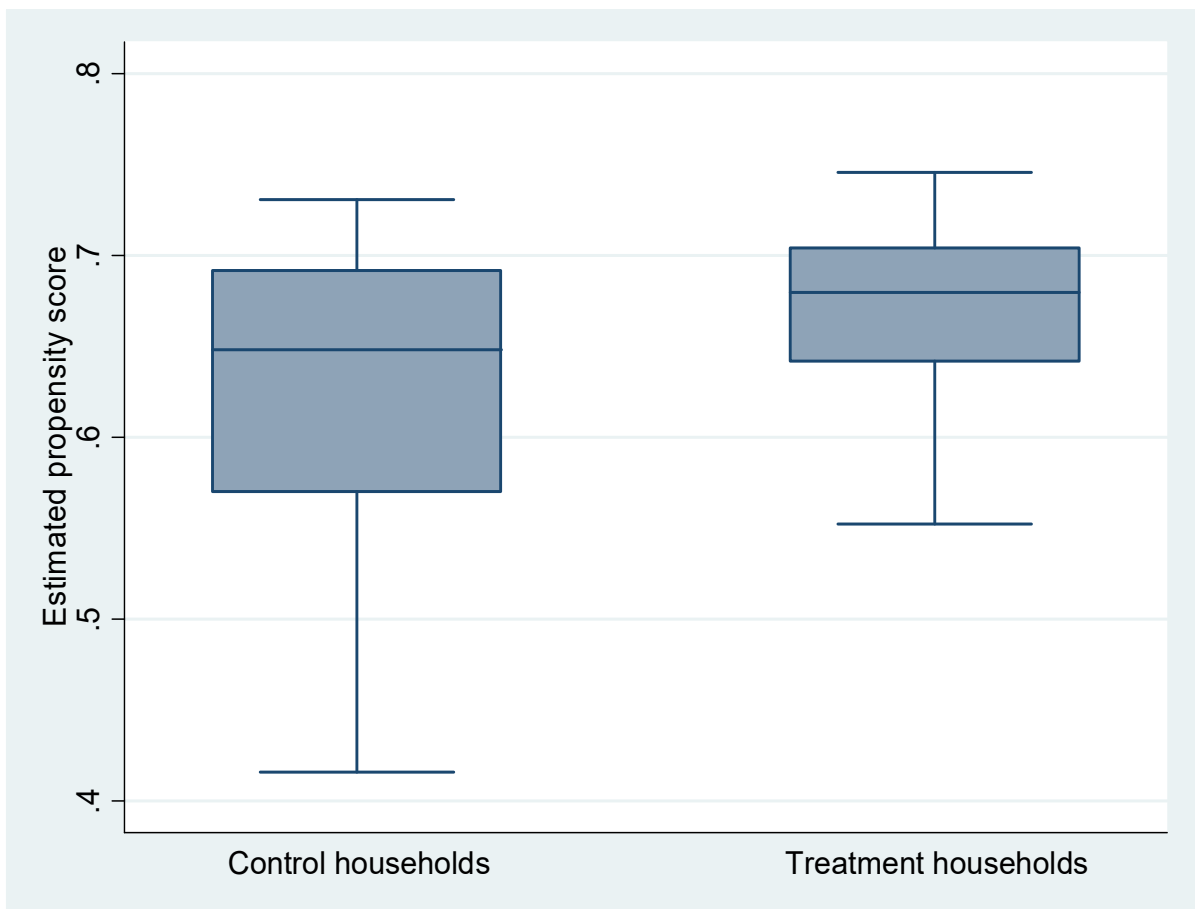
Figure A2: Propensity score distribution
Source: Author's computation from the RALS 2015 database