Do the land poor gain from agricultural investments? Empirical evidence from Zambia using panel data

Pelle Ahlerup and Sven Tengstam*

Department of Economics, University of Gothenburg

Abstract

In the context of the global land rush, some portray large-scale land acquisitions as a potent threat to the livelihoods of already marginalized rural farming households in Africa. In order to avoid the potential pitfall of studying a particular project that may well have atypical effects, this paper systematically investigates the impact of all pledged investments in the agricultural sector on commercial farm wage incomes for rural smallholder households in Zambia 1994–2007. The results, which are robust to both placebo tests and a variety of different specifications and time frames, show that agricultural investments are associated with a moderately positive effect, but only for households with a relative shortage of land.

Keywords: Agriculture, Investments, Land, Income, Sub-Saharan Africa

JEL-codes: Q12, O13, O16, N57

---

* Pelle Ahlerup: University of Gothenburg, Department of Economics, Box 640, 405 30 Gothenburg, Sweden. E-mail: Pelle.Ahlerup@economics.gu.se. Sven Tengstam: University of Gothenburg, Department of Economics, Box 640, 405 30 Gothenburg, Sweden. E-mail: Sven.Tengstam@economics.gu.se.

1 Introduction

Sub-Saharan Africa (henceforth, Africa) has gradually become a more democratic, peaceful, and stable region, characterized by higher economic growth and social improvement. After decades of relatively scant investor interest, the net inflow of foreign direct investments to Africa has increased dramatically since the turn of the millennium (UNCTAD, 2016), but also domestic investments have increased. There is a growing consensus that commercial agriculture has a strong potential in this part of the world (World Bank, 2013). For the populations of the still largely rural and agriculture-dependent African countries, investments in agriculture have the potential to deeply influence economic development. This paper studies the impact of agricultural investments on commercial farm wage incomes for land-poor smallholder households in Zambia.

The number and scale of land acquisitions in developing countries have accelerated dramatically in the last decade, yet estimates of the number of hectares involved vary greatly, from 15–20 million hectares to over 200 million hectares (Schoneveld, 2014). In Zambia alone, in 2011 it was estimated that the government was planning and marketing at least 1.5 million hectares of land for agricultural purposes (Oakland Institute, 2011). Considering that Zambia in 2009 had about 9 million hectares of land suitable for agriculture, with 1.7 million hectares under cultivation (GRZ 2009), this is a high figure, and an illustration of how agricultural investments often are highly sought after by developing country governments. In contrast to this quite positive view of the process of large-scale land acquisitions, many NGOs view it as a threat to the livelihood of the already poor or marginalized (see, e.g., Richards 2013).

Zambia has a dual land system of both communal and private land. The pro-market 1995 Land Act facilitated the transformation of communal to private land, and also enabled foreigners to own land. Brown (2005) analyzes the effects of this reform and finds that local elites and foreign investors, but not the poor and marginalized, had benefited. The marginalized in Zambia may have gotten the short end of the stick after the pro-market land reform, but it is not well understood whether they are also on the losing side when it comes to agricultural investments. Most investments in agriculture in Zambia are made on private land through the purchase of existing farms. One reason for this is that commercial entities own a lot of unused land that is generally accessible by road and rail making it a type of land that is both of interest to and available for investors. New money into an already existing farm makes expansion and modernization possible (FAO, 2012).

The global process of large-scale land acquisitions has gained considerable media attention. The content of these deals as well as their potential outcomes have kept many NGOs and development agencies occupied, and some have been deeply concerned. Land acquisitions are often portrayed as a threat to the livelihood of rural households, a group that make up a fair share of the poor and vulnerable in Africa. Critics call these deals “land grabbing” or “water grabbing,” and evoke arguments about neo-colonialism. In contrast, supporters see a potential for much needed foreign capital and know-how. In light of all of this, it is becoming increasingly important to further our understanding of the actual economic effects for rural populations.

This paper focuses on a potential micro-level outcome from large-scale land acquisitions. Since these land acquisitions, and agricultural investments in general, mainly relate to the introduction or expansion of large-scale commercial farming, we hold that if the relatively poor rural households have anything to gain from these deals, it may be from an increase in wage incomes from working on commercial farms. These investments could also affect rural households through, e.g., displacement, rising land prices, employment opportunities in related sectors, improved infrastructure, technological diffusion, and spillover effects in a wide sense, but these effects are beyond the scope of the present paper. Zambia makes an interesting case as it has attracted large quantities of agricultural investments and is planning for even more. The question we ask in this paper is thus how the wage incomes earned by land poor smallholder households from commercial farms in Zambia are affected by agricultural investments.

The casual observer may think that the gains for smallholders in general are obvious, but that is not the case. There are good arguments and findings from case studies that point in the opposite direction, as described in the review of findings in the related literature in Section 2.1. New firms may drive old firms out of the market, mechanize rather than employ, change to less labor-intensive crops, pay mediocre wages, hire workers from other areas, hire only seasonally, and only hire more educated workers, who are less likely to come from land-poor households.

We focus on employment effects for the land-poor households for three reasons. First, in Zambia, as in many poor countries, landholdings are very unequally distributed (Sitko and Jayne, 2014), and access to land and poverty are strongly correlated (Jayne et al., 2009). Second, it has been argued that these households are the ones most at risk in the global land rush. Third, the employment effects may differ across households depending on their access to land. There are theoretical arguments suggesting that households with a relative shortage of land could benefit more than others from the expansion of job opportunities. Land-abundant households can produce more on their own farms, which implies less of a need to seek alternative sources of income, and, the larger the household, the lower the marginal productivity per worker for a given plot size. We investigate the validity of this reasoning by focusing on whether the effects of agricultural investments vary with the individual households' access to farmland.

To avoid pitfalls from analyzing only one or a few, possibly atypical, investments, a strategy used in most related literature, we use data on all pledged commercial agricultural investments gathered by the Zambia Development Agency (2014). To assess the impact on rural households, we use three waves of panel data from the Supplemental Survey to the Post Harvest Survey (PHS/SS) in Zambia. Our results, which are robust to a series of robustness and placebo tests, show that agricultural investments have a positive impact on the wage incomes that smallholder farmers earn from commercial farms in rural Zambia, but only for households with a relative scarcity of land. This means that while the overall effect of agricultural investments is uncertain, they indeed have the potential to benefit those who need it the most, i.e., the rural land poor.

The remainder of this paper proceeds as follows. In Section 2, we discuss the literature related to large-scale land acquisitions and the land situation in Zambia. In Section 3, we present our main empirical indicators. The empirical framework is discussed jointly with our empirical results in Section 4, and Section 5 concludes the paper.

2 Background

2.1 Large-scale land acquisitions

Deininger (2011) and Deininger et al. (2011) estimate that large-scale land acquisitions covering a total of 45 million hectares to be leased or purchased in developing countries have been planned, negotiated, or implemented since 2000. In fact, Anseeuw et al. (2012) estimate the figure to be as high as 203 million hectares. As pointed out by Schoneveld (2014), the different figures either relate to deals planned, under negotiation, or signed, or deals actually implemented, depending on the source, wherefore the higher figures in some studies overstate the amount of land on which new investors have started to operate. The figures can also be misleading as a lack of officially maintained data of good quality has led to a reliance on media reports suffering from selection bias (Schoneveld, 2014). Yet, also more moderate estimates are on a scale that suggests that these land deals should have the potential to have real effects on the economic structure of target countries. However, when Cotula et al. (2014) study large-scale land deals in Ethiopia, Ghana, and Tanzania, they find, e.g., that in all three countries the scale of land acquisition is small in relation to the available land suited for agriculture, and also that there has been limited implementation.

Looking at the demand side of the land acquisition process, three main drivers are mentioned in the literature. First, after the hike in food prices in 2007–2008, also rich food-importing countries started to be concerned about food security. Second, in response to global warming, developed countries have made commitments to switch to biofuels, and these cannot be produced without making use of land and water. Third, the global financial crisis of 2008 in combination with expectations of rising food prices as well as improvements made in the business environment of target countries have made investment in agricultural land more attractive. The expectations of rising food prices are in turn caused by rising income levels and an increased demand for land for biofuel production, but also by climate change, as this may entail increased land degradation and water scarcity. Western European countries account for about 40 percent of the total investments, but also countries in the Middle East (such as Saudi Arabia), Africa, East Asia (such as China and South Korea), and North America have been active (Arezki et al., 2015; GTZ, 2009; Cotula et al., 2009).

Looking at the large-scale land acquisitions in recent years, there are clear patterns in investor identities and target countries. Most deals involve private investors supported by their home government, but there is also direct government involvement in the form of outright land acquisition by government agencies and state-owned enterprises (Cotula et al., 2009). Significant characteristics of the investor countries include large populations and high food import dependence (Arezki et al., 2015). Others argue that investor countries tend to have a combination of a relative abundance of financial means and a shortage of land suitable for agriculture due to unfavorable climatic conditions, population growth, or urbanization (GTZ, 2009). In his study of farmland investments in sub-Saharan Africa, Schoneveld (2014) finds that the majority of investors are from Europe or North America, and that investments, rather than being driven by food security concerns, often are speculative and caused by biofuel demand and favorable trade conditions for high-value cash crops. The increased number and size of deals following the 2007–2008 price increases and the 2008 financial crises (Arezki et al., 2015) are consistent with a concern for food security but also indicate that some investments were made for more speculative purposes, or due to a drying-up of alternative investment projects. Food prices have fallen lately (FAO, 2015), but it remains to be seen whether this fall is temporary or reflects a more long-term development.

These land and water deals often target developing countries, especially countries in Africa or Southeast Asia. The main benefits to the target countries are expected to be mediated by improved access to technology, an upscaling of the physical infrastructure, and improved employment opportunities (Cotula et al., 2009). At the same time, the process has led to increased pressure on land with good irrigation possibilities and located close to markets. Arezki et al. (2015) find that the share of investments targeting Africa accounts for about 50 percent of the area involved, and the agro-ecological potential in the target country is an important driver, while the yield gap (the difference between actual and potential yield on areas already cultivated) appears not to be. They also find that more deals are undertaken if there is weak land governance, but that, when other factors are held constant, there is no robust effect of other measures of the quality of formal institutions. This is in contrast to the findings in Bujko et al. (2015), who use a different methodology and find that higher levels of corruption are associated with a higher number of land deals.

Many previous studies on the effects of large-scale land acquisitions are either qualitative case studies or investigate the impact of deals known to have been associated with considerable displacement of population segments that only held customary land rights. In terms of labor market-related outcomes, some studies have found projects that were not in full operation until several years after the deals were signed or that were labor-intensive initially but later became more mechanized, with a resulting drop in labor demand. Others have identified projets where investors changed crops to less labor intensive ones, which also leads to reduced labor demand, as well as cases where new jobs were not filled by local residents but by workers from other areas or from abroad, and if there were jobs for local people, these were often short-term or seasonal and poorly paid. Some documented projects have also been associated with complete or partial loss of access to farm land for local populations, with detrimental consequences for food security, especially for the marginalized who had little land to begin with (see, e.g., FAO, 2012; Richards, 2013).

A clearly negative outcome of large-scale land acquisitions found in some studies is inter- and intra-community violent conflict (Cotula et al., 2014; Richards, 2013). A more typical finding is that of increased food insecurity. For instance, Shete and Rutten (2015) study the effects of a land acquisition on households in a relatively densely populated region of Ethiopia and find a loss of income and increased food insecurity for households that lost their customary farm- and grazing land. Yet, many studies on the overall effects come to conclusions that are not easy to reconcile. Recent studies on Ghana can serve as an illustration. Väth (2013) studies an investment in an oil plantation in Ghana, and while employment opportunities improved, the displacement compensation was insufficient, especially to households who had little land to begin with. Schoneveld et al. (2011) study a land acquisition made for biofuel production in Ghana and find increased rural poverty, especially affecting women and migrants, as it was made on customary land and therefore deprived households of their livelihood resources. Also for Ghana, Djokoto (2012) finds a detrimental effect of foreign investments in agricultural on food consumption. In contrast, in terms of employment effects, FAO (2012) finds that foreign investments in agriculture in Ghana contributed to more than 180,000 jobs from 2001 to 2008.

What there is more agreement on is that the promises and goals of many of the large-scale land acquisitions have not been met (Cotula et al., 2014; Richards, 2013). Because so many deals have proven unsuccessful or were not fully implemented in the first place, Deininger and Byerlee (2012) argue that there is a need for a mechanism to re-allocate land to entrepreneurs who are more productive.

2.2 Land and agriculture in Zambia

Zambia is relatively land abundant, yet less than a quarter of the suitable land is currently cultivated. Due to this in combination with low productivity, actual yields are in the range of 10–15 percent of the total potential yield (Deininger et al., 2011). The lackluster performance of the agricultural sector in Zambia is related to high production costs. For the case of maize, Deininger et al. (2011: 25) note that "In Zambia, large farms produce at a cost twice the world market price and only the protection provided by high transport costs allows them to turn a modest profit."

During the years as a British colony, there was an expansion of large commercial farms operated by white farmers on crown land. The land remaining for the native Africans was called native reserves, trusts, and, later, native trusts. During the years of "African socialism" under President Kaunda (1964–1991), crown land was renamed state land, and the state suppressed the market for land but allowed the chiefs to keep the control of the land in the native reserves and trusts "given" to them by the colonizers (Brown, 2005). With the 1995 Land Act, which was part of the pro-market reforms undertaken as a condition for debt restructuring, it was again possible to sell and buy land, also for foreigners. Land tenure in Zambia is now either communal or privately titled, i.e., there is a dual land system (Sitko, 2010). Chiefs or tribal community headmen control the allocation of customary land, and this land can be converted to private land for investors but cannot be sold. Jayne et al. (2009) discuss how chiefs, in principle, could allocate uncultivated customary land to the rural poor, but this land is mostly available in remote areas with little in terms of public goods or services making people less inclined to settle there and cultivate it

The most productive land is held as private land, which accounts for less than 10 percent of total land in Zambia and which can be sold, bought, and owned by both domestic and foreign individuals. It is mostly concentrated around major cities, productive farming areas, along the railway corridor between Livingstone and the Congolese border, and in the mining areas of the Copperbelt (Brown, 2005).[1] Foreigners can buy land, and investors can convert land in

[1] Zambia has a set of designated farm blocks to which they try to direct agricultural investments, but investors have shown little interest in this land (Deininger et al., 2011).

customary areas to leasehold if “the investor’s proposed use of the land is deemed to be of ‘community’ or national interest” (Brown, 2005: 87), but it is still costly for a smallholder to arrange for all documents needed to convert land. Brown (2005) concludes that the 1995 Land Act led to elite capture, land speculation, intra-community conflicts, and displacement and enclosures, sometimes with the chief’s consent. Though customary land cannot be sold, and chiefs cannot be officially compensated when land is converted from customary to private, some chiefs have been compensated with “palaces, vehicles, or cash” (Brown 2005: 98).

The enforcement of formal rules is currently weak, as noted by Nolte (2014) in a qualitative study on the land governance system in Zambia and its interaction with large-scale agricultural investments. She finds that the presence of a new actor, the investor, has altered the balance of power in favor of local and central authorities, and left local land users more marginalized. Another qualitative study of the issue of large-scale agricultural investments in Zambia is German et al. (2011). They explore the processes involved in these large-scale land transfers and argue that they are not a matter of a global “land grab” driven by the private sector. Rather, there is a supply-driven mechanism in which the government and local (customary) entities play an active role, motivated by a firm belief that economic development benefits from the involvement of and investments by the foreign private sector. They also argue that customary rights seldom are adequately protected in the context of land negotiations despite widespread legal recognition of these rights.

FAO (2012) investigates the impact of two large-scale investments in Zambia and finds evidence of some positive effects on the poor. In terms of labor market outcomes, jobs were created, but the number of jobs created was low relative to the size of the rural labor force, and while some skilled positions where created, the rural poor were more likely to take up low-paying jobs. A more recent quantitative study on Zambia, by Sipangule and Lay (2015), study the relationship between agricultural investments and productivity, fertilizer use, and wage-employment opportunities, but reveal no consistent effects on these variables.[2]

Zambian nationals are also heavily involved in investments in agriculture and land acquisitions in Zambia. Sitko and Jayne (2012, 2014) find that the group of emerging farmers with 20–200 hectares does not consist of smallholders expanding but rather of people from urban areas who have earned money and influence from working in the public sector. Emerging farmers operating on title land cultivate on average less than 30 percent of their total available land, which suggests that the employment effect per hectare owned on emergent farms is likely to be limited. Hichaambwa and Jayne (2012) report an increased commercialization of farming, in particular of maize, but households with little land do not seem to take part. Evidently, access to land influences people's choice of income sources and possibly also their diversification into labor work.

3 Data

3.1 Post-Harvest Survey

In this section, we motivate and describe our data on household wage incomes and other household-level characteristics. Our data on investments is described in Section 3.2. A set of additional control variables at the district level is discussed in Section 4.

[2] In contrast to the present paper, Sipangule and Lay (2015) do not study effects on the land poor.

Household-level data is drawn from three rounds of the Supplemental Survey to the Post-Harvest Survey (PHS/SS), conducted in 2001, 2004, and 2008 (CSO/MAL/IAPRI 2008). The supplemental surveys, carried out by the Central Statistical Office in conjunction with the Ministry of Agriculture, Food, and Fisheries and commissioned by the Food Security Research Project (FSRP), cover the incomes and livelihoods of small and medium-scale rural holdings. The surveys covered the same sample of roughly 7,000 households as the 1999/2000 Post-Harvest Survey. A sampling frame of smallholder farmers (cultivating less than 20 ha) in the rural areas of Zambia was used, and a household has to have at least some land to be included.

We have two income indicators. First, *commercial farm wage income* is the household real wage income from work on commercial farms. In the three waves of the PHS/SS, two percent of the households have such income. The median value among households that have income from commercial farm wage work is 2,110,000 kwacha. This is equivalent to about 1,100 USD (PPP) and slightly more than a third of Zambia's GDP/capita in 2009. Summary statistics for the income variables as well as for the other variables used are presented in Table 1, and more details on these variables and their sources can be found in Table A1 in the appendix. All incomes are in 2009 kwacha. Second, *smallholder farm wage income* is the household real wage income from work on smallholder farms. Six percent of the households have such income. The median amount for those who have income from this source is 100,000 kwacha. Hence, the typical income from work on smallholder farms is on an order of magnitude lower than the income from working on commercial farms.

Our main socio-demographic indicator is *hectares per HH member*, which is the number of hectares available for the household divided by household size. Available land refers to land either being cultivated or under fallow[3]. *Household size* is the number of persons in the household in the year prior to the survey. This number is adjusted to account for the fact that not all household members are considered part of the household during the entire year. For example, a person who was part of a household for only one month is included as 1/12 of a person. The average household size using this indicator is six persons, but there are instances of households reported to include more than 40 people. Most households have access to quite little land. The mean and median numbers of hectares available are 1.9 and 1.4, respectively. Per household member, the figures are 0.39 and 0.26, respectively. Finally, *household head level of education* is the household head's number of years of education, and *male household head* is a dummy for having a male household head.

[3] Ideally, it should include virgin land as well, but the PHS/SS of 2004 did not collect information on virgin land.

Table 1. Summary statistics

	N	Mean	Median	Std.dev.	Min	Max	N	Mean	Median	Std.dev.	Min	Max
			Long-term sample						*Short-term sample*			
Panel A: Individual level												
Commercial farm wage income (000s)	4490	35.34	0	374.41	0	10347.38	15368	51.77	0	462.99	0	12104.91
Hectares available	4404	1.90	1.42	1.80	0	19.75	15044	1.92	1.41	1.84	0	20
Hectares per HH member	4404	0.39	0.26	0.41	0	5.5	15044	0.39	0.26	0.43	0	11
Household head level of education	4496	5.09	5	3.70	0	18	15376	5.10	5	3.79	0	19
Household size	4499	5.92	6	2.88	0.5	30	15380	5.92	5.83	2.93	0.08	41
Male household head	4499	0.75	1	0.43	0	1	15380	0.76	1	0.43	0	1
Smallholder farm wage income (000s)	4491	20.58	0	163.25	0	3801.08	15368	18.11	0	176.11	0	6657.70
Panel B: District level												
Agricultural investments	4499	360.16	0	854.98	0	4852	15380	107.33	0	352.16	0	2893
Cropland	4499	10.04	7.58	8.25	0.52	30.26	15380	9.86	7.01	8.13	0.52	30.26
Electricity	4499	2.51	1.68	3.19	0	27.32	15380	2.52	1.68	3.18	0	27.32
Forest	4499	0.50	0.43	0.40	0.02	1.96	15380	0.51	0.43	0.41	0.02	1.96
Grassland	4499	0.07	0.03	0.08	0.00	0.38	15380	0.07	0.03	0.08	0.00	0.38
Log District area	4499	9.19	9.28	0.68	6.52	10.59	15380	9.19	9.28	0.68	6.52	10.59
Log District population	4499	11.55	11.63	0.45	9.92	12.73	15380	11.54	11.58	0.45	9.92	12.73
Log Light density	4499	-6.88	-6.56	1.85	-9.21	-3.00	15380	-6.87	-6.56	1.86	-9.21	-3.00
Non-agricultural investments	4499	376.18	73	895.18	0	9019	15380	108.75	0	438.47	0	8754
Railroad	4499	5.28	0	11.82	0	74.04	15380	5.17	0	11.70	0	74.04
Rainfall	4499	1033.64	1016.92	196.59	678.50	1413.33	15380	1035.87	1016.92	196.60	678.5	1413.33
Water body	4499	2.32	0.41	6.12	0.01	43.76	15380	2.46	0.41	6.68	0.01	43.76

Notes: The figures represent the weighted statistics for the data used in Table 2 (long term) and Tables 3─5 (short term). The numbers of observations are not weighted.

3.2 Investments

Our indicator for agricultural investment is a district-level measure of the number of workers that investors (foreign or domestic) state they will employ when they apply for an investment certificate from the Zambia Development Agency. From this agency, which issues investment certificates also for non-agricultural sectors, we have information on sector targeted by each investment, year the pledge was made, the size of the pledged investment in terms of intended investment amount and number of employees, and in which district the investment is located (Zambia Development Agency, 2014).[4] The figures in the data represent both start-up companies and investments in existing companies, a reflection of the fact that many commercial farms have a lot of unused farmland on which expansion is possible (FAO, 2012).

Our analysis looks at both short- and long-term effects, as these may differ. The effect may be increasing over time, as it has been argued that the full impact of large-scale land acquisitions may only be visible after a long time (Cotula et al., 2014). The effect may also diminish over time, as some case studies reported in FAO (2012) find that projects are labor intensive during the initial phase but become increasingly mechanized later on. When we look at long-term effects, the variable *agricultural investments* represents pledged investments in the agricultural sector 1994–2007 in total. Two of the districts, Lusaka and Ndola, are purely urban so therefore the PHS/SS does not include respondents from them and all investments pertaining to these two districts are excluded from both the short- and long-term analyses. We do not separate foreign

[4] Data on pledged investments from the Zambia Development Agency is also used by Kragelund (2009), who does not focus on agriculture, Jenkin (2012), who only presents descriptive statistics, and Sipangule and Lay (2015), who also combines this with data from PHS/SS but differ from the present paper in terms of focus as well as and empirical method.

investors from domestic, since domestic investors have played a prominent role in land acquisition in agriculture (see, e.g., Cotula et al., 2014), even though the media focus may have been on foreign investors, and many of the projects in our data are undertaken as joint ventures between Zambian firms and foreign firms. Since we focus on employment effects (measured as wage income from commercial farms), we hold that the number of employees is a more appropriate measure of the size of the investment than is the dollar value of the investment. During this period, i.e., 1994–2007, the total number of pledged agricultural investment projects was 237. The mean and median of the number of workers investors planned to employ in these projects were 109 and 50, respectively.

From 1994 to 2007, pledges where made for investments in 29 of the 70 districts used in our analysis. The average per-district sum of workers investors planned to employ over the period is 360; see Table 1. Among districts with positive values, the average and median are 825 and 332, respectively.

In order to investigate the short-term effects, we use five-year periods prior to each of the three waves of the PHS/SS. For each wave, *agricultural investments* represents pledged investments in the agricultural sector in the five years prior to the survey. *Agricultural investments* is measured during three somewhat overlapping time periods (1996–2000, 1999–2003, and 2003–2007). Positive levels of *agricultural investments* are recorded for 45 of the 210 district-period combinations, or slightly more than 20 percent. The district average number of employees planned for these projects is 107.3; see Table 1. Looking at district-periods with positive values only, the average and median numbers are 429 and 221, respectively. Though there is some persistence regarding the districts that are targeted by investments, there is also potentially useful variation, as can be seen in Figures 1a–c.

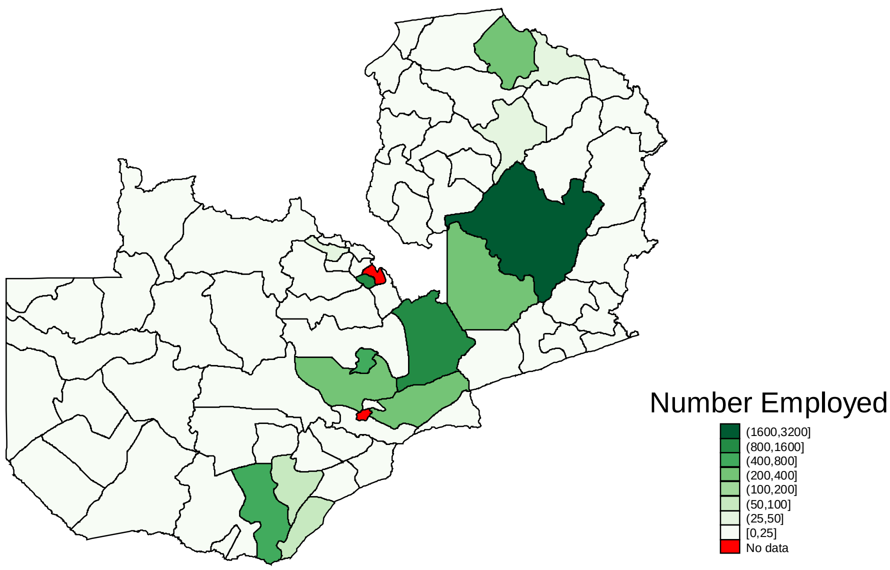

Figure 1.a. Pledged investments in agriculture 1996–2000.

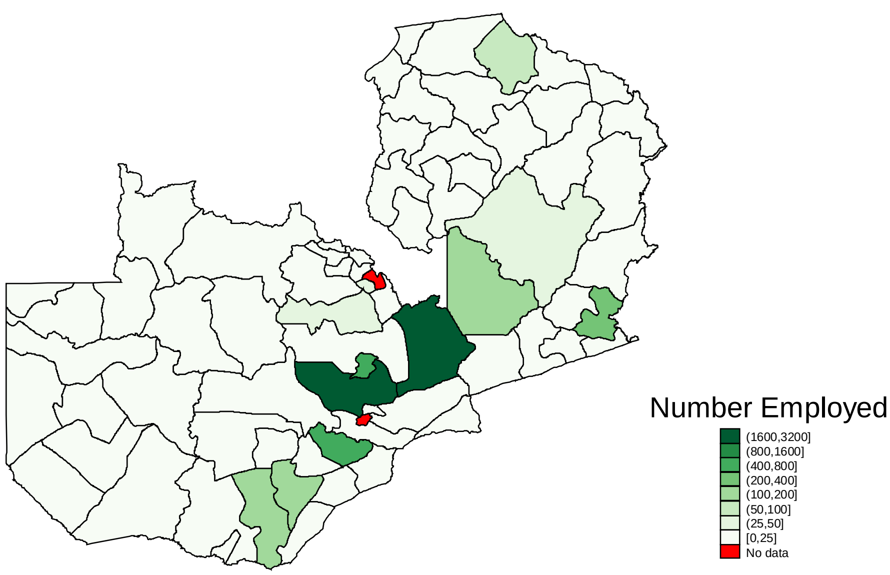

Figure 1.b. Pledged investments in agriculture 1999–2003.

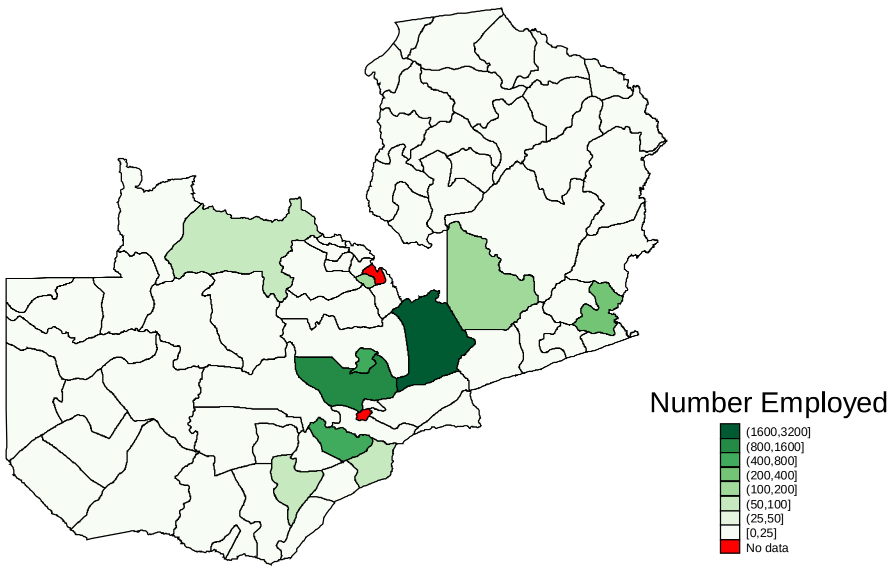

Figure 1.c. Pledged investments in agriculture 2003–2007.

We acknowledge that *agricultural investments* is a noisy signal of the employment opportunities resulting from fully implemented investments, as there is good reason to suspect that not all of the pledged investments have been realized. The level of implementation in these projects is not monitored, but Kragelund (2009) refers to an official from the agency who stated that 70 percent of the pledged investments have been carried out. An alternative to using pledges would be to try to identify which investments have actually been implemented, but the problem with such an approach is that one is unlikely to obtain comprehensive data on this. What one gets is a dataset of confirmed investments, which is likely to be only a subset of actual investments. If this subset is random, or at least if the selection mechanism is uncorrelated with all other relevant aspects, there is no problem. One can then perform statistical analysis on confirmed investments and the conclusions will be valid for all actual investments. However, if there is systematic selection of confirmed investments, the results will be biased. Similarly, if the data on pledged investments, too, is unrepresentative of actual investments, the econometric results from analyzing pledged investments also end up biased. We argue that the problem with pledged investments not being representative of actual investments is smaller than the problem of confirmed investments not being representative of actual investments. The reason is that it is at least easier to predict, and therefore to handle, the bias from using pledged investments than to get a picture of the bias from using confirmed investments. The verification process itself thus risks introducing systematic errors.[5] Consequently, we refrain from all attempts to verify implementation. Incomplete implementation, if not systematically related to our outcome measure, means that our estimates will suffer from an attenuation bias and accordingly may underestimate the true effect of actual investments in the agricultural sector on commercial farm wages among the land poor. This means that our estimates will probably be conservative. Yet, investment data from the agency may also underrepresent investments as investments can also be licensed from line ministries (Kragelund, 2009) and because the stringency of record keeping has varied over time (Jenkin, 2012).

4 Results and discussion

4.1 The long-term relationship

Are agricultural investments associated with higher or lower earnings from commercial farm wage work, and do the marginalized, in terms of access to farmland, have less or more than other to gain from these investments? We use two different empirical set-ups, one focusing on the long term and one focusing on the short term. With the short-term framework, explained in more detail

[5] Deininger et al. (2011) discuss this problem. As they run into problems when trying to collect data on implementation of projects for their case studies, they acknowledge that “The sample can be considered to represent the projects that were in operation and where investors did not refuse access. If anything, these projects are likely to be the ones that are more successful and that will provide larger benefits to local people” (Deininger et al., 2011:64).

below, we can control for more confounding factors that could be problematic in terms of identification. However, a focus on the short term only means that one could miss important dynamics that take longer to affect the commercial farm sector. This motivates a joint focus on the long and the short term.

First, in order to see whether there is a relationship between agricultural investments and wage incomes from commercial farm work in the longer run, we estimate variants of the following,

$$y_{hh,2008} = \alpha + \gamma_0 \times Agricultural\ investments_{d,1994-2007} + \gamma_1 \times Hectares\ per\ HH\ member_{hh,2008} + \gamma_2 \times Agricultural\ investments_{d,1994-2007} \times Hectares\ per\ HH\ member_{hh,2008} + \boldsymbol{X\beta_X} + \varepsilon_{hh,2008}, \quad \text{(Equation 1)}$$

where $y_{hh,2008}$ is *commercial farm wage income* and $agricultural\ investments_{d,1994-2007}$ represents the total number of planned employees in pledged agricultural investments in the district of the household over the full period from 1994 to 2007. The latter variable is included on its own and interacted with our indicator of household size-adjusted access to land, $hectares\ per\ HH\ member_{hh,2008}$. $\boldsymbol{X}$ is a vector of controls that always contains household characteristics, and in some specifications province fixed effects and a set of district characteristics. All specifications are estimated with weighted OLS, and standard errors are robust and clustered at the district level. We will later, in the short-run specifications presented in Tables 4 and 5, include district fixed effects. Given our interest in the long-run relationship in this section we cannot include district fixed effects, since there is only one long-term sum of pledged investments per district. As explained above, *agricultural investments* is a noisy signal of the true number of employees in new projects. There is a risk that the signal-to-noise ratio would not be high enough for us to be able to detect an effect on wage incomes. As long as the noise is not systematically related to our variables of interest, our estimates will only be biased toward zero. If this is the case, our estimates could be seen as conservative in the sense that we will underestimate rather than overestimate the possible effects. On the other hand, some areas will have characteristics that both are good for economic development in general and make them more attractive to investors. Unless we can properly capture this with our set of control variables, we will have an omitted variables bias that, in this case, exerts an upward pressure on our estimate.

Table 2. Long term: Agricultural investments 1994–2007 and commercial farm wage incomes

	(1)	(2)	(3)	(4)
Dependent variable:		*Commercial farm wage income*		
Agricultural investments	0.064**	0.074***	0.075***	0.107***
	(0.032)	(0.027)	(0.020)	(0.034)
Hectares per HH member	-32.569**	-29.684	-24.604	5.114
	(16.410)	(19.078)	(17.796)	(10.608)
Agricultural investments * Hectares per HH member				-0.087**
				(0.043)
Household-level controls	Yes	Yes	Yes	Yes
Province fixed effects		Yes	Yes	Yes
District-level controls			Yes	Yes
Observations	4,348	4,348	4,348	4,348

Notes: Estimated with (weighted) OLS. Robust standard errors, clustered by district, in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent level, respectively. The dependent variable is in 000s of kwacha and drawn from the 2008 wave of the PHS/SS. *Agricultural investments* refers to pledged investments 1994–2007. The household-level controls are *household head level of education*, *household size*, and *male household head*. The district-level controls are *cropland*, *electricity*, *forest*, *grassland*, *log district area*, *log district population*, *log light density*, *railroad*, *rain*, and *water body*.

Is there a long-run effect of new agricultural projects on wage incomes from commercial farms? The results presented in Table 2 suggest that the answer to this question is yes, but the sign of the effect depends on the amount of land at the households' disposal. The estimate for *agricultural investments* is positive and reasonably significant. The size of the coefficients in columns 1–3, where no interaction term has been added, suggests that if an additional investment project of median size were to take place in the respondent's district, the average long-run increase in wage income per smallholder household from working on commercial farms would be 3,200–3,700 kwacha (2009), equivalent to about 1.7–1.9 USD (PPP).[6] This is not a high figure, but it should be remembered that only a few percent of the households report this income source and here we report the average effect for all households. We control for household characteristics (hectares per household member, household size, male-headed household, and education of household head) in all columns, and in column 2 we add province fixed effects. This allows us to cleanse out systematic differences among the nine provinces of Zambia (Central, Copperbelt, Eastern, Luapula, Lusaka, North-Western, Northern, Southern, and Western). If anything, the positive relationship between investments in agriculture and commercial farm wage incomes is slightly strengthened by this.

In our short-run empirical set-up, we can go further and add fixed effects at the district, standard enumeration area (the smallest geographical unit in our dataset, representing approximately 800 persons on average), and household level, but that is not possible for the long-run specification. To capture factors at the district level that may be systematically related to both the inflow of agricultural investments and wage incomes from commercial farms, we resort to adding a battery of district-level variables created in ArcGIS. More details on these variables and their sources can

[6] The median of the number of workers investors plan to hire in in each project in the agricultural sector is 50, see Section 3.2

be found in Table A1 in the appendix. The large commercial farms that trace their history back to the colonial years were traditionally located close to the railroad network. Also today, access to infrastructure is a key determinant of where investors go. At the same time, differences in access to infrastructure between the households and firms in different districts are likely to have affected economic development more generally and thus profitability and incomes from commercial farms. We add *railroad*, which is the percentage of a district within ten kilometers of a railroad, and *electricity*, which represents the percentage of a district within one kilometer of an electricity transmission network. Both *railroad* and *electricity* are for the year 2006. Since agriculture in Zambia is largely rainfed, the amount of precipitation in an area is likely to affect the productivity of existing smallholder and commercial farms as well as decisions on where to locate investments. *Rain* is the average annual rainfall in a district in mm over the period 1961–1990. We add four variables that relate to land use and land cover, *cropland*, *forest*, *grassland*, and *water body*, which represent the percentages of a district area covered by cropland, forests, grassland, and water bodies, respectively, in the year 2000. They may be endogenous in our specification, but at the time of writing, this was the earliest date for which we could find publically available data with this level of detail. We add two indicators of district size: *district area* is the area of a district in square kilometers *and district population* refers to the total population in the district in 1990. To capture the level of economic development prior to the period during which our agricultural investment pledges where made, we add *light density*, which is the population-adjusted nighttime light intensity in 1992. The district-level controls are included in column 3, and they have little effect on the estimate for agricultural investment.

The results indicate that, on average, there is a moderately positive long-run effect of agricultural investments on commercial farm wage incomes for smallholders in Zambia. However, when we in column 4 address the question of whether the land poor have more to lose or more to gain, we see that the size of the effect, and possibly even the sign, depends on the amount of land available per member of the household. The negative interaction term suggests that households with less land have more to gain than others. This seems reasonable, as the land-poor households are likely to be the ones with the lowest marginal productivity of labor on their own farm and therefore have relatively more to gain from the opening up of new work opportunities in the district. Based on the point estimates in column 4, the total marginal effect goes from positive to negative for households with more than 1.2 hectares per household member, yet only four percent of the households in our sample have this much land. Considering the confidence intervals that surround our estimates, one obviously cannot interpret this as an exact cut-off point, yet the results nevertheless suggest that most households gain from agricultural investments.

Our dependent variable, incomes from commercial farms, is a corner solution response with many zeros. While this implies that OLS is not an ideal estimation method, there are no obviously superior alternatives. Tobit is a censored regression model that in principle could be used, but it relies on strong assumptions. More specifically, it relies on normality and homoscedasticity in the underlying latent variable model. Heteroscedasticity does not affect unbiasedness or consistency of OLS, although we must of course use robust standard errors. There are generalizations of the Tobit model, such as the sample selection model, but also this model is less robust than OLS. Against this background, we infer that OLS is more reliable than Tobit in this setting. We have estimated the specification used in column 4 of Table 2 with Tobit, and our results are confirmed. These results are not shown but are available on request.

4.2 The short-term relationship

Our second empirical framework intends to uncover the short-term relationship between agricultural investments and commercial farm wage incomes. Importantly, this allows us to include fixed effects at the district, SEA (standard enumeration area, the smallest geographical unit in our dataset, representing approximately 800 persons on average), and even household level.

Before we present our main short-run results obtained using district fixed effects, we illustrate the overall pattern with a simple graphical presentation and the results from a few short-run specifications that, while they do not include district fixed effects, include a variety of other reasonable control variables. In Figure 2 below, we divide households into four groups along the dimension of how much land they have per household member. We classify households with land per household member amounting to less than the 25th percentile as *very land poor*. In the same manner, the *land poor* have land per household member above the 25th percentile but below the median, *land rich* are above the median but below the 75th percentile, and *very land rich* are above the 75th percentile. We also classify the districts in which the households live along the dimension of pledged investments. *Zero* reflects no pledged investments in the five years prior to the household survey round, *some* denotes districts with *agricultural investments* less than the median among districts with non-zero pledged investments, and *a lot* denotes districts with *agricultural investments* above the median among districts with non-zero pledged investments.

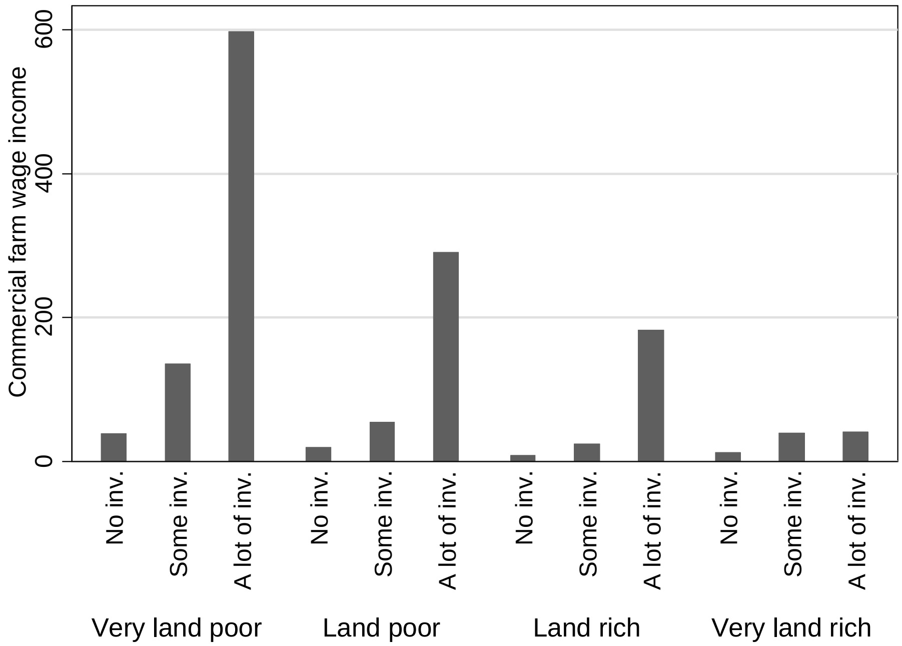

Figure 2. Average within-group commercial farm incomes along two dimensions

Note: The lower dimension is land per household member, ranging from very land poor to very land rich. The upper dimension is the amount of pledged investments in the district in the five years prior to the household survey, ranging from zero to a lot. See the text for more details.

For all groups of households except the *very land rich*, Figure 2 shows a clear pattern where wage incomes from commercial farms are higher for households in districts with more pledged investments. The figure also suggests that the relatively land poor gain more than other households. The empirical pattern revealed by our long-term empirical framework thus appears to hold also for the short term. We proceed to estimate variants of the following:

$$y_{hh,t} = \alpha + \gamma_0 \times Agricultural\ investments_{d,t} + \gamma_1 \times Hectares\ per\ HH\ member_{hh,t}$$

$$+\gamma_2 \times Agricultural\ investments_{d,t} \times Hectares\ per\ HH\ member_{hh,t} + \boldsymbol{X\beta_X} + \varepsilon_{hh,t},$$

(Equation 2)

where $y_{hh,t}$ represent *commercial farm wage income*. $Agricultural\ investments_{d,t}$, which here represents pledged agricultural investments in the five years prior to each survey, is included on its own and interacted with our indicator of household size-adjusted access to land, $hectares\ per\ HH\ member_{hh,t}$. The content of the vector of controls, $\boldsymbol{X}$, varies depending on specification. $\boldsymbol{X}$ always includes household characteristics and year fixed effects, and in some specifications the district characteristics already described in the previous section. Standard errors are robust and clustered at the district level. All specifications are estimated with OLS, and households are weighted by their initial population weights. If agricultural investments in any given five-year period is positively correlated with prior investments, and if these prior investments positively affect our outcome variable, the estimated coefficient for agricultural investments will have an upward bias.

In columns 1–2 of Table 3, the only control variables are household characteristics. *Agricultural investments* is positively related to *commercial farm wage incomes*. The magnitude is larger than what we saw in Table 2, where the focus was on the long run. This may reflect a positive bias or capture that the effect does indeed diminish over time. This would be consistent with the findings reported in FAO (2012) that some projects were initially labor intensive but became more mechanized over time.

Table 3. Short term: Agricultural investments in the last five years and commercial farm wage incomes

	(1)	(2)	(3)	(4)
Dependent variable:		*Commercial farm wage income*		
Agricultural investments	0.140***	0.216***	0.128***	0.201***
	(0.048)	(0.077)	(0.043)	(0.071)
Hectares per HH member	-43.391***	-22.372**	-44.164**	-24.209*
	(15.366)	(10.166)	(17.639)	(12.957)
Agricultural investments * Hectares per HH member		-0.188**		-0.175**
		(0.073)		(0.071)
Household-level controls	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
District-level controls			Yes	Yes
Observations	14,932	14,932	14,932	14,932

Notes: Estimated with (weighted) OLS. Standard errors, clustered by district, in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent level, respectively. The dependent variable is in 000s of kwacha and drawn from the 2001, 2004, and 2008 waves of the PHS/SS. *Agricultural investments* refers pledged investments during the previous five years. The household-level controls are *household head level of education*, *household size*, and *male household head*. The district-level controls are *cropland*, *electricity*, *forest*, *grassland*, *log district area*, *log district population*, *log light density*, *railroad*, *rain*, and *water body*.

A natural concern is that the results could be affected by an omitted variables bias, which could, for instance, be the case if some district characteristics determine the incidence and the scope of new projects as well as the activity among already existing commercial farmers. We begin to address this potential problem in columns 3–4, where we include our vector of district-level control variables. Adding these controls has little consequence for our estimates.

Overall, the patterns illustrated by Figure 2 and the estimates in Table 3 do suggest that the land poor have more than others to gain from agricultural investments but also hint at the possibility that the effect of agricultural investments may diminish over time.

The vector of district-level control variables that we use in columns 3–4 in Table 3 probably does not contain all relevant district characteristics. To cleanse out all time-invariant district characteristics, and thus regress wage income from commercial farms on only the within-district variation in pledged agricultural investments, we add district fixed effects to equation (2) and estimate variants of the following specification:

$$y_{hh,t} = \alpha + \gamma_0 \times Agricultural\ investments_{d,t} + \gamma_1 \times Hectares\ per\ HH\ member_{hh,t}$$

$$+\gamma_2 \times Agricultural\ investments_{d,t} \times Hectares\ per\ HH\ member_{hh,t} + \boldsymbol{X\beta_X} + Z_d + \varepsilon_{hh,t},$$

(Equation 3)

where Z_d represent district fixed effects. Columns 1–2 in Table 4 show the results when we have replaced the district-level controls in columns 3–4 in Table 3 with district fixed effects. With this modification, we still see that households with relatively little land benefit more from the agricultural investments, but unless we add the interaction term, there is no significant relationship between investments and incomes. The fact that the estimated effect of investments is clearly smaller when adding district fixed effects indicates that the estimates in Table 3 suffer from endogeneity, and that there is a need for district fixed effects.

Table 4. Short term: Agricultural investments in the last five years and commercial farm wage incomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Sample:	*Full sample*						*Land-poor households only*		
Dependent variable:	*Commercial farm wage income*								
Agricultural investments	-0.018	0.050*	-0.010	0.049**	-0.011	0.049	0.052**	0.067**	0.065*
	(0.012)	(0.026)	(0.010)	(0.024)	(0.010)	(0.034)	(0.022)	(0.032)	(0.035)
Hectares per HH member	-42.338**	-23.783*	-20.187**	-4.571	-8.574	4.851	-178.751*	-30.175	-26.419
	(16.806)	(12.544)	(9.276)	(5.944)	(7.765)	(6.752)	(107.877)	(50.782)	(52.786)
Agricultural investments * Hectares per HH member		-0.160**		-0.135**		-0.138*			
		(0.065)		(0.060)		(0.071)			
Household-level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District fixed effects	Yes	Yes					Yes		
SEA fixed effects			Yes	Yes				Yes	
HH fixed effects					Yes	Yes			Yes
Observations	14,932	14,932	14,932	14,932	14,800	14,800	7,076	7,076	7,004

Notes Estimated with (weighted) OLS. Standard errors, clustered by district, in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent level, respectively. The dependent variable is in 000s of kwacha and drawn from the 2001, 2004, and 2008 waves of the PHS/SS. *Agricultural investments* refers to pledged investments during the previous five years. The household-level controls are *household head level of education*, *household size*, and *male household head*. Land-poor households are households that in the three surveys on average have less than 0.30 hectares per HH member.

Looking at column 2, we see that here the threshold number of hectares per household member where the total marginal effect goes from positive to negative is 0.3. Since most households have so little land available, the total marginal effect of *agricultural investments* is positive for 60 percent of the households in our sample.[7] In results not shown (but available on request), we re-estimated our benchmark specification with Tobit (for reasons discussed in Section 4.1), and again our results are confirmed.

Further, one additional investment project of median size (50 employees) would on average raise the wage income from commercial farms for a household with 0.15 hectares of land (the 25th percentile value of *hectares per HH member*) by 1,300 kwacha, equivalent to 0.67 USD (international, PPP), which amounts to about 2.5 percent of the average wage income from commercial farms. As argued above, this may seem like a low figure, but it should be seen in light of the fact that this is the average increase for the whole sample and that only a few percent of the households report any wage income from working on commercial farms.

Since our main source of variation is at the district level, it is reasonable to use district fixed effects rather than SEA or household fixed effects. Another benefit of using district fixed effects rather than fixed effects for smaller units such as standard enumeration areas or households is that when we control for district fixed effects, all within-district variation in land per household member is used in the estimations. When controlling for SEA or household fixed effects, only the within SEA or within household variation in land per household member is used in the estimations. On the other hand, the benefit of controlling for smaller units is that one can control for factors at the SEA or household level that may be systematically related to the local inflow of

[7] Underlying these calculations is the specification with imposed linearity of the interaction term. One might want to study a sample of the land poor, and thereby relax the imposed linearity. We do this in columns 7–9, as discussed later.

agricultural investments, land ownership, and/or wage incomes from commercial farms. If the estimates in the specifications with SEA or household fixed effects were significantly different from the estimates in the specifications with district fixed effects, it would indicate that fixed effects on a lower level than district should be used.

In columns 3–4 in Table 4, the district fixed effects are replaced with SEA fixed effects, and in columns 5–6 the district fixed effects are replaced with household fixed effects. The results in Table 4 show no significant difference between the estimates when using SEA and household fixed effects compared with when using district fixed effects. This makes us confident in treating the district fixed effects specification as our benchmark. Nevertheless, it is worth noting that even though the estimated coefficients when using household fixed effects in column 6 are very similar to the estimated coefficients when using district fixed effects in column 2, the coefficient for *agricultural investments* is not statistically significant when using household fixed effects.

The non-significance might be due to, e.g., that only the within-household variation in land per household member is used in the interaction term, or that there simply is no effect to be found. Another plausible contributing explanation is that the non-significance is an artefact caused by the way equation (3) imposes linearity on the influence of land ownership on the relationship between commercial farm wage incomes for smallholders and agricultural investments. In columns 7–9, we relax the linearity assumption and estimate a model without an interaction term but using a sample consisting only of land poor, which we define as *hectares per household member* below 0.3. Evidently, among the land poor, more agricultural investments is significantly related to higher commercial farm wage incomes in all specifications (controlling for district fixed effects, SEA fixed effects, and household fixed effects, respectively).[8] This confirms and strengthens not only the results in column 6, but also the previous results obtained with district and SEA fixed effects.

4.3 Further robustness and placebo tests

In the first column of Table 5, we repeat the estimates from our benchmark model. In column 2, we test the importance *agricultural investments* in the two years preceding the survey, rather than the prior five years used elsewhere in the paper. The estimates are even more significant, and again the coefficients are in line with the notion of a larger effect in the shorter than in the longer run.

Zoomers (2010) and Schoneveld (2014) discuss how the pressure on land for commercial use relates not only to investments in the production of food, non-food agricultural commodities, and biofuels, but also to the development of protected areas and reserves and areas for tourism activities, to infrastructure and urbanization, and to the demand from more traditional sectors such as mining. Our main interpretation of the results presented thus far is that the expansion of commercial farms pulls workers into activities that are more profitable to them. Could we instead be capturing that rural households are pushed into wage employment because they become land poor as a direct consequence of either the expansion of commercial farms or land acquisitions related to investments in the non-agricultural sector? If what we capture here is a push into commercial farm work from the displacement of smallholders, then investments in the non-

[8] The 0.3 hectares per household member cut-off was chosen, as it (approximately) is the value where the total marginal effect of agricultural investments turns from positive to negative for the estimates in columns 2, 4, and 6 in Table 4.

agricultural sector should have a similar impact on commercial farm wage income as investments in the agricultural sector. In fact, using pledged investments in non-agricultural sectors, i.e., *non-agricultural investments* instead of *agricultural investments*, is probably the closest we can get to a placebo test of the impact of agricultural investments on commercial farm wage incomes. In column 3 of Table 5, we show that there is no indication that investments in other sectors affect incomes from commercial farms. These results also reassure us that the estimated relationship between agricultural investments and wage incomes from commercial farms does not capture that agricultural investments go to areas with an overall more favorable investment climate.

Moreover, if *agricultural investments* captured an environment generally more favorable for agricultural wage work and thus is positively correlated with hiring of small-scale farmers, we would expect *agricultural investments*, on its own or interacted with *hectares per HH member*, to be significantly related also to wage income from working on smallholder farms. In the last column in Table 5, we re-estimate our benchmark specification with the important difference that the dependent variable is *smallholder farm wage income*. There is no effect on wage income from working on smallholder farms. The coefficient for *agricultural investments* is close to zero and not statistically significant, and the same goes for the interaction with land per household member. This suggests that what we are capturing is actually a pull into commercial farm wage work rather than into general farm wage work.

To sum up, Table 5 supports our interpretation of the results presented in Tables 2–4. We are therefore reasonably confident that there is an effect on the labor market for commercial farm workers, and that the sign and magnitude of this effect depend on how much land per person a household has available.

Table 5. Robustness and placebo tests

	(1)	(2)	(3)	(4)
Dependent variable:	*Commercial farm wage income*			*Smallholder farm wage income*
Agricultural investments	0.050*			0.009
	(0.026)			(0.007)
Agricultural investments (last two years)		0.153***		
		(0.044)		
Hectares per HH member	-23.783*	-30.564**	-36.729**	-3.736
	(12.544)	(13.629)	(16.325)	(2.734)
Agricultural investments * Hectares per HH member	-0.160**			-0.006
	(0.065)			(0.006)
Agricultural investments (last two years) * Hectares per HH member		-0.335***		
		(0.070)		
Non-agricultural investments			0.023	
			(0.025)	
Non-agricultural investments * Hectares per HH member			-0.056	
			(0.059)	
Household-level controls	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
District fixed effects	Yes	Yes	Yes	Yes
Observations	14,932	14,932	14,932	14,932

Notes: Estimated with (weighted) OLS. Standard errors, clustered by district, in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent level, respectively. The dependent variable is in 000s of kwacha and drawn from the 2001, 2004, and 2008 waves of the PHS/SS. *Agricultural investments* refers to pledged investments during the previous five years (columns 1, 3, and 4). *Agricultural investments (last two years)* refers to pledged investments during the previous two years (column 2). *Non-agricultural investments* refers to pledged investments in sectors other than agriculture during the previous five years. The household-level controls are *household head level of education*, *household size*, and *male household head*.

5 Concluding remarks

The global land rush has caught the attention of many observers, but where some see an opportunity, others fear that the already vulnerable may face yet another challenge. This paper systematically assesses the long- and short-term implications of agricultural investments in Zambia from 1994 to 2007 for wage incomes from commercial farm work for rural smallholder households. Special attention is given to the impact on households with relatively little land (per household member). Our results, which are robust to both placebo tests and a variety of different specifications and time frames, show that agricultural investments have a moderately positive effect for the land poor. It appears that, compared with more land abundant households, the land poor have the most to gain from agricultural investments when it comes to employment opportunities.

We do not dispute that the global land rush has created both winners and losers as our results readily confirms such a pattern, and nor should the results presented in this paper be seen as suggesting that the land poor smallholder farmers always will come out on the winning side. Rather, the results highlight the complexity of the issue and that the effects at the micro level may differ between individuals and households depending on their capacity and willingness to adapt to new economic circumstances.

Funding

This work was supported by the Swedish Research Council [Grant number: SWE-2012-137].

Acknowledgements

We thank seminar participants at the Nordic Conference in Development Economics 2015 for helpful comments. We are furthermore grateful for help received from Nick Sitko, Patrick M. Chuni, Göran Forssén, Karin Alfredsson, Chazya Silwimba, Ndulo Manenga and from the Central Statistical Office of Zambia, the Indaba Agricultural Policy Research Institute, the Zambia Development Agency, and We Effect.

References

ADBG. 2015. Africa Infrastructure Country Diagnostics. African Development Bank Group.

Anseeuw, W., Wily, L. A., Cotula, L., and Taylor, M. 2012. Land Rights and the Rush for Land: Findings of the Global Commercial Pressures on Land Research Project. ILC, Rome

Arezki, R., Deininger, K., and Selod, H. 2015. What Drives the Global "Land Rush"? *World Bank Economic Review*, 29(2): 207–233.

Brown, T. 2005. Contestation, confusion and corruption: market based land reform in Zambia. In Evers, S., Spierenburg, M., and Wels, H. (eds) *Competing Jurisdictions: Settling land claims in Africa*, pp. 79–107. Leiden: Brill Academic Publishers.

Bujko, M., Fischer, C., Krieger, T., and Meierrieks, D. 2015. How Institutions Shape Land Deals: The Role of Corruption. *CESifo Working Paper No. 5178.*

CIESIN (2015) Center for International Earth Science Information Network – CIESIN – Columbia University, United Nations Food and Agriculture Programme – FAO, and Centro Internacional de Agricultura Tropical – CIAT. 2005. Gridded Population of the World, Version 3 (GPWv3): Population Count Grid. Palisades, NY: NASA Socioeconomic Data and Applications Center (SEDAC).

Cotula, L., Vermeulen, S., Leonard, L., and Keeley, J. 2009. Land Grab or Development Opportunity? Agricultural Investment and International Land Deals in Africa. London/Rome: IIED/FAO/IFAD.

Cotula, L., Oya, C., Codjoe, E. A., Eid, A., Kakraba-Ampeh, M., Keeley, J., Kidewa, A. L., Makwarimba, M., Seide, W. M, Ole Nasha, W. O., Asare, R. O., and Rizzo, M. 2014. Testing Claims about Large Land Deals in Africa: Findings from a Multi-Country Study. *Journal of Development Studies*, 50(7): 903–925.

CSO/MAL/IAPRI. 2008. Supplemental Surveys, 2001, 2004, and 2008, to Post-Harvest Surveys. Lusaka, Zambia: Central Statistics Office, Ministry of Agriculture and Livestock, and Indaba Agricultural Policy Research Institute.

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

Deininger, K., and Byerlee, D. 2012. The Rise of Large Farms in Land Abundant Countries: Do They Have a Future? *World Development*, 40(4): 701–714.

Deininger, K., Byerlee, D., Lindsay, J., Norton, A., Selod, H., and Stickler, M. 2011. Rising Global Interest in Farmland. Can It Yield Sustainable and Equitable Benefits? Washington: World Bank.

DIVA-GIS. 2015. Available online at www.diva-gis.org.

Djokoto, J. G. 2012. Effects of Foreign Direct Investment Inflows into Agriculture on Food Security in Ghana. *Journal of Economics and Sustainable Development*, 3(2): 81–92.

FAO. 2010. Global map of monthly precipitation – 10 arc minutes. Available online at www.fao.org/geonetwork.

FAO. 2012. Trends and Impacts of Foreign Investment in Developing Country Agriculture. Evidence from case studies. Rome: Food and Agriculture Organization of the United Nations.

FAO. 2015. Food Outlook: Biannual Report on Global Food Markets, May 2015. Rome: Food and Agriculture Organization of the United Nations.

GADM. 2015. Global Administrative Areas. Available online at www.gadm.org.

German, L., Schoneveld, G., and Mwangi, E. 2011. Contemporary processes of large-scale land acquisition by investors: case studies from sub-Saharan Africa. *Occasional Paper 68*. CIFOR, Bogor, Indonesia.

GRZ. 2009. Economic Report. Lusaka: GRZ, Ministry of Finance and National Planning.

GTZ. 2009. Foreign Direct Investment (FDI) in Land in developing countries. Deutsche Gesellschaft für Technische Zusammenarbeit, Eschborn.

Hichaambwa, M., and Jayne, T. S. 2012. Smallholder commercialization trends as affected by land constraints in Zambia: What are the policy implications? *IAPRI Working Paper*.

Jayne, T. S., Yamano, T., Weber, M. T., Tschirley, D., Benfica, R., Chapoto, A., and Zulu, B. 2003. Smallholder income and land distribution in Africa: implications for poverty reduction strategies. Food Policy 28(2003): 253–275

Jayne, T. S., Zulu, B., Kajoba, G., and Weber, M. T. 2009. Access to land and poverty reduction in rural Zambia: Connecting the policy issues. Food Security Research Project, Policy synthesis, No. 34.

Jenkin, S. 2012. Foreign investment in agriculture. A medium-term perspective in Zambia. *Mimeo*, Lund University.

Kragelund, P. 2009. Part of the disease or part of the cure? Chinese investments in the Zambian mining and construction sectors. *European Journal of Development Research*, 21: 644–661.

NOAA. 2015. National Centers For Environmental Information. National Oceanic and Atmosphere Administration. Available online at http://ngdc.noaa.gov/eog/dmsp/downloadV4composites.html.

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.

RCMRD. 2015. Regional Centre of Mapping of Resources for Development. Available online at servirportal.rcmrd.org.

Richards, M. 2013. Social and Environmental Impacts of Agricultural Large-Scale Land Acquisitions in Africa – With a Focus on West and Central Africa. Washington, D.C.: Rights and Resources Initiative.

Schoneveld, G. C. 2014. The geographic and sectoral patterns of large-scale farmland investments in sub-Saharan Africa. *Food Policy*, 48:34–50.

Schoneveld, G. C., German, L. A., and Nutakor, E. 2011. Land-based Investments for Rural Development? A Grounded Analysis of the Local Impacts of Biofuel Feedstock Plantations in Ghana. Ecology and Society, 16(4).

Shete, M., and Rutten, M. 2015. Impacts of large-scale farming on local communities' food security and income levels – Empirical evidence from Oromia Region, Ethiopia. *Land Use Policy*, 47: 282–292.

Sipangule, K., and Lay, J. 2015. The Impact of Foreign Large-Scale Land Acquisitions on Smallholder Productivity: Evidence from Zambia. *AGRODEP Working Paper 0011*.

Sitko, N. J. 2010. Fractured governance and local frictions: The exclusionary nature of a clandestine land market in southern Zambia. *Africa*, 80(1): 36–55.

Sitko, N. J., and Jayne, T. S. 2012. The rising class of emergent farmers: An effective model for achieving agricultural growth and poverty reduction in Africa? *IAPRI working paper 69*.

Sitko, N. J., and Jayne, T. S. 2014. *Structural transformation or elite land capture?: The growth of "emergent" farmers in Zambia*. Food Policy, 48: 194–202.

UNCTAD. 2016. World Investment Report 20116. UNCTAD, UN.

Väth, S. J. 2013. Gaining neighbors or big losers. What happened when large-scale, land-based investment in the Ghanaian oil palm sector met the local population on the ground? LDPI Working Paper 24.

World Bank, 2013. Growing Africa Unlocking the Potential of Agriculture. AFTFP/AFTAI. Washington: World Bank.

Zambia Development Agency. 2014. Investment pledges from 1994–2013. Dataset. Lusaka, Zambia.

Zoomers, A. 2010. Globalisation and the foreignisation of space: seven processes driving the current global land grab. *Journal of Peasant Studies*, 37(2): 429–447.

Appendix

Table A1. Variables

Panel A: Household-level

Variable	Source	Short Description
Commercial farm wage income	PHS/SS	Household real wage income from working on commercial farm(s). In 000s of kwacha (2009).
Hectares available	PHS/SS	Cultivated and fallow land.
Hectares per household member	PHS/SS	Hectares available divided by the number of members in the household.
Household head level of education	PHS/SS	Educational attainment in years of household head.
Household size	PHS/SS	Number of members in the household.
Male household head	PHS/SS	The household head is male.
Smallholder farm wage income	PHS/SS	Household real wage income from working on smallholder farm(s). In 000s of kwacha.

Panel B: District-level

Variable	Source	Short Description
Agricultural investments	ZDA	Total number of workers in pledged investments in the agricultural sector during (i) 1994–2007 or (ii) the 5-year period prior to the PHS/SS survey.
Cropland	RCMRD (2015)	Proportion of cropland in a district (2000).
Electricity	ADBG (2015)	Percentage of a district within one km of medium to high voltage transmission line (2006).
Forest	RCMRD (2015)	Proportion of forest in a district (2000).
Grassland	RCMRD (2015)	Proportion of grassland in a district (2000).
Log District area	GADM (2015)	Natural log of area of a district in km2.
Log District population	CIESIN (2015)	Natural log of total population in a district in 1990.
Log Light density	NOAA (2015) and CIESIN (2015)	The natural log of 0.0001 plus the intensity of nighttime light in 1992 divided by the 1990 population level.
Non-agricultural investments	ZDA	Total number of workers in pledged investments in sectors other than agriculture during (i) 1994–2007 or (ii) the 5-year period prior to the PHS/SS survey.
Railroad	DIVA-GIS (2015)	Percentage of a district within 10 km of railroad (2006).
Rainfall	FAO (2010)	Average annual rainfall in a district 1960–1990 in mm.
Water body	RCMRD (2015)	Proportion of water body in a district (2000).

Panel C: Additional information

Data	Source	Short Description
District boundaries	GADM (2015)	Administrative boundaries data extracted from the GADM database.