Social capital and large-scale agricultural investments

An experimental investigation

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Abstract

Following the 2007-2008 global food crisis international agricultural producers have invested in large tracts of land in developing countries. We investigate how the new arrival of large-scale market-oriented farms changes social capital in traditional subsistence-oriented villages. Specifically, we employ a lab-in-the-field and a natural field experiment to elicit cooperativeness in villages that lie near large-scale farms and compare them to villages at a distance. Our data reveal greater social capital in near villages. Smallholders who worked on large farms also show greater cooperativeness. These results are likely to be driven by increased exposure to market-oriented forms of agriculture.

Keywords: social capital; market exposure; cooperation; large-scale agricultural investments; field experiment; smallholders; Zambia

JEL codes: C93; O10; O13; P14; Q12; Q15

1   Introduction

The aftermath of the global commodity price spike of 2007-2008 has been characterised by a high demand for large tracts of agricultural land in developing countries. The Land Matrix Observatory reports more than 1,000 concluded international deals and more than 40 million hectares (an area greater than the size of Germany) that have been acquired by investors since the year 2000.[1] Particularly in many African countries, farm land has been sought after due to a number of reasons that include speculation on high profits to be earned from investing in low productive and underutilised lands, widespread perceptions of land abundance as well as attractive investment incentives offered by host governments (Deininger et al., 2011; Collier and Venables, 2012). This increase in the demand for agricultural land has come to be known in the media by the more contentious terms 'land grab', 'new scramble for Africa' and 'global land rush' (Cotula et al., 2009; Cuffaro and Hallam, 2011). In the last years, a fairly large body of literature has been dedicated to understanding what triggered the rise in large scale agricultural investments (LSAIs) (Zoomers, 2010; Arezki et al. 2015), how they can be governed (Margulis et al., 2013; Nolte 2014), and whether they are beneficial or detrimental for the countries that host them (Cotula et al., 2009; von Braun and Meinzen-Dick, 2009).

A key insight that has emerged from this literature is that there are spill-over effects that arise from LSAIs to surrounding smallholder settlements (Deininger et al., 2016). The effects on these communities may either be positive – for example, through employment creation and infrastructural development – or negative – through displacements, increased land tenure insecurity and heightened perceptions of increased land scarcity. With recent improvements in data quality, empirical works (Baumgartner et al., 2015; Deininger et al., 2016; Sipangule and Lay, 2015) have analysed the spill-over effects of these investments on the rural communities that surround them. The welfare effects of LSAIs have also been modelled in theoretical works (see for instance, Dessy et al., 2012; Kleemann and Thiele, 2015).

So far, this literature has focused on how directly observable outcomes such as income, agricultural productivity, employment and land accessibility are affected by LSAIs. However, to the best of our knowledge no systematic research has been conducted on the implications of LSAIs on other important outcomes such as social capital that are more difficult to measure or directly observe. The materialisation of LSAIs in the vicinity of smallholder communities may affect smallholders' social capital levels by exposing them to market-oriented forms of

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[1] For more information, see www.landmatrix.org. The Land Matrix Observatory is a database which was set up by partners such as the International Land Coalition, Centre de Coopération Internationale en Recherche Agronomique pour le Développement, the Centre of Development and Environment at the University of Bern, the German Institute of Global and Area Studies and the German Corporation for International Cooperation.

agricultural production that are based on strong property right systems and profit-making incentives. This form of agriculture greatly differs from smallholder agriculture that is less productive and subsistence-orientated.

This paper contributes to filling the existing gap in the literature by using experimental methods to analyse how the establishment of LSAIs affects the social capital of smallholders living within their vicinities. Our approach of identifying the impacts of large-scale agricultural investments builds on the experimental economics literature on social capital in developing countries (Glaeser et al., 2000; Karlan, 2005; Bouma et al., 2008; Braaten, 2014). Within this literature, a broad definition of social capital is used to encompass trust, norms of reciprocity, and group interactions that are possible via densely connected social networks (Putnam 1993, Woolcock, 1998; Ostrom, 2000; Durlauf and Fafchamps, 2005).

We are specifically interested in understanding how the levels of intra-village trust and reciprocity of smallholders are affected after a LSAI is set up within their proximity. For this purpose, we employ an artefactual field experiment using the sequential Prisoner's Dilemma (Clark and Sefton, 2001; Khadjavi and Lange, 2013). We conduct the field experiment in 13 randomly selected villages close to two LSAIs in Zambia, and take 16 similar randomly selected villages further away from the investments as the control group. Zambia makes a compelling case study as it is a major destination of LSAIs and has a land governance structure that is fairly representative of many other sub-Saharan African countries. The experiment is set up such that half of the smallholders included in the sample act as first movers who make trust-based decisions and the other half take the role of second movers who have a choice between reciprocal, altruistic or selfish decisions. We thereby essentially measure the extent of unconditional cooperation of the first movers and conditional cooperation of the second movers. We complement our analysis with a natural field experiment in which we observe the governance of public goods, i.e., how solar systems that are bestowed as public goods to the villages in our study are administered and maintained.

Our results from the Prisoner's Dilemma indicate significantly higher levels of (first-mover) cooperation in the villages close to LSAIs. While we do not find any difference for (second-mover) conditional cooperation between the two groups of villages per se, we do find that smallholders who have worked on LSAIs show significantly higher propensies both to cooperate when they are first movers and to reciprocate cooperative behaviour (or the lack of it) when they act as second movers in our experiment. The natural field experiment indicates a higher propensity to share the public good in villages closer to the LSAI, which further substantiates our main result. It also reveals a significant positive correlation between the levels of trust in a community and the levels of public good governance.

These findings are in line with the literature that shows that integrating small-scale societies into market-orientated settings induces norms of cooperation that result in higher payoffs in experimental games (Henrich et al., 2001). LSAIs may also affect smallholders' social capital through other transmission channels such as higher income levels and employment related migration for which we do not find evidence.

The remainder of our paper is organized as follows. Section 2 discusses markets and their influence on social capital. Section 3 explains the choice of the study sites and their representativeness. Section 4 describes the experimental design. The hypotheses and results are presented in section 5. Finally, section 6 concludes.

2   Markets and their influence on social capital

The debate on markets and their influence on the evolution of moral values and preferences is a long-standing one that has intrigued researchers in the social sciences. This debate has resulted in two contending camps. The first camp advocates the role of markets in fostering norms of cooperation, while the second camp points out the erosion of morals and values that are associated with an increase in market accessibility.

Early works dating back as far as the mid-eighteenth century by French political philosopher Montesquieu describe commerce as a civilising force that is linked the to the formation of 'gentle manners' such as assiduity, discipline, honesty, punctuality, prudence and reliability (Hirschman, 1982). Hirschman (1982) refers to this effect as the *doux-commerce* thesis and argues that the spread of commerce leads men to become more cautious about arousing adverse judgment from present and future acquaintances. Today, the doux-commerce thesis is still advocated by economists who argue that the market nourishes virtues of honest behaviour, civility and cooperation (McCloskey, 2006; Fourcade and Healy, 2007). Commercial society is thought to make people more cooperative by binding them together and reducing social tensions. Engagement in frequent economic interactions associated with markets also leads one to place a higher importance on developing one's credibility and reputation (Fourcade and Healy, 2007).

Studies analysing the determinants of social preferences across 15 small-scale societies find that higher levels of aggregate market integration are associated with increased cooperation or altruism, which is measured by positive offer sizes in ultimatum games (Henrich et al., 2001; Henrich et al., 2004). One of these studies conducted amongst a pastoral group in Northern Kenya by Ensminger (2004) reveals that market integration – measured by the presence or absence of wage/trade income – leads to more fair offer sizes (50-50 splits) in the ultimatum

and dictator games. In line with the doux-commerce thesis, Ensminger (2004) suggests that subjects participating in the labour and service markets place a higher value on the importance of reputation and behaving fair-mindedly, which is reflected in the results of the one shot games.

Other studies conducted within this cross-cultural context arrive at a similar conclusion. Tracer (2004) compares two villages in rural Papua New Guinea and finds that the village with less market integration has a higher distribution of low offers in the ultimatum game. In addition, doing a within village comparison reveals that those with higher market integration proxies such as thatched roofs and wage employment have higher offers even though the small sample size used in the study makes more research necessary. A follow up study uses more refined measurements of market integration, i.e. the percentage of calories purchased in the market, to replicate the results of the earlier studies and finds that fairness increases with a population's degree of market integration (Henrich et al., 2010; Ensminger and Henrich, 2014).

While the studies discussed above support the hypothesis that markets have a positive effect on cooperative behaviour, a large body of literature whose roots can be traced to Marx's work on capitalism argues that markets undermine the moral foundations of society (Hirschman, 1982). This market-based erosion of morals that Hirschman refers to as the *self-destruction* thesis arises when markets crowd out cooperation and altruism and reduce them to a narrow form of self-interest (Fourcade and Healy, 2007).

The erosion of collective goods and rise in self-interest associated with market exposure is illustrated in a qualitative study by Kajoba (1994). He shows how the advent of agricultural commercialisation led to a change in the perceptions of villagers in Chinene, Zambia, who began to favour more individualised forms of land tenure. Not only did the commercialisation of agriculture increase the value of land in Chinene village but it also heightened villagers' perceptions of land scarcity causing them to fence their properties and desire individual land title. In addition, Kajoba (1994) reports that the rise in self-regarding behaviour amongst villagers in Chinene was accompanied by a degeneration in social cohesion. An analogous process is described by Lesorogol (2005), who presents evidence showing that pastoralists living in communities that have experienced privatisation of their parcels and have been brought into greater contact with markets for land engage in fewer cooperative activities on a day-to-day basis. This reduction in cooperation occurs as a result of the resettlement of households as well as the increased reliance on crop cultivation and decline in the use of communal pastoral grounds. This crowding out of cooperation is reinforced by the results of a public goods game that reveals lower contributions by the villagers that have experienced privatisation.

Although the two strands of literature are at opposite poles, in practice the positive and negative effects of markets on social capital do not always have to be mutually exclusive. It may well be that market exposure results in both an increase in self-regarding behaviour and increased cooperation amongst a certain group of individuals simultaneously. For instance, a recent study that analyses the effect of the formalisation of land rights on community cooperation in Peru by Braaten (2014) shows that when measured as distance to markets, market integration is negatively associated with cooperation, whereas a positive and significant effect is found for income from trade that is used as a proxy for market experience. Thus based on the discussion in this section, markets may enhance, deteriorate or have an ambiguous effect on social capital. The mechanisms through which market exposure affects social capital will be described in more detail in section 5 where we derive the hypotheses to be tested in the experimental analysis. But first we explain our choice of study area and the design of the field experiments.

3   Choice of country and study sites

Zambia is a compelling case to study for two major reasons. First, it is an important destination of LSAIs. Between 2003 and 2011, 34 LSAIs expressed an interest in 1,588,916 hectares of agricultural land (Harding et al., 2016). A third of this land was previously cultivated by smallholders (Harding et al., 2016). This indicates that it is not uncommon for LSAIs to operate within the proximity of smallholders. Second, Zambia has a dual land governance structure that is fairly representative of many other sub-Saharan African countries. Land in regions cultivated by smallholders is governed under a customary system of tenure that assigns authority to chiefs and local headwomen or –men who act as custodians of the land on behalf of the chiefs. Within this system, formal property rights are a rarity. By contrast, land cultivated by LSAIs is almost always titled and follows a formal land governance system. The rise in the number of LSAIs, particularly in regions that border customary land, increases smallholder exposure to formalised market orientated systems of agriculture. LSAIs have also been established in the proximity of smallholder communities in other sub-Saharan African countries that allow for both titled and customary land tenure system such as Ethiopia (Baumgartner et al., 2015; Ali et al., 2016), Ghana and Kenya (Nolte and Väth, 2015) and Nigeria (Adewumie et al., 2013; Osabuohien, 2014).

We conducted the artefactual field experiment[2] from mid-August to the end of September 2015 in two commercial farming areas in Mumbwa and Mkushi districts. The LSAI in Mumbwa is leased by Amatheon Agri and covers an area of nearly 30,000 hectares. Currently the farm

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[2] The term was coined by Harrison and List (2004). Such experiments are also commonly referred to as 'lab-in-the-field experiments' and 'extra-lab experiments' (Charness et al., 2013).

only operates 3000 hectares of this land. The LSAI in Mkushi, which is operated by Chobe Agrivision, consists of 6 different farms which together account for an area of 4,000 hectares. Both farms operate within formalised institutional settings; they acquired titled state land for their establishments, they are foreign owned and undertake corporate social responsibility activities within their communities[3]. The farm in Mkushi began its operations in 2010 while the one in Mumbwa has been operational since 2012. The key distinction between the two farms is the extent of land commercialisation prior to the establishment of the LSAIs. The land in Mumbwa forms part of the Big Concession farming scheme and despite being titled, it remained largely underdeveloped (greenfield investment) until the commercial farm was set up. On the contrary, the LSAI in Mkushi falls within the Mkushi farm block that has a long history of commercial farming; the land for the farm was acquired from established commercial farms (brownfield investment) (Chu, 2013).

In terms of the size of land and crops cultivated, the two LSAIs included in this study are very similar to 13 other operational LSAIs listed by the Land Matrix (see Table A.1 in the appendix). The farms operated by Amatheon Agri and Agrivision Africa both cultivate maize, wheat and soya beans; at least one of these crops is also cultivated in all but two of the other LSAIs operational in Zambia.

Figure 1a. Randomly selected villages in the Mkushi region.
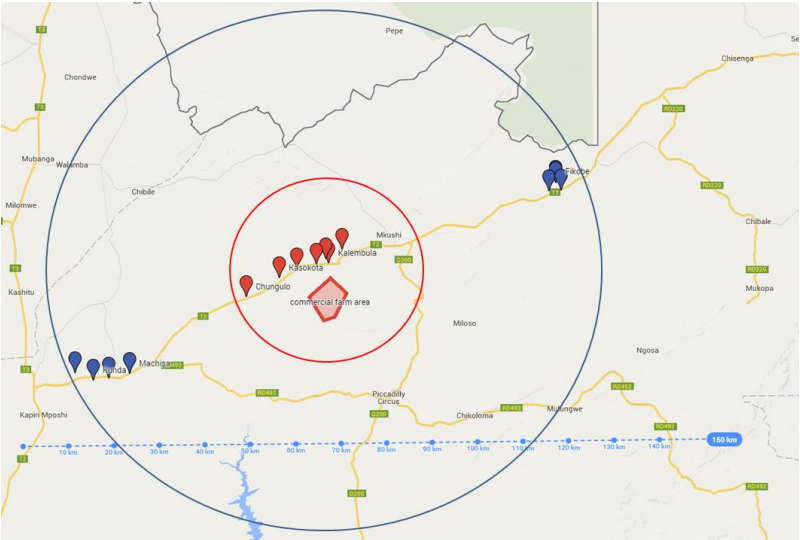
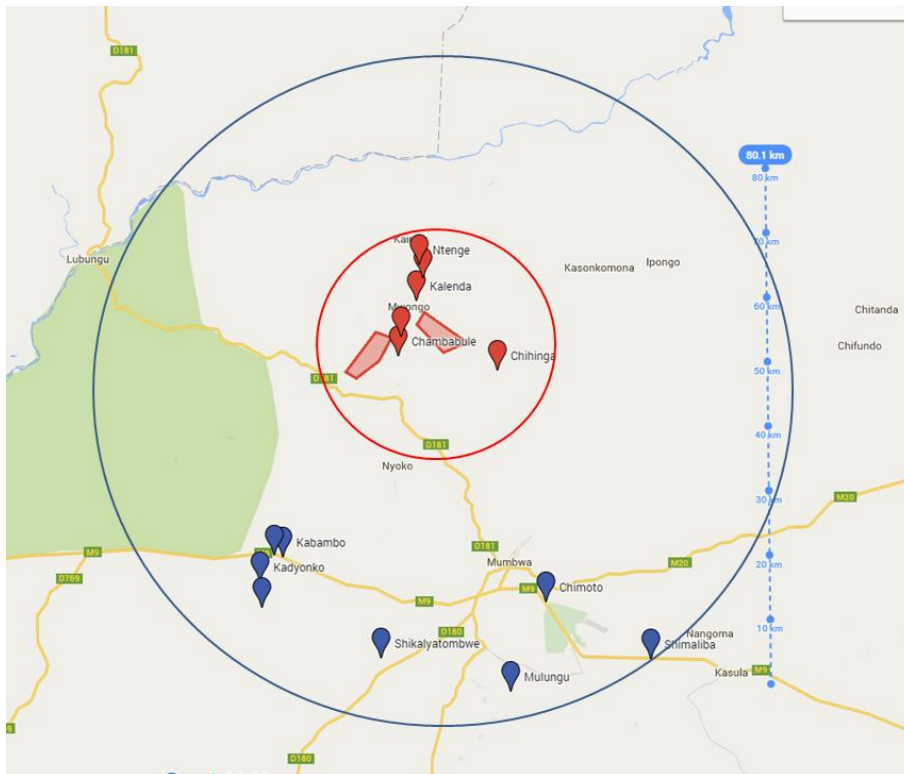**Note:** The red polygons depict the locations of the commercial farming areas; the red pins indicate the locations of the _near villages while the blue pins show the _further villages.

Source: authors' own data.

Figure 1b. Randomly selected villages in the Mumbwa region.

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[3] Nolte and Subakanya (2016) provide a detailed account of the two LSAIs and their points of contact with the communities surrounding them.

Amatheon Agri has been contracted the largest amount of land (38,760 hectares) but in terms of the area cultivated (3,000 hectares) it does not differ greatly from Agrivision Africa or the other LSAIs operational in Zambia. In addition, the LSAIs selected for this study are similar to most of the other operational LSAIs in that they only began their operations after the peak in demand for agricultural land that occurred in 2008/2009. These similarities make us confident that the results we obtain are not only confined to our study area but hold equally important lessons for other operational LSAIs administered in a similar way.

Our choice of these two farming areas was not only motivated by selecting LSAIs that are representative at the national level but also by other key criteria such as: identifying farms that are both located in the same province, situated close to main roads and are similarly close to Zambia's capital city Lusaka.

After the locations of the two LSAIs were identified, village lists and maps of the regions surrounding these farms were obtained from the Zambian Central Statistical Office (CSO) in Lusaka. These maps were essential for the randomisation process employed in selecting villages. 29 randomly selected villages located close to a main road were sampled, out of which 15 villages were located in Mkushi District and 14 were in Mumbwa District.[4] Altogether, we conducted the experiment with 932 smallholders in these villages. Figures 1a and 1b

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[4] We selected villages close to a main road to avoid any distorting effects caused by proximity to markets and infrastructure.

illustrate the study locations.

We compare the social capital of villages in the proximity of the two LSAIs with counterfactual villages that do not have LSAIs. In each district, we randomly selected villages (_near) within a 15 kilometre radius from the large scale farms as well as villages *(_further)* located in a 50 to 70 kilometre radius around the centre of the large-scale farms. Extra caution was taken to ensure that the villages located further away where not located closely to other large-scale farms. The radii were calibrated in order to have villages from which smallholders could walk to work in the LSAI on a daily basis (_*near* villages) and to have villages in the same region while ruling out this everyday-contact (_*further* villages). Table 1 reports summary statistics of the villages located further and close to the investments.

The summary statistics clearly bear out that proximity to LSAIs matters. As expected, villages within the 15 kilometre radius have a significantly larger amount of workers employed on LSAIs – the share of LSAI workers in _*near* villages is more than double that in _*further* villages – and a lower number of villagers that are solely engaged in smallholder agriculture. By contrast, with the exception of the age of the household head, all relevant village-level socio-demographic characteristics are balanced and do not differ significantly. The asset-index and hectares cultivated by villagers do not indicate that _*near* villages are wealthier than _*further villages* despite the employment opportunities offered by the LSAI in the _*near* villages. There is also no indication of differences in soil quality that might drive our results. We obtained soil samples in all the villages in our study (including signed agreements for the extractions from each headwoman or -man). The soil samples were analysed by the Zambia Agriculture Research Institute, the official research institute of the Ministry of Agriculture in Zambia.[5] Pairwise correlations of villages being _*near* a LSAI or _*further* and each of the nine soil quality indicators do not yield any significant differences. Finally recall that we only selected villages close to a main road to rule out any systematic differences in access to infrastructure and markets. As a result, we are confident that our randomisation strategy was successful in matching similar villages that only differ in terms of their proximity to LSAIs.

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[5] The soil samples were tested for their levels of organic carbon, calcium chloride and pH. They were also tested for trace elements of potassium, phosphorous, sodium, calcium, magnesium, zinc and iron. Figure A.2 in appendix A presents correspondence with the institute.

Table 1. Village level summary statistics.

Variable	_near villages		_further villages		
	Mean	SD	Mean	SD	p-values
Male	0.54	0.15	0.47	0.12	0.13
Household head	0.46	0.09	0.50	0.13	0.32
Age (in years)	35.07	2.46	41.11	5.25	**0.00**
Ethnic groups in village	8.46	3.31	8.00	2.92	0.68
Migrant	0.53	0.20	0.60	0.18	0.51
Years of education	6.56	1.08	6.53	0.87	1.00
Literacy (with 5 is the highest level)	2.68	0.39	2.65	0.38	0.93
Asset index*	0.42	0.03	0.41	0.10	0.46
Hectares cultivated	4.95	2.17	5.11	1.96	0.83
LSAI worker	0.52	0.26	0.24	0.19	**0.00**
Smallholder	0.71	0.17	0.84	0.10	**0.04**
Village has a public good	0.77	0.44	0.63	0.50	0.41
LSAI requested land in the village	0.18	0.41	0.15	0.38	0.86
Individuals	445		487		
Number of villages	13		16		

Note: Statistically significant p-values in bold. The p-values are based on two-sided Mann-Whitney tests on the village-level. The asset index includes information on the households' possessions of livestock holdings, radios, agricultural equipment, transportation, as well indicators of the quality of housing. The asset index was constructed using Principal Components Analysis (Filmer and Pritchett, 2001).

A potential problem for our empirical analysis is that the locations of the large-scale farms were not randomly selected. Being market oriented, they were established in regions where the LSAI owners expected to yield high returns from their investments. This non-random location may give rise to biased estimates if the social capital of surrounding communities is a determinant of where LSAIs are established. In our case, the Zambian Development Agency (ZDA) facilitates land acquisition through the local government, traditional leaders and Commissioner of Lands. They allocate land to investors based on a detailed project proposal with clear indication of the agriculture activities they intend to implement and associated requirements regarding irrigation, types of crops or livestock, land size, location, et cetera. Among the criteria the ZDA's land allocation agencies apply for identifying suitable land are topographic and soil characteristics as well as prevailing land tenure systems. Criteria that might be regarded as proxies of social capital in surrounding communities do not play a role in the allocation of land for investments, rendering a bias due to non-random selection of LSAI locations unlikely.[6]

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[6] More information about our correspondence with the ZDA is available upon request. Nolte and Subakanya (2016) provided us with responses from the managers of the large-scale farms in our study. The explanations for how and why the exact locations were acquired do not indicate any proxies for

Still, we are aware that our approach is not without problems when it comes to identifying the causal effects of LSAIs on social capital. In particular, we lack information on pre-investment levels of social capital in the villages. An ideal identification strategy would take the form of a field experiment with a panel dimension that would install and manage a considerable number of 4,000 hectares-large LSAIs in random locations around the country. It would measure social capital in communities in the proximity of and other communities further away from these randomly selected sites before and a number of years after the installation and continuous operation of these farms. Yet, such a difference-in-differences field experiment would be very costly and would arguably not stand a thorough cost-benefit analysis. For this reason, we regard our approach as a worthwhile option that is cost effective and allows at least a tentative causal interpretation of the link between the establishment of LSAIs and social capital in neighbouring village communities.

4 Experimental design and procedures

In line with the literature on social capital we opted for the use of experimental methods to measure our outcomes of interest. For instance, in their seminal contributions, Glaeser et al. (2000) and Karlan (2005) use the trust game to measure social capital, consisting of trust and reciprocity (also referred to as 'trustworthiness'). Taking our study setting into account, we simplified the game and elicited unconditional and conditional cooperation through the use of the sequential Prisoner's Dilemma (Clark and Sefton, 2001; Khadjavi and Lange, 2013).[7] Given our context in rural Zambia involving a high number of illiterate participants, we decided in favour of the binary sequential Prisoner's Dilemma (PD). This was done to establish the highest level of simplicity of the game while still being able to measure cooperation[8]. The game was played one-shot and designed in a simple graphical manner that enabled villagers with low levels of literacy to understand the procedure.[9]

After receiving general introductory instructions, participants were randomly assigned to two groups of first or second movers by drawing a black or a green numbered ID card from a bag. The two groups were then spatially separated with adequate distances and sight-barriers such as huts, trees and bushes to prevent both verbal and non-verbal communication between the

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social capital either.

[7] The battery of our lab-in-the-field experiment also included a sender-receiver cheap-talk game (Gneezy, 2005) and a competition game (Gneezy et al., 2009). Those two games were played *after* the sequential Prisoner's Dilemma and were not pre-announced. They should therefore not have any influence on the data reported in this paper. We aim to discuss these games in future companion papers.

[8] Nearly 25 percent of the participants report that they are not able to read or write at all in any of the local languages or English.

[9] We carried out pilot tests and included control questions to test the efficacy of the instruments. These additional measures assured us that even those participants that are illiterate were able to follow our experiment

groups. Each group was accompanied by two Zambian research assistants (always one male and one female). The instructions for the Prisoner's Dilemma were then presented to the respective group and read aloud by the same research assistants throughout all experiments.[10]

In the black group, individuals made the first decision (move) to cooperate or defect. Figure 2 illustrates the decision sheet that members from the black group received. The individuals in the green group made two decisions which were contingent on the first mover's choice. The results from the first movers determine the level of unconditional cooperation of the villagers, while the results from the second movers indicate strategies such as conditional cooperation, payoff maximization or altruism. To ensure that illiterate individuals were able to make incentivised decisions, the decisions were based on easily identifiable colours (*Pink* or *Yellow*) and the possible payoffs from a decision were represented by pictures of the associated banknotes. Participants could earn between 5 and 50 Zambian Kwacha depending on their decisions: 40 Kwacha for each player was the payoff in case of mutual cooperation, 30 Kwacha for each player in case of mutual defection, while 50 Kwacha was the 'temptation payoff' and 5 Kwacha was the 'sucker payoff'.

Figure 2. Decision sheet for Black Group members as the first mover in the PD.

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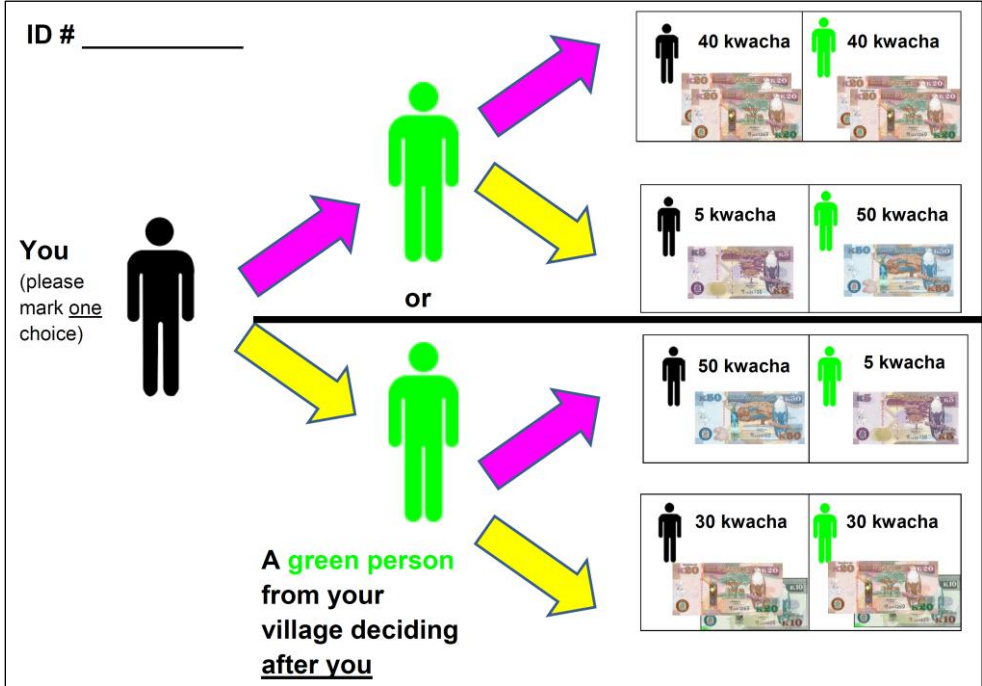
[10] Although English is the official language in Zambia, local regional languages are spoken more frequently in rural settings. To ensure that all participants understood their tasks, the instructions were administered in Bemba in Mkushi and Nyanja in Mumbwa. As a way of testing that the original meanings of the instructions were maintained across the experiments, we had the instructions translated into Bemba and Nyanja from English and retranslated into English by two separate, uninvolved parties. This is the standard validation procedure (see Brislin, 1970). Instructions in English are provided in the appendix B.

To make a decision, each participant's ID number was called by a research assistant and the participant was led to an isolated area to make her or his choice (pink or yellow). When called, participants were allowed to ask the research assistants questions about the instructions before making their decisions. After the decisions had been made the research assistants posed control questions to the participants to test for understanding of the instructions. During the decision making process another research assistant stayed with the group of participants that had not been called out to ensure that participants did not communicate before their numbers had been called out. After participants had made their decisions, they were asked to go to a second waiting area.

Including a show up fee of 5 Kwacha, participants earned 119.72 Kwacha on average (13.30 USD at the time of the experiment) for participating in all parts of the experiment for roughly four hours, including personal ex-post surveys and leisure time between the activities. This amount is approximately the equivalent of the weekly income of LSAI workers. Hence, the stakes in our experiment can be regarded as fairly large.

Importantly, the research assistants were not informed about the research questions during the data collection phase of the study to avoid biases. They were only debriefed after the collection of data in the last village at the end of September 2015.

Before each session (there was always only one session per village to avoid information spill-overs), we visited each randomly selected village to request permission from the village headman (or headwoman) and to seek his (her) assistance in recruiting villagers to participate in the study. The village headmen and –women were informed about the nature of the experiment (but not the research questions), the duration of the study, the average expected earnings and that participation in the study was voluntary. We also presented a letter of support from the provincial government that encouraged our research (see Figure A.1 in the appendix). We stressed that only individuals from the respective village are allowed to participate, that we need at least 20 individuals per village, that there is no upper limit to the amount of participants from a given village and that the average payment does not decrease with the number of participants. Refraining from setting an upper bound and randomising at the individual level was crucial to avoid selection issues since village censuses were unavailable. Only adults (people over the age of 16 that were eligible for the National Registration Card (NRC)) were allowed to participate in the experiment due to its monetised nature.

Throughout the experiment and thereafter the identity of the matched players from the differently coloured groups were kept anonymous. After the experiment was completed, the participants' decisions from the green and black groups were randomly matched.

The information collected in the experiment was supplemented with data from community and household surveys that were conducted after the experiments. The community questionnaire – only answered by village headmen or –women – gathered information on institutional arrangements, land tenure systems, soil quality and interactions with outsiders[11]. The household questionnaire gathered information on socio-demographic characteristics, social networks and land tenure arrangements. This information is mainly used to control for possible confounding factors in the subsequent empirical analysis.

5   Hypotheses and results

We first develop a set of hypotheses as to how – and through which mechanisms – the exposure to LSAIs might affect the social capital of local communities in their vicinity (section 5.1). Against the background of these hypotheses, we present the results of our experimental investigation, first discussing first-mover behaviour in the sequential Prisoner's Dilemma (section 5.2), and then analysing different strategies of second movers (section 5.3). In a further step, we provide a tentative assessment of the mechanisms that are likely to drive our results (section 5.4). Finally, we discuss the outcome of the natural field experiment and how it compares to the lab-in-the-field experiment (section 5.5).

5.1   Hypotheses

As discussed above, the smallholder communities that surround LSAIs are characterised by informal institutions that are governed by traditional authorities. When LSAIs that operate using a different set of institutions are set up in the proximity of these communities, we posit that the trust and reciprocity of smallholders may be affected in the following ways:[12]

i.   Individualism
When LSAIs are established in the proximity of a smallholder community, the increased exposure to modern agricultural techniques and the profit-seeking business model of the LSAI

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[11] In four cases where the headman was absent, the community questionnaires where answered by the deputy village headman, chairperson or school head teacher.

[12] Social capital of smallholders may also be affected by displacements or resettlement (Lesorogol, 2005) and through a leadership effect which may occur if the land acquisition process is opaque and causes villagers to distrust their local leaders. However these effects are unlikely to be relevant for our study. There were no displacements within the villages of our study and the leadership effect does not apply since the chiefs and not the local village headmen and –women were involved in the settlement of the LSAIs. Furthermore, immigration driven by employment opportunities on the investment farms may have an impact on villagers' social capital, but we find no significant differences in the incidence of migration between villages close to the investment farms and those further away (Table 1). Lastly, the statistics in Table 1 do not indicate any differences in the asset levels (our proxy for income levels) of villages near and further away from the LSAI, which dispels any concerns of an income effect across the study villages.

may raise smallholders' awareness of an individualistic lifestyle. Similar to the example of Chinene village (Kajoba, 1994), commercialisation may lead to more self-regarding and individualistic behaviour of smallholders who wish to utilise their land in more productive ways such as through the cultivation of cash crops. This individualistic behaviour is at odds with the customary system of tenure that favours cooperation and trust amongst individuals. Thus it is possible that social capital of smallholders living in these communities might deteriorate. Consequently, we formulate:

Hypothesis 1a. *Due to a rise in individualism, the levels of cooperation in the _near villages are lower than in the _further villages.*

  ii.   Communal Coping

Conversely, if smallholders perceive the materialization of a LSAI as a threat or a positive development they may bond together as a way of dealing with the new actors within their communities. This could result in more frequent community meetings or other forms of mutual cooperation that raise the social capital of the village. Lyons et al. (1998:583) introduce the notion of communal coping which occurs when "one or more individuals perceive a stressor as 'our problem'…and activate a process of shared or collaborative coping". If communal coping occurs in the villages next to the LSAIs it may lead to increased levels of intra-village cooperation amongst smallholders.

Hypothesis 1b. *Due to an increasing presence of LSAIs in a village, cooperation levels in the _near villages are higher than in the _further villages.*

  iii.   Reputation

As smallholders are employed on LSAIs, they may acquire traits such as reliability, reciprocity and fairness that are necessary for the functioning of more formalised market institutions. As demonstrated by Ensminger (2004), smallholders may internalise these norms and apply them in similar anonymised settings within their communities. This will lead to an increase in the levels of trust and reciprocity among smallholders that are in direct contact with these investments.

Hypothesis 2. *Due to interaction with the LSAI, cooperation levels of LSAI-employed villagers are higher than those of non-employed villagers.*
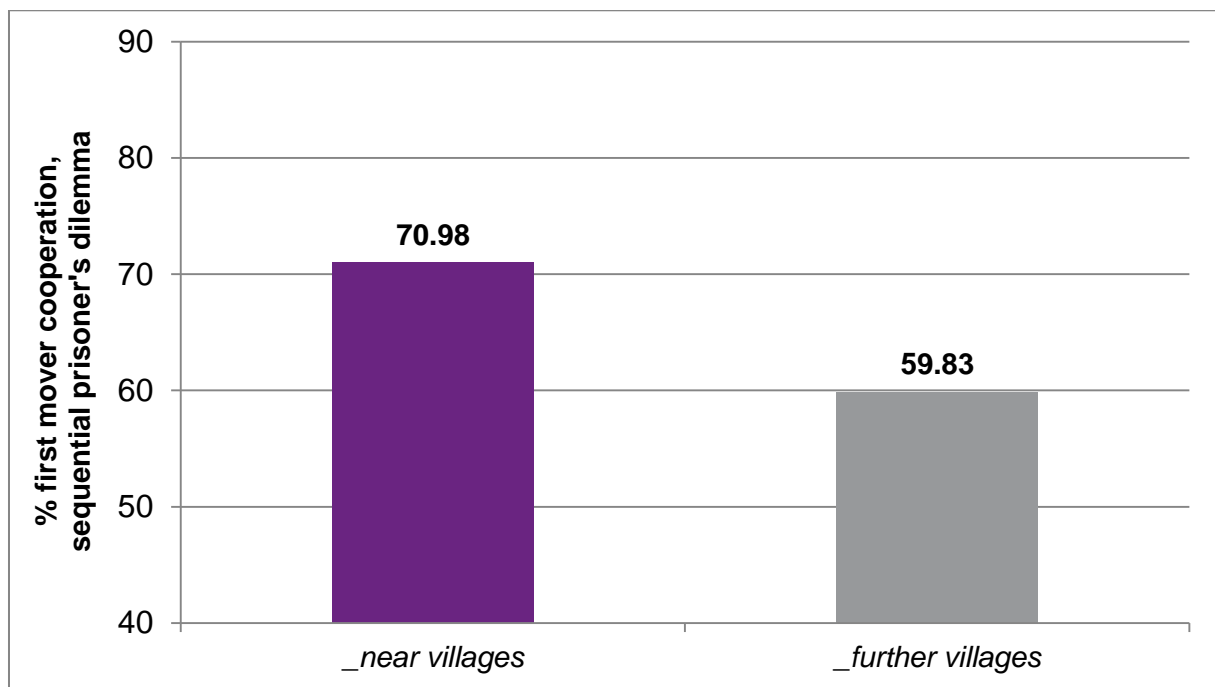
5.2   Results: First-Mover Cooperation

The results in Figure 3 indicate that smallholders living in *_near* villages tend to be more cooperative than those in *_further* villages. The level of first-mover cooperation in the sequential Prisoner's Dilemma is 70.98 percent in *_near* villages compared to 59.83 percent in *_further* villages. Employing a (two-sided) chi-squared test for a first-glance analysis, we find that this difference is statistically significant at p-value = 0.012.

Likewise, we find a 71.09 percent propensity of LSAI workers to cooperate as first movers compared to 61.27 percent of non-LSAI workers. This difference is significant at p-value = 0.033 (chi-squared test). Figures 3 and 4 depict these differences.

Figure 3. Smallholder proximity and cooperation of first movers in the sequential PD.

The first-glance result of first-mover cooperation above needs to be substantiated by a regression analysis. It is crucial that we take the structure of the data into account and control for socio-economic observables. We estimated two logit regressions, one employing a parsimonious specification and one controlling for a large set of observables, clustering the standard errors at the village level. We present the results in Table 2. The estimations confirm the increase in first-mover cooperation of smallholders in villages close to LSAIs and that of LSAI workers. Even if we cluster the standard errors and control for a variety of potential confounding factors, the effects remain significant at the 10 percent level (estimation II).

Table 2. Regression analysis of first mover cooperation.

VARIABLES	(1) I Logit regression	(2) II Logit regression
_near village (dummy, 1 = yes)	0.113**	0.092*
	(0.050)	(0.049)
Age (continuous)	-0.055	0.000
	(0.050)	(0.084)
Male (dummy, 1 = yes)	-0.045	-0.005
	(0.038)	(0.057)
Education in years (continuous)	-0.002	0.007
	(0.010)	(0.013)
Literacy (continuous)	-0.017	-0.028
	(0.024)	(0.029)
LSAI worker (dummy, 1 =yes)		0.095*
		(0.056)
Born in the village (dummy, 1 = yes)		0.002
		(0.043)
Own hectares (continuous)		0.003
		(0.004)
Household head (dummy, 1 = yes)		-0.078
		(0.071)
Village Area (continuous)		0.011
		(0.012)
Land title (dummy, 1 = yes)		0.008
		(0.064)
Ethnicity		-0.003
		(0.003)
Asset index based on pca		-0.158
		(0.229)
Observations	454	391
Region	NO	YES
Crops		YES

The table presents marginal effects. The observations from the control villages are the baseline of the estimations. The standard errors in parentheses are clustered at the village level for 29 villages in all estimations. Statistical Significance*** p<0.01, ** p<0.05, * p<0.1

We therefore find evidence in favour of Hypotheses 1b and 2:

Result 1. *First-mover cooperation is significantly greater in* near_ *villages compared to* _further *villages. Communal coping may explain this result.*

Result 2. *First-mover cooperation is significantly greater for LSAI workers than for non-workers, which may point to a reputation effect.*

Note that the support for Hypothesis 1b by Result 1 does not reject Hypothesis 1a. Rather, it may be that we measure a composite effect in which the communal coping mechanism

dominates.

Figure 4. LSAI workers and cooperation of first movers in the sequential PD.
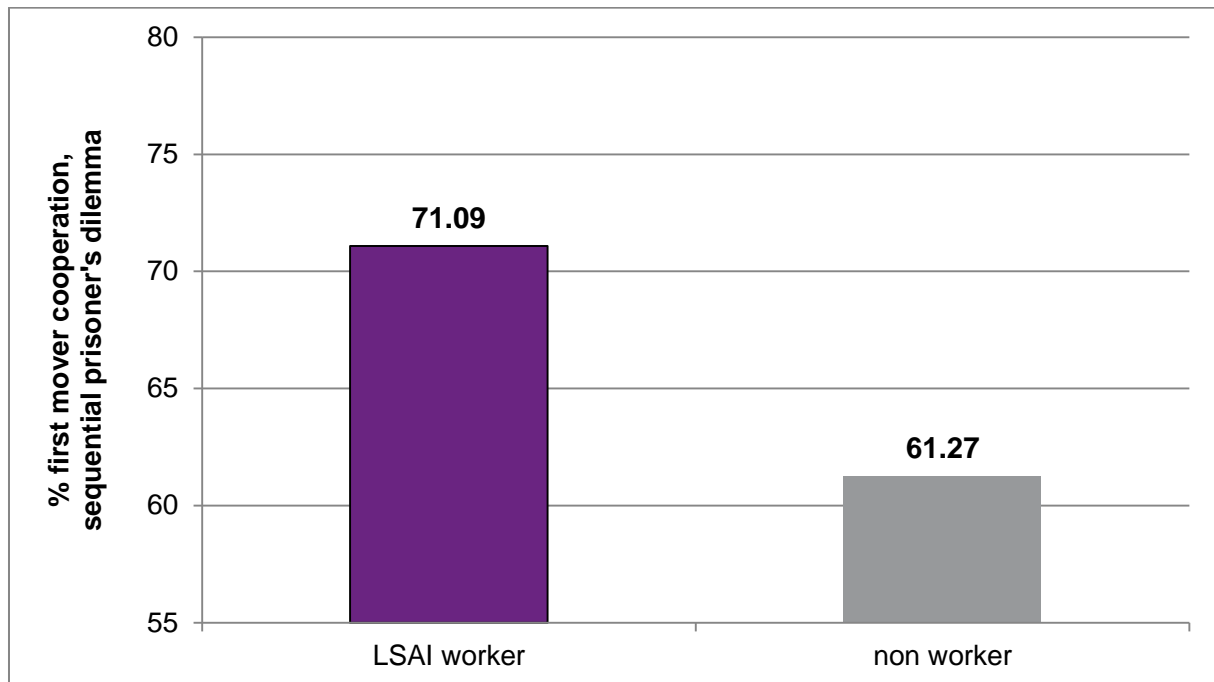
5.3   Results: Second-Mover Conditional Cooperation

The decision making of the second movers in the sequential Prisoner's Dilemma involved two choices: (1) cooperation (pink choice) or defection (yellow choice) in the case of first-mover cooperation and (2) cooperation or defection in the case of first-mover defection. In order to analyse the decisions of second movers, we formulate four strategies: first, *reciprocity* (or *conditional cooperation*) when second movers answer cooperation with cooperation and defection with defection; second, *payoff maximization* which is characterized by defection in both cases; third, *altruism* which occurs when second movers cooperate in both cases; and fourth, a seemingly *irrational strategy* of answering cooperation with defection and defection with cooperation.

We find similar rates for all strategies in _*near* and _*further* villages; none of the differences is statistically significant. Conditional cooperation varies between 36 and 38 percent, payoff maximization varies between 29 and 31 percent, and altruism between 19 and 17 percent. The remaining 14 percent were second movers with a seemingly irrational strategy.

Thus, we do not find a direct effect of the proximity of large-scale agricultural investments on

the propensity to play a certain strategy more often (i.e. null results for Hypotheses 1a and 1b for second movers). Next, we again look at whether there is any effect for LSAI workers (Hypothesis 2). We are especially interested in the propensity of conditional cooperation. Indeed, we find that the share of conditional cooperation among LSAI workers is 42.62 percent and thereby significantly greater than the share among non-workers (32.29 percent). This difference is significant at p-value = 0.025 (chi-squared test). Figure 5 depicts this result.

Figure 5. Conditional cooperation of LSAI workers and non-workers.
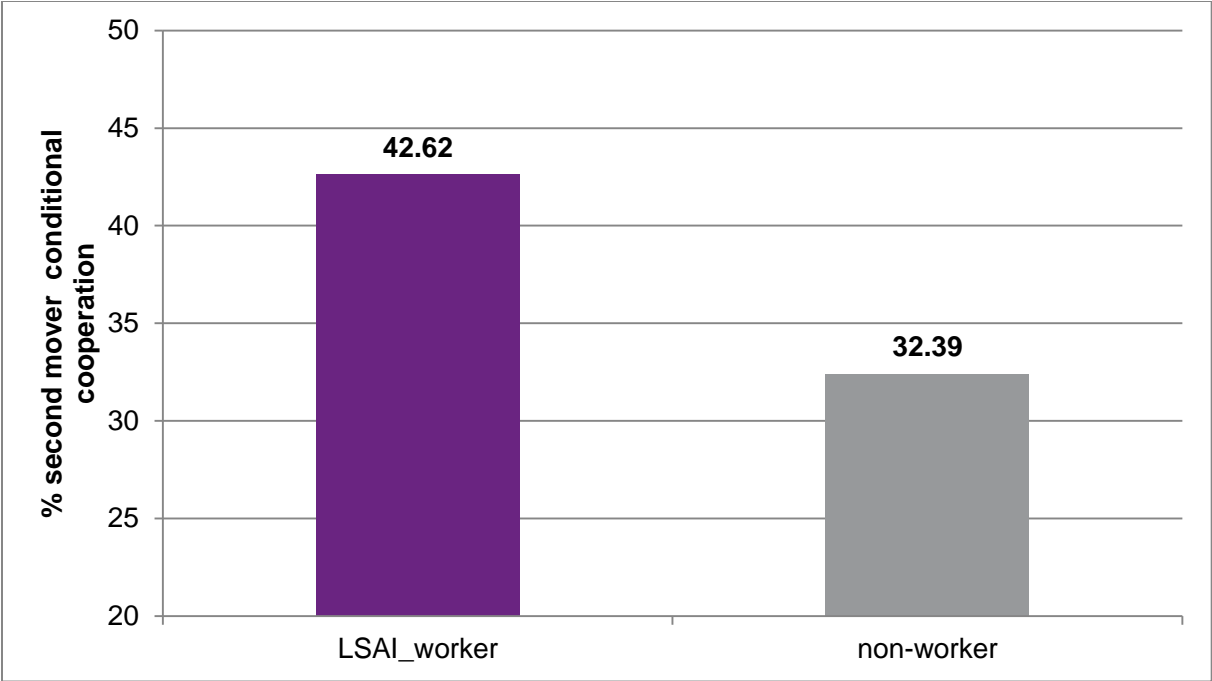
Again, we complement our first-glance chi-squared test with a regression analysis for second movers' cooperation which mirrors the analysis for first movers. Table 3 provides the results.

Table 3. Regression analysis of second mover conditional cooperation.

VARIABLES	(1) III Logit regression	(2) IV Logit regression
_near village (dummy, 1 = yes)	0.028	0.026
	(0.041)	(0.043)
Age (continuous)	0.002	0.001
	(0.001)	(0.002)
Male (dummy, 1 = yes)	-0.031	-0.035
	(0.058)	(0.070)
Education in years (continuous)	-0.005	-0.011
	(0.011)	(0.011)
Literacy (continuous)	-0.016	-0.011
	(0.030)	(0.030)
LSAI worker (dummy, 1 =yes)	0.082*	0.112*
	(0.048)	(0.058)
Born in the village (dummy, 1 = yes)		-0.089**
		(0.041)
Household head (dummy, 1 = yes)		0.010
		(0.064)
Own hectares (continuous)		0.003
		(0.004)
Village Area (continuous)		-0.008
		(0.012)
Land title (dummy, 1 = yes)		0.031
		(0.071)
Ethnicity		0.002
		(0.002)
Asset index based on pca		0.011
		(0.171)
Observations	455	409
Region	NO	YES
Crops		YES

The table presents marginal effects. The observations from the control villages are the baseline of the estimations. The standard errors in parentheses are clustered at the village level for 29 villages in all estimations. Statistical Significance*** p<0.01, ** p<0.05, * p<0.1

We find that this effect remains statistically significant at the 10% level and robust to changes in the regression specification (see regressions III and IV). We therefore formulate:

Result 3. *Conditional cooperation is more pronounced for smallholders who worked on a large-scale farm than for comparable smallholders.*

This finding is consistent with Hypothesis 2 and with Ensminger (2004) and Heinrich et al. (2001), who find that market integration increases cooperativeness and fair pay-offs. Recall that our descriptive statistics in Table 1 shows more than double the amount of smallholders

with work experience on the investment farm in _near villages compared to _further villages.

Since the effect of being employed on the investment farm turned out to be particularly dominant in the case of both first mover and second mover cooperation, a natural follow up question that arises is whether the levels of cooperation vary with the duration of market exposure or employment on the LSAI.

In the individual questionnaire, we asked participants who stated that they had worked on a LSAI about the length of their employment. A pairwise correlation (and similarly a logit regression) does not yield any significant effect for first-mover cooperation. Conversely, a pairwise correlation (and a logit regression) between second-mover conditional cooperation and the length of employment yields a positive and significant effect at the 5 percent level. The propensity to conditionally cooperate is about 50 percent higher for farm workers who have been employed for more than a year compared to those who were employed less than 3 months (an increase from 30 percent to 50 percent). Figure 6 visualizes the effect. Hence, we find evidence that cooperation of long-term employees is significantly greater than of short-term employees. When controlling for village location, gender, age, being born in the village and years of education, the effect remains significant at the 5 percent level (the estimation results can be found in Table A.2 in appendix A).

Figure 6. Second mover reciprocity and length of employment on the LSAI.
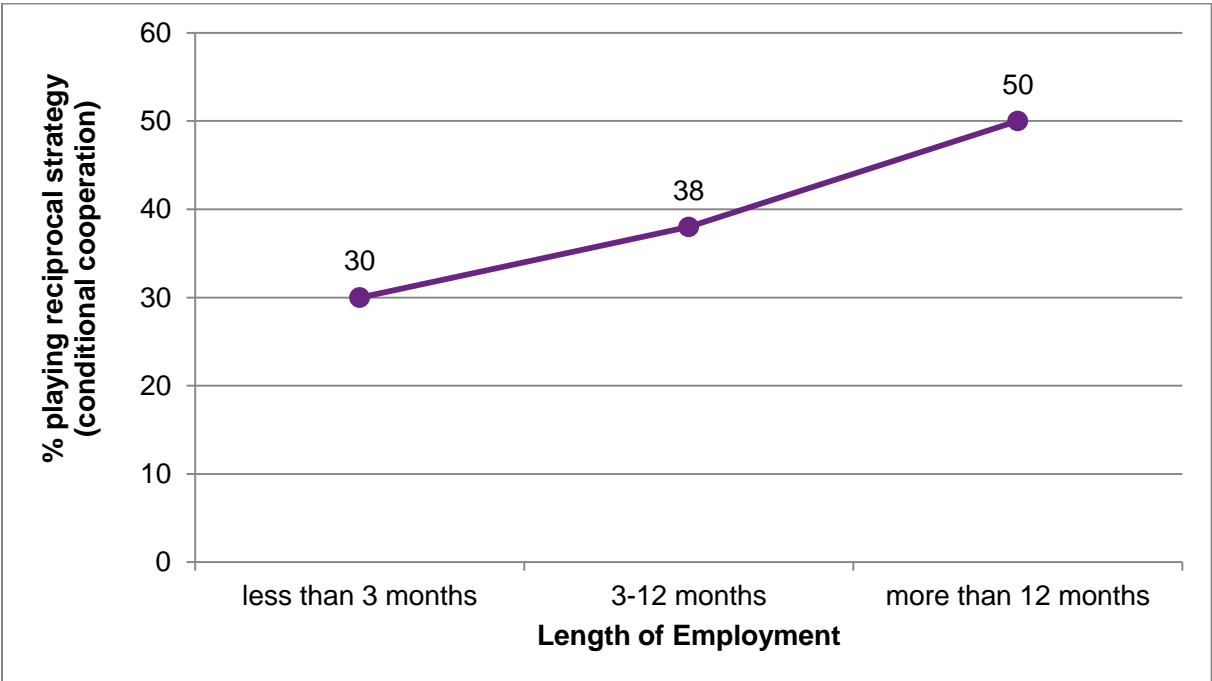
Of course, we cannot fully rule out reverse causality. For instance, it could be that employees that are not reciprocative do not reach long-term employment and get laid off beforehand. Our finding is nevertheless in line with the reputation hypothesis that reciprocal behaviour and market integration go hand in hand (Henrich et al., 2001; Ensminger, 2004; Ensminger and Henrich, 2014).

5.4   Support for Communal Coping and the Reputation Hypothesis

As described in the sections above, the first trip of our field research that occurred between mid-August and the end of September 2015 was conducted in a blinded manner so that neither the field research assistants nor the study respondents were aware of the central research question. In addition, neither the research support letter by the provincial government nor the questionnaires used for the study included questions on the LSAIs in order to rule out response biases.

The second round of field work was conducted in July 2016. The main aim of this visit was to collect information that would substantiate the transmission mechanisms described above. Having collected all the experimental data, we could freely engage village representatives in discussions about their interactions with LSAIs, land governance as well as the frequency of village meetings and the topics discussed without fear of biasing the results from the lab-in-the-field experiment.

To verify whether communal coping drives the results that we observe for first movers in _*near* villages, we asked each village headman (or –woman) and other community members present if there was a LSAI within walking distance of their community. In line with our expectations and own observations, only the participants from _*near* villages responded affirmatively. Within these villages, there was a general perception of uncertainty and disgruntlement mostly caused by the belief that the LSAIs did not adequately compensate their employees for the amount of work they were expected to do. Over 90 percent of the community representatives and members interviewed in the _*near* villages, indicated that they were not happy with the remuneration offered by the LSAI and that there had been at least one meeting (formal or informal) were this topic had been discussed. While the villagers from the _*further* villages also met frequently to discuss different topics, there was no topic that directly affected all community members within these villages. This indicates that perceptions of uncertainty and adversity caused by the presence of the LSAI have led the smallholders in _*near* villages to bond together. Overall, this provides support for the communal coping channel.

At first glance our main findings, i.e. LSAI workers having a greater propensity to cooperate, may appear paradoxical considering the general discontentment with the LSAIs reported above. To better understand what might be driving these results, we compare the socioeconomic characteristics of LSAI workers with other villagers that do not have any experience on LSAIs. From Table 4, it is clear that LSAI workers own fewer assets and have less land holdings than other villagers that have not been employed on the LSAI. This suggests that increased incomes or a sense of 'giving back to the community' cannot be driving the cooperative outcomes observed in Tables 1 and 2.

Table 4. LSAI worker socioeconomic characteristics.

	Non- workers		LSAI workers		
Variable	Mean	SD	Mean	SD	p-values
Male	0.44	0.50	0.59	0.49	**0.00**
Household head	0.44	0.50	0.49	0.50	0.12
Age (in years)	38.48	17.55	37.58	14.96	0.94
Migrant	0.56	0.50	0.51	0.50	0.12
Years of education	6.57	3.49	6.26	3.23	0.12
Literacy (with 5 is the highest level)	2.65	1.30	2.59	1.33	0.48
Asset index	0.43	0.18	0.40	0.15	**0.01**
Hectares cultivated	5.13	6.56	4.72	6.76	**0.01**
Individuals	569		356		

Note: Statistically significant p-values in bold. The p-values are based on two-sided Mann-Whitney tests for the continuous variables and chi-squared tests for the binary variables.

In our communication with representatives from the _*near* villages on the LSAI recruitment process and work conditions, many of the respondents indicated that the employment opportunities offered by the LSAI were low skill positions that did not require any specific expertise. They also suggested that it was not difficult to work for the LSAIs since they did not have strict recruitment criteria. Once newly employed, workers were usually first offered short term contracts which could be renewed for the next harvesting (high labour demand) season depending on their performance. Some of the key characteristics expected of the workers were that they were punctual, reliable and hard working.

From this, it is clear that although there is no strict screening process during the recruitment phase, once employed, workers are required to invest in reputation-enhancing traits if they are to secure a contract for the next harvesting season or even a permanent contract. As shown in other studies (Ensminger, 2004), it is possible that these reputation-enhancing traits are

internalised by villagers as norms and applied in their natural settings. This is in accordance with our finding that cooperation increases with the length of employment on the investment farm (Figure 6).

5.5   Natural Field Experiment

In addition to the lab-in-the-field experiment, we conducted a natural field experiment that compared the governance of public goods across the study villages. This experiment had two objectives: (i) to provide independent evidence on the effect of LSAIs on villagers' social capital; and (ii) to validate the lab-in-the-field experiment. Narayan and Pritchett (1996:887) state that social capital at the village-level can also be measured through the "management of resources that are treated as common property within the village or among several villages, such as improved water supplies, local irrigation capabilities, and local roads". For this reason, during our first field research trip in August and September 2015, we endowed each village in our sample with a free public good that took the form of a solar system.[13]

The public good was a d.light D20 solar system. This product comes with a solar panel, a battery unit, two stationary and a portable LED lamp, two light switches and a USB port accompanied by several adaptors for mobile phone battery charging. It is manufactured to meet the needs of poor people in the developing world: it is very simple to handle and robust in extreme weather conditions. Once fully charged, the solar systems can provide lighting for 7-15 hours and can charge 4-5 simple mobile phones per day.[14] In mid-July 2016 we returned to the villages for an unannounced visit to examine the status of the solar systems.

The solar systems were bestowed in each village only after all lab-in-the-field games had been played and the administration of the household surveys was coming to an end.[15] We followed a script that amongst others stated that the solar system was provided by our research team

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[13] There are several reasons why this product was useful as a public good in a village setting like the one we investigated in our study. First, 98.17 percent of all participants in our study did not have access to the electricity grid. 65.63 percent reported to use battery-powered torches for lighting followed by 28.26 percent who reported using candles. Given the very low income of individuals in our study environment and our observations, we assume that these options were not used regularly. Often these individuals did not have any source of light beyond the fireplace outside their huts. Hence, the lamps of the public good were very useful.
Likewise phone charging is very useful to the villagers. While 79.51 percent of them reported owning a mobile phone (these are almost always simple and affordable mobile phone to make phone calls or send a text message, not smartphones), most of them do not have electricity access at home. Hence, the usual way of charging mobile phones is to travel to a shop with electricity and pay for charging. It often takes several hours to reach these shops by foot. Hence, the public good can serve as a source of electricity for charging mobile phones for free and close by.
[14] More information about the solar system is available on the product website: http://www.dlight.com/.
[15] We recorded pictures and videos of the handing over of the public goods in all villages. These media files are available from the authors upon request.

(and our funding institution, the International Growth Centre at the London School of Economics) for free and without any obligations. We stressed that the solar system was given to the whole community and invited the respective headman or –woman to receive the solar system on behalf of the community members. We demonstrated how to operate the solar system and provided examples of the different ways in which the solar systems could be used as a public good. For instance, we suggested that the lamps could be used for village gatherings such as overnight services at the church, weddings, and funerals as well as studying in groups at night, and childbirths. In addition, we pointed out that the panel could be used by all members of the village to charge the batteries of their mobile phones for free (given the battery life and sporadic use of these simple mobile phones this was a realistic scenario). In front of all study participants, all village headmen or –women confirmed that they would use the solar system for the good of the community and acknowledged that they had understood all the information provided.

We expected heterogeneity concerning the community solar system along two dimensions. First, we were interested in how many solar systems were still present and working in the villages (and not sold, lost, stolen or broken, for instance). Second, we were interested in whether the public good nature of the community solar system was maintained almost a year after or whether it had been privatized (assumingly by the headman or –woman). Note again that there was never any announcement that we would ever return to the village which makes the anticipation of our return as a motivator highly unlikely.

Along the first dimension we were surprised to find very little heterogeneity. All but two solar systems were still present and working in the villages including all of their parts.[16] Along the second dimension we indeed found several solar systems that were privatized by the headman or –woman, while others were shared either by means of using the lamps at village gatherings, by allowing community members to charge their mobile phones for free, or both.[17] The sorting into two broad categories – privatized and shared – and into various degrees of sharing was done by interviewing multiple random individuals from the villages independently, interviewing the headmen and –women, and rating of the statements by a new set of two 'blind' research assistants who neither knew the research question nor the game outcomes from the villages.

As shown in Figure 7, the results from this sorting into privatized and shared solar systems reveal a significant difference between _near and _further villages (p= 0.011, chi-squared test

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[16] One solar system was missing and another one was damaged due to improper use (drilling into the battery). Two headmen and their families were absent, so that these observations are missing.
[17] For this comparison we are able to consider 25 of 29 villages. One solar system was damaged, another one was gone, as described above, and in two villages we were not able to interview the headman or the family due to absence.

test). Strikingly, sharing occurred in all _near villages, whereas the solar systems were privatized in almost half the _further villages. This corroborates the findings of the lab-in-the-field experiment, even though the evidence should only be regarded as suggestive due to the low number of 25 observations.

Figure 7. Sharing of Community Solar System and Proximity to LSAIs.
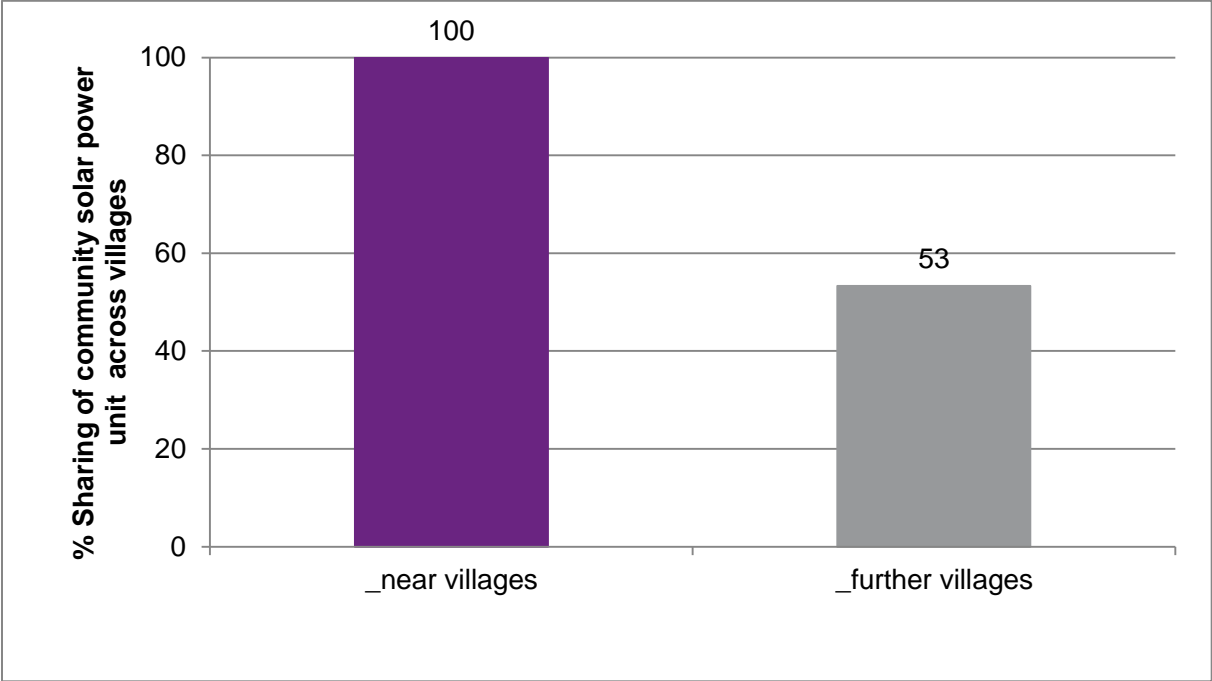
Next, as a simple validation exercise, we pool all villages and test for a correlation between the measures of social capital in the lab-in-the-field and the natural field experiment. It turns out that the propensity to cooperate of first-movers at the village-level indeed correlates with the extent to which solar systems are shared in the village. While the average propensity to cooperate is 49.9 percent in the 7 villages where the solar systems were fully privatized a year later, it is 68.3 percent in the 18 villages that share at least to some degree. This difference in propensities is statistically significant (two-sided Mann-Whitney test, $p = 0.0082$). The propensity to conditionally cooperate does not differ between the two categories of villages (37.5 percent for privatized and 35.5 percent for shared solar systems). Figure 8 provides an overview of these results.

Figure 8. Lab-in-the-field and natural field experiment measures.
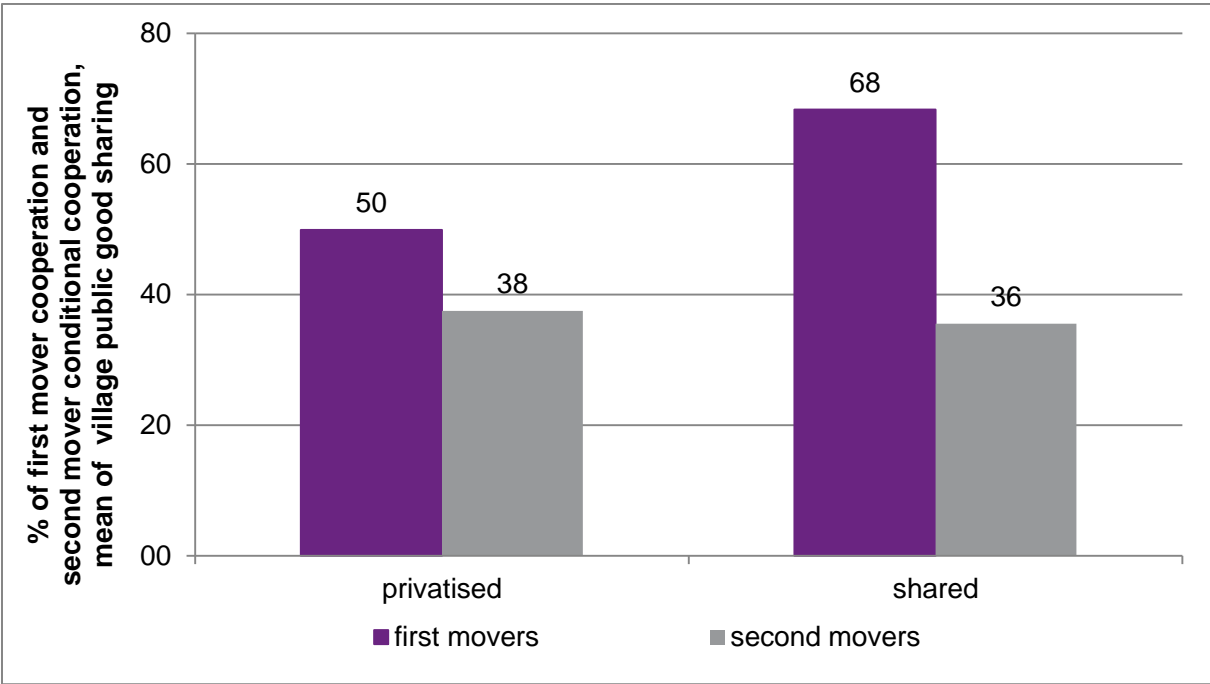
In summary, we find that our natural field experimental measure of social capital, i.e. sharing a public good, correlates significantly with one of the lab-in-the-field measures, i.e. first-mover cooperation in the sequential Prisoner's Dilemma. This is in line with literature that argues that villages with higher social capital are bound to have better communal property or public goods management (Narayan and Pritchett, 1996). Our natural field experiment therefore provides some external validity for our findings from the lab-in-the-field experiment.[18]

6   Summary and Conclusion

The latest wave of LSAIs has prompted a growing literature that analyses the spill-over effects of these investments on communities residing in their proximity. So far this research has focused on directly observable outcomes of such investments that include changes in employment, input use and productivity. In this paper, we provide first insights into the impacts of LSAIs on social capital, which is not directly observable yet highly important for economic development. Using both a lab-in-the-field and a natural field experiment, we examine whether intra-village levels of cooperation among smallholders are affected by neighbouring LSAIs. Our basic hypothesis is that village communities adjust their cooperative behaviour when exposed

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[18] Similar approaches for behaviour in different domains like common pool resources, (charitable) giving and cheating are discussed by Levitt and List (2007), Stoop et al., (2012), Stoop (2014), Galizzi and Navarro-Martinez (2015), Cohn and Maréchal (2016) and Potters and Stoop (2016).

to market-oriented systems such as those that characterise LSAIs. We find that smallholders in villages close to LSAIs tend to trust each other more than those in villages further away, and that villagers who have worked on a LSAI are more likely both to trust and to reciprocate. Our field experiment regarding governance of a public good – a community solar system– points in the same direction of greater cooperation in communities neighbouring LSAIs.

The two LSAIs selected for this study are largely representative of other LSAIs that are operational in Zambia. Thus the findings of this study hold lessons beyond the particular case considered here in at least two major respects. First, given that the settings in which LSAIs operate in Zambia resemble those in other parts of Sub-Saharan Africa, our findings may carry over to African countries that have similarly experienced a rise in demand for agricultural land. Still, more research is needed to confirm our results for a wider set of countries. Future research may also take a closer look at different employment modes on large-scale farms that foster positive externalities. Second, the establishment of LSAIs constitutes only one of many examples where traditional communities are exposed to market-oriented systems in the course of economic development and structural transformation. While the overall effects of market exposure may differ from case to case, outcomes are likely to be driven by common transmission mechanisms.

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Appendix A – Additional Figures and Tables

Figure A.1. The support letter from the Provincial Government

Telephone: 222421/5
Telegrams: PERMSEC: KABWE
Fax: 224256

In reply, please quote
No:.........................

REPUBLIC OF ZAMBIA

OFFICE OF THE PRESIDENT

PROVINCIAL ADMINISTRATION
CENTRAL PROVINCE
P.O BOX 80903
KABWE.

12th August 2015

TO WHOM IT MAY CONCERN

RE   :   INTRODUCTION LETTER

Reference is made to the subject matter above.

The Kiel Institute of World Economy, an International Centre for Research in Global Economic Affairs is conducting a study in selected areas in Chibombo, Mumbwa and Mkushi Districts. The objective of the study is to investigate the Social Capital of people living in villages and farms.

The Data Collection exercise is scheduled to commence in the last week of August 2015. A team of interviewers will visit your area and conduct group discussions with the villagers and their leaders to collect information pertaining to the study. You are requested to cooperate with the Data Collectors in order to make the research a success.

I thank you in advance for your cooperation.

Abigail K Malukutila
Assistant Secretary
For/ Permanent Secretary
CENTRAL PROVINCE

Figure A.2. Correspondence with the Zambia Agriculture Research Institute.

All communication should be addressed to the
DIRECTOR
Telephone: CHILANGA (+260 211) 278380 /278141/ 278130

Fax : +260 211 278130
E-mail:zaridirector@gov.zm
www.zari.gov.zm

In reply please quote:

*MMCR/*101/13/1..................

REPUBLIC OF ZAMBIA
MINISTRY OF AGRICULTURE

ZAMBIA AGRICULTURE RESEARCH INSTITUTE
MOUNT MAKULU CENTRAL RESEARCH STATION
PRIVATE BAG 7
CHILANGA

KACANA SIPANGULE
KIEL INSTITUTE FOR THE WORLD ECONOMY
HINDENBURGUFER 66
D-24105 KIEL
GERMANY

27th JULY, 2016.

Dear Madam,

REF: SOIL ANALYTICAL RESULTS

Attached are soil analytical results for the soil samples that were brought to the Soil Chemistry Laboratory for nutrient analysis.

Thank you for using the chemical testing facility of the Zambia Agriculture Research Institute for your soil analytical requirements.

Yours Faithfully,

27/07/16

H. Tembo
CHIEF AGRICULTURE RESEARCH OFFICER
For/DIRECTOR- ZAMBIA AGRICULTURE RESEARCH INSTITUTE-ZARI

Table A.1. LSAIs operational in Zambia

Name of Investor	Country of origin	Location	Hectares contracted	Crops
Lin Changming	China	Lusaka	400	Maize, Vegetables, Wheat
Hawkwood Capital LLC	United Kingdom	Choma, Kabwe, Kalomo	27087	Maize, Soya Beans, Wheat
Emvest	South Africa	Kalonga Estates	2513	Banana, Maize, Soya Beans, Wheat
Agrivision Africa (Pty) Ltd	South Africa	Mkushi	4094	Maize, Soya Beans, Wheat
AG-Zam	South Africa	Kazungula	15000	Sugar Cane
Agrivision Africa (Pty) Ltd	South Africa	Mpongwe	12822	Maize, Soya Beans, Wheat
Denbia	Denmark	Lusaka	3000	Coffee Plant, Maize, Fruit, Onion, Potatoes, Soya Beans, Sun Flower, Wheat
Amatheon Agri Holding N.V.	Germany	Kaindu (Mumbwa)	38760	Barley, Maize, Soya Beans, Wheat
Olam International Ltd.	Singapore	Kasama, Mbala, Mungwi	4380	Coffee Plant, Maize, Sun Flower
Crookes Brothers Ltd	South Africa	Mazabuka	440	Sugar Cane
InfraCo Limited	United Kingdom	Kafue	1575	Barley, Sorghum, Maize, Soya Beans, Wheat
Ambika	Russia	Mkushi	1700	Maize
Herdon Investments	United Kingdom	Chibombo	650	Sun Flower, Soya Beans
Vixers Farming	Zimbabwe	Chibombo	1200	Soya Beans
Tiso Blackstar	South Africa	Mpande	990	Maize, Soya Beans

Data downloaded on August 28, 2016 from Land Matrix website: http://www.landmatrix.org/en/get-the-detail/by-target-country/zambia/

Table A.2. Regression analysis of second mover conditional cooperation and length of employment (dependent variable: second mover conditional cooperation in the sequential PD (1 = yes)).

	(A.1) Logit regression	(A.2) Logit regression
Variables		
Amount of time worker worked on farm	0.055*	0.058**
	(0.029)	(0.026)
_near village (dummy, 1 = yes)		-0.015
		(0.081)
Age (continuous)		-0.000
		(0.003)
Male (dummy, 1 = yes)		-0.168**
		(0.080)
Born in the village (dummy, 1 = yes)		-0.105
		(0.075)
Education in years (continuous)		0.000
		(0.011)
Observations	180	177

*Note: The table presents marginal effects. The observations from the control villages are the baseline of the estimations. Statistical significance: *p < 0.10, **p < 0.05, ***p < 0.01.*

Appendix B – Instructions

Introduction

Thank you all for taking the time to come today. Today's activities may take three to four hours. Before we begin I want to make some general comments about what we are doing here today and explain the rules that we must follow.

We will ask each of you to make decisions involving money and to answer a few questions. Whatever money you earn during the activities will be yours to keep and take home. Nobody but the researchers and you will know what you decided and earned, and **money will be given in private. No other participant will learn about your decisions and earned money.** We will be supplying the money. This money was given to us by the London School of Economics, a university in Great Britain, to use for research and it is not our own personal money.

Before we proceed any further, **let me stress something that is very important**. Many of you were invited here without knowing very much about what we are planning to do today. If at any time you find that this is something that you do not wish to participate in for any reason, you are of course free to leave whether we have started the activity or not.

We will be asking you to do **three activities** with other individuals in your village today. **Your earnings from all three activities sums to your total earnings**. You will be informed about the outcomes in the three activities and your total earnings in private **at the end of all activities**.

If you have heard anything about these types of activities, you should try to forget about that because each activity can be completely different. It is important that you listen as carefully as possible.

We will run through some examples of how the activities work. **You cannot ask questions or talk while here in the group. This is very important.** Please be sure that you obey this rule, because it is possible for one person to spoil the activities for everyone. If one person talks about the activities while others can hear it, we would not be able to carry out the activities today. Do not worry if you do not completely understand the rules as we go through them here in the group. Each of you will have a chance to ask questions in private to be sure that you understand how the activities work.

Before we explain the activities we divide you into **two groups, the Green Group and the Black Group**, according to the colored cards that you have drawn from the bag a moment ago. The two groups will separate, so that green-card people and black-card people cannot see or hear each other.

After we have explained the activities, you will all wait in a group. We will call you by the number on your ticket, so please listen carefully for your number. While you are waiting you can talk about anything else you want other than the activities here today.

Activity 1 – Black Group

In activity 1 you can choose between two options: **Pink** and **Yellow**. Another person from the Green Group, who is randomly matched with you, also chooses between Pink and Yellow.

You decide first and then the other person from the Green Group will decide second.

Your payment and the payment of the other person depend on your own decision and the decision of the other person:

- If you choose **Pink** and the other person also chooses **Pink**, then you will receive **40 kwacha** and the other person will also receive **40 kwacha**.
- If you choose **Yellow** and the other person chooses **Pink**, then you will receive **50 kwacha** and the other person will receive **5 kwacha**.
- If you choose **Pink** and the other person chooses **Yellow**, then you will receive **5 kwacha** and the other person will receive **50 kwacha**.
- If you choose **Yellow** and the other person also chooses **Yellow**, then you will receive **30 kwacha** and the other person will also receive **30 kwacha**.

Remember, you decide first and then the other person from the Green Group will decide second.

Please choose on the sheet of paper by marking your choice with the pen on the Pink or the Yellow arrow.

_____

Activity 1 – Green Group

In activity 1 you can choose between two options: **Pink** and **Yellow**. Another person from the Black Group, who is randomly matched with you, also chooses between Pink and Yellow.

You will decide second; that is, the other person from the Black Group decides before you.

Your payment and the payment of the other person depend on your own decision and the decision of the other person:

- If you choose **Pink** and the other person also chooses **Pink**, then you will receive **40 kwacha** and the other person will also receive **40 kwacha**.
- If you choose **Yellow** and the other person chooses **Pink**, then you will receive **50 kwacha** and the other person will receive **5 kwacha**.
- If you choose **Pink** and the other person chooses **Yellow**, then you will receive **5 kwacha** and the other person will receive **50 kwacha**.
- If you choose **Yellow** and the other person also chooses **Yellow**, then you will receive **30 kwacha** and the other person will also receive **30 kwacha**.

You will decide second; that is, the other person from the Black Group decides before you.

Please choose on the sheet of paper by marking your <u>two choices, one for each of the two possible scenarios,</u> with the pen on the Pink or the Yellow arrow.

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