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SOCIAL CAPITAL AND LARGE-SCALE AGRICULTURAL INVESTMENTS: AN EXPERIMENTAL INVESTIGATION*

Menusch Khadjavi, Kacana Sipangule and Rainer Thiele

Following the 2007–8 global food crisis, agricultural producers have invested in large tracts of land in developing countries. We investigate how the arrival of large-scale farms changes inter-personal trust and reciprocity, important components of social capital, in traditional villages. We elicit trust and reciprocal behaviour in villages that lie near large-scale farms and compare them with villages at a distance. Our data reveal greater trust in villages close to large-scale farms. Reciprocity is more frequent after farm employment. These results are likely driven by communal coping and reputation building. A natural field measure shows that trust correlates with public good sharing.

The aftermath of the global commodity price spike of 2007–8 has been characterised by high demand for large tracts of agricultural land in developing countries. The Land Matrix Global Observatory reports more than 1,500 concluded international deals and more than 48 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 about the 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 recent 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 these investments can be governed (Margulis *et al.*, 2013; Nolte 2014) and whether they are beneficial for the countries that host them (Cotula *et al.*, 2009; von Braun and Meinzen-Dick, 2009).

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The data and codes for this paper are available on the Journal website. They were checked for their ability to replicate the results presented in the paper.

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¹ For more information, see www.landmatrix.org. The Land Matrix Global Observatory is a database that was set up by 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 GIZ.

A key insight from this literature is that there are spill-over effects from LSAIs on neighbouring communities (Deininger and Xia, 2016). These effects may be either positive (for example, through employment creation and infrastructural development) or negative (through displacements, increased land tenure insecurity and heightened perceptions of increased land scarcity). Empirical works (e.g., Deininger and Xia, 2016; Lay *et al.*, 2018) have analysed the spill-over effects of LSAIs on the rural communities that surround them. Lay *et al.* (2018) find that rural Zambian smallholders that are located in wards with LSAIs have higher yields and cultivated areas than smallholders in wards without large-scale farms. In the case of Mozambique, Deininger and Xia (2016) find positive spill-overs on smallholders' adoption of agricultural practices and input use but not on perceived well-being, access to output markets or the cultivation of larger areas.

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 and observe directly. Fukuyama (1995), Woolcock (1998) and authors of different chapters in the seminal contribution of Dasgupta and Serageldin (1999) provide different definitions of social capital.² Commonly defined denominators for social capital are trust, reciprocity (trustworthiness) within groups, and high connectedness in social networks.³

This article focuses on the trust and reciprocity components of social capital. It contributes to filling the existing gap in the literature by using experimental methods to analyse how the establishment of LSAIs affects trust and reciprocity of smallholders living within their vicinities. Smallholders' trust and reciprocity can be affected if they feel threatened or uncertain by the materialisation of the LSAI within their vicinity and through their engagement with LSAIs in employee–employer relationships.

Based on the literatures on market exposure (e.g., Hirschman, 1982; Bowles, 1998), communal coping (Lyons *et al.*, 1998) and gift-exchange relationships (Arrow, 1972; Akerlof, 1982) that provide insights from functionally similar set-ups, we formulate predictions on how trust and reciprocity of smallholders may change with the establishment of LSAIs.

First, exposure to market-oriented LSAIs is likely to change smallholders' economic and social behaviour. Hirschman (1982) and Bowles (1998) present opposing views on the potential effects of market exposure. On the one hand, markets may foster virtues of honesty, civility and co-operation (McCloskey, 2006; Fourcade and Healy, 2007). Engagement in frequent economic interactions associated with markets may also lead one to place a higher importance on developing one's credibility and reputation (Arrow, 1972; Fourcade and Healy, 2007). On the other hand, a 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 arises when markets crowd out cooperation and altruism and reduce them to a narrow form of self-interested individualism (Fourcade and Healy, 2007).

Secondly, the establishment of LSAIs may pose a threat to smallholders. Many smallholders in developing countries do not hold formal property rights (formal title) for the land that their families have been farming for generations—they typically hold only traditional, usufruct rights. When a LSAI with formal property rights is established in the vicinity of a traditional village, the two forms of property rights may clash, with the formal property rights of the LSAI being legally superior. This situation may create uncertainty and threaten the village community. Lyons *et al.*

² Sobel (2002) provides a review and assessment of the contributions in the chapters.

³ See also Durlauf (2002) and Durlauf and Fafchamps (2005) for discussions of different definitions.

(1998) provides evidence that members of a community band together to cope with uncertainty. Given the asymmetries in the property rights of LSAIs and smallholders, we expect to observe some form of communal coping.

Thirdly, smallholders in rural peasant settings usually lack opportunities for formal employment. As van den Broeck, Swinnen and Maertens (2017) have shown large-scale farms may provide employment opportunities to poor agricultural households in their vicinity. Akerlof (1982) and Fehr *et al.* (1993) provide theory and empirical evidence that gift exchange is an essential part of labour relationships. Gift exchange typically occurs when employees reciprocate above-minimum wages and other rewards with greater work effort. Besides our focus on intra-village trust, we are also interested in observing whether employee–employer relationships with LSAIs foster reciprocal behaviour.

Our approach of identifying the impacts of large-scale agricultural investments on trust and reciprocity builds on the experimental economics literature on social capital in developing countries (Glaeser *et al.*, 2000; Karlan, 2005; Bouma *et al.*, 2008; Braaten, 2014). We are specifically interested in understanding how the levels of intra-village trust and reciprocity of smallholders are affected after an LSAI is set up within their proximity. For this purpose, we employ a lab-in-the-field experiment⁴ using the sequential Prisoner's Dilemma (PD) (Clark and Sefton, 2001; Khadjavi and Lange, 2013). We conducted 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 in the sample act as first movers who make trust decisions and the other half take the role of second movers who can choose to make reciprocal, altruistic or selfish decisions. We thereby measure the extent of trust of the first movers and reciprocity of the second movers. We complement our analysis with a natural field measure related to social capital in which we observe the governance of public goods, i.e., how community solar power systems that are bestowed as public goods to the villages in our study are administered and maintained.⁵

Our results provide evidence for increased trust and reciprocity via the channels of communal coping and gift exchange. We find significantly higher levels of intra-village trust in the villages close to LSAIs. These levels go hand in hand with more frequent village meetings where smallholders discuss how they can with the LSAI. We also find a significant correlation between intra-village trust and the success of villages to equitably share the community solar power systems. Smallholders who engage in formal employment relationships with the LSAIs also show a greater propensity to reciprocate. Our data shows that this correlation intensifies with the duration of employment and that this effect is not due to changes in income.

1. 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

⁴ Such experiments are also commonly referred to as 'artefactual field experiments' (Harrison and List, 2004) and 'extra-lab experiments' (Charness *et al.*, 2013).

⁵ The natural field measure was administered within the participants' natural settings without their awareness of their partaking in an experiment. Natural field experiments differ from natural experiments that also occur in natural settings but have variation that is caused by exogenous factors which are beyond the experimenters' control.

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. Secondly, 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. Chiefs are assisted by local headwomen or headmen who act as custodians of the land on their behalf. Within this system, formal property rights are rare. Smallholders have usufruct rights over their plots, but land sales to outsiders are prohibited without the chief's consent. 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-oriented systems of agriculture. LSAIs have also been established in the proximity of smallholder communities in other sub-Saharan African countries that have a parallel system of titled and customary land tenure such as Ethiopia (Baumgartner *et al.*, 2015; Ali *et al.*, 2016), Ghana and Kenya (Nolte and Váth, 2015) and Nigeria (Adewumi *et al.*, 2013; Osabuohien, 2014).

We conducted the lab-in-the-field experiments in two commercial farming areas in Mumbwa and Mkushi districts. The LSAI in Mumbwa is leased by Amatheon Agri and covers an area of more than 30,000 hectares. Amatheon Agri is a German-owned agribusiness and processing company that seeks to vertically integrate grain and livestock into the food value chain. It has been operational since 2012. According to the company's annual reports, the farm currently operates 3,000 hectares for cropping and an additional 2,000 hectares for cattle grazing. In 2015, Amatheon acquired three ranching and meat-processing companies, thereby making it the second-largest meat operation in the country. In the same year, Amatheon reports that one-third of its staff held permanent positions, while the remaining two-thirds were employed as casual labourers. It further states that it invests in the professional development of its employees by designing individualised training for each employee to close any knowledge gaps that exist when they engage in skilled positions, and that it encouraged the formation of the National Union of Plantation Agriculture and Allied Workers that serves as a platform between the farm and its employees. The firm allegedly engages with 5,000 neighbouring smallholders in an outgrower programme that sells agricultural inputs and purchases grain. The company's annual reports further claim to support local communities through partnerships with non-governmental organisations such as World Vision that resulted in the upgrading of a community school, as well as with Musika through the Amatheon Agri Extension Programme.⁶ Based on its experience in Zambia, Amatheon Agri has further expanded its operations to Zimbabwe and Uganda.

The LSAI in Mkushi, which is operated by Chobe Agrivision (a subsidiary of Agrivision Africa), consists of six different farms which together account for an area of 4,000 hectares. Agrivision Africa is an agribusiness enterprise that is financed by the Africa Agriculture and Trade Investment Fund (AATIF).⁷ Its main mission is to engage in vertical business integration and as such, it recently acquired a milling plant to process the maize and wheat cultivated on its two farms in Mkushi and Somawhe (North-Western Province of Zambia). Chobe Agrivision began its operations in Mkushi in 2010. The main markets that Chobe Agrivision target for their processed

⁶ Annual reports that provide more detailed background information on Amatheon are available on the company's website: <http://www.amatheon-agri.com/>.

⁷ The AATIF was set up by the German Development Bank KfW, on behalf of the Federal Ministry for Economic Co-operation and Development, and Deutsche Bank. More information on the AATIF as well as on Chobe Agrivision is available on the website of the AATIF: <https://www.aatif.lu/home.html>.

output are Zambia and the Democratic Republic of Congo. Prior to the start of its operations, Chobe Agrivision received consent from the Government of Zambia and signed an Investment Promotion and Protection Agreement (IPPA) with the Zambia Development Agency (ZDA).⁸ The investment also has coverage against political risk from the World Bank's Multilateral Investment Guarantee Agency. AATIF reports that the development phase of the LSAI in Mkushi was labour intensive and led to the hiring of approximately 300 fixed-term employees. However, the number of fixed-term employees was halved after the LSAI came into full operation in 2013. Currently, the LSAI mostly relies on casual labour in the peak harvest seasons. Chobe Agrivision is a member of the Zambia National Farmers Union (ZNFU). It reports to be actively engaged in promoting the welfare of its employees and neighbouring communities through the provision of training programmes for smallholders, employment schemes for worker development and alcohol abuse mitigation programmes for workers. The company further states that it has supported the rehabilitation and extension of a community school.⁹

The key distinction between the two LSAIs is the extent of land commercialisation prior to their establishment. The land in Mumbwa formed 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, Chobe Agrivision is situated within the Mkushi farm block—the land for the farm was acquired from established commercial farms (brownfield investment) that were consolidated (Chu, 2013).

In terms of the area and crops cultivated, the two LSAIs included in this study are very similar to the 13 other operational LSAIs listed by the Land Matrix (see Table A.1 in the Appendix).¹⁰ 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 after 2008. However, it is also important to point out that there are some minor differences between these two LSAIs and others. For instance, a report by the United Nation's Special Rapporteur on the Right to Food alludes to communities in Zambia having been resettled due to LSAIs. However, the documentation of these resettlements is poor and estimating the number of displacements that have occurred due to LSAIs is challenging (United Nations, 2018). The two LSAIs slightly differ from others because they both acquired titled land and displacements were kept to a minimum.

Our choice of these two LSAIs was motivated not only by our desire to select LSAIs that are representative at the national level, but also by other key criteria such as: identifying LSAIs 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 in Lusaka. 29 villages located close to a main road were randomly selected from these maps, out of which

⁸ IPPAs are standardised agreements offered to all investors that wish to obtain a certificate of registration. Upon the submission of all documents required for the processing of the IPPA, investors that invest more than USD 500,000 in priority sectors (that include agriculture) are eligible to a wide range of fiscal and non-fiscal incentives such as 0% import duty rate on capital equipment and machinery for five years, protection against nationalisation and the free facilitation of applications for immigration permits, secondary licences and utilities.

⁹ The information provided on the two LSAIs is sourced from their annual reports, thus it is likely that these reports may tend to portray the LSAIs in a good light and not report any negative aspects that arise.

¹⁰ The Land Matrix reports another 1,700-hectare LSAI, Ambika, that has been established in Mkushi. Its approximate location (sourced from the Land Matrix) has been illustrated in Figure 1A. Ambika is located within a 15-kilometre radius of Chobe Agrivision.

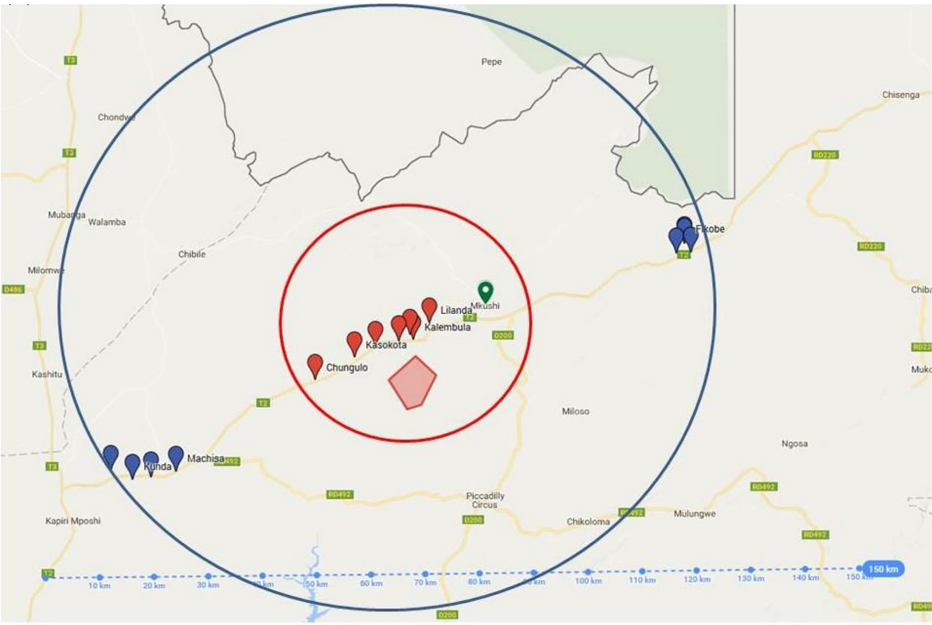


Fig. 1A. Randomly Selected Villages in the Mkushi Region.

Notes: The polygons depict the locations of the large-scale farming areas; the pins in the centre of the small circle indicate the locations of the *_near* villages while the outer pins show the *_further* villages. The pin with the dot depicts the approximate location of another farm in Mkushi reported by the Land Matrix (see Table A.1).

Source. Authors' own and Land Matrix data. Map created using Google Map Maker.

15 villages were located in Mkushi District and 14 were in Mumbwa District.¹¹ Altogether, we conducted the experiment with 932 smallholders in these villages. Figures 1A and 1B illustrate the study locations.

We compare the intra-village trust and reciprocity of villages in the proximity of the two LSAs with counterfactual villages that do not have LSAs. In each district, we randomly selected villages within a 15-kilometre radius from the large-scale farms (denoted *_near* villages) as well as villages located in a 50- to 70-kilometre radius around the centre of the large-scale farms (denoted *_further* villages). The average distance between the LSAs and the *_near* and *_further* villages was 9 and 51 kilometres respectively. Caution was taken to ensure that the villages located further away were not located close to other large-scale farms. The radii were calibrated in order to have villages from which smallholders could walk to the LSA on a daily basis for work (*_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 LSAs matters. As expected, villages within the 15-kilometre radius have a significantly larger amount of workers employed on

¹¹ We randomly selected villages close to a main road to avoid any distorting effects caused by proximity to markets and infrastructure.

¹² While the LSAs engage in small-scale corporate social responsibility (CSR) activities within the communities such as the improvement of school infrastructure, we do not find a difference in public goods between the two village groups. Nolte and Subakanya (2016) provide more information about CSR activities of the two LSAs.

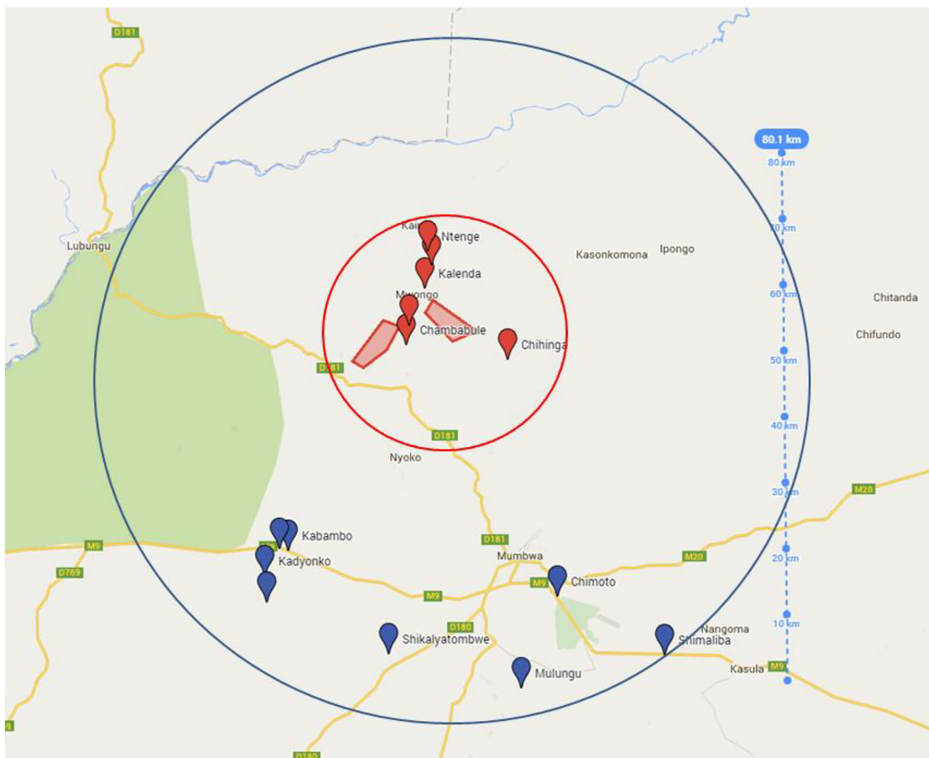


Fig. 1B. Randomly Selected Villages in the Mumbwa Region.

Notes: The polygons depict the locations of the large-scale farming areas; the pins in the centre of the small circle indicate the locations of the *near* villages while the outer pins show the *further* villages.

Source. Authors' own and Land Matrix data. Map created using Google Map Maker.

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 smallholders. Not surprisingly, households in *further* villages sell some of their agricultural produce as there is no other dominant employer or source of income generation in their proximity.¹³ By contrast, with the exception of the age and marital status of the household head, all relevant village-level socio-demographic characteristics are balanced and do not differ significantly. We are unable to explain why individuals in our sample tend to be younger and married more often in the vicinity of the LSAI and include these two variables as controls in our regressions. The asset index, intensity of night lights 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.¹⁴ We obtained soil samples in all the villages in our study (including signed agreements for the extractions

¹³ These households do not take their agricultural produce to the markets in main towns and district headquarters but instead sell it to traders and passers-by on the roadside.

¹⁴ Our proxy for wealth is derived from an asset index that is constructed from a linear index of households' physical assets whose weights have been obtained using a principal components analysis (Filmer and Pritchett, 2001). Asset indices are widely used to measure households' welfare levels when consumption, price and expenditure data is missing or inaccurate (Sahn and Stifel, 2003). We opted in favour of an asset index in this study as collecting detailed long period consumption or expenditure data would have been prone to recall bias (Deaton, 1997; Gibson, 2002; Beegle *et al.*, 2012).

Table 1. *Village-Level Summary Statistics.*

Variable	<i>near</i> villages		<i>–further</i> villages		<i>p</i> -value
	Mean	SD	Mean	SD	
Male (%)	0.54	0.15	0.47	0.12	0.12
Household head (%)	0.46	0.09	0.49	0.13	0.32
Married (%)	0.67	0.09	0.57	0.15	0.05
Age (in years)	35.07	2.46	41.11	5.25	0.003
Migrated after LSAI was set up (%)	0.2	0.16	0.16	0.13	0.61
Years of education	6.56	1.08	6.52	0.86	1
Literacy (with 5 being the highest level)	2.68	0.39	2.65	0.38	0.93
Asset index	0.42	0.03	0.41	0.1	0.46
Night lights (5-km buffer)	0	0	0.02	0.07	0.37
Land title (%)	0.35	0.29	0.31	0.29	0.66
Acquired plot from chief (%)	0.44	0.23	0.53	0.32	0.51
Inherited plot (%)	0.25	0.16	0.27	0.19	0.83
Purchased plot (%)	0.21	0.19	0.13	0.16	0.15
Hectares cultivated	4.95	2.17	5.11	1.96	0.83
Household sells crops (%)	0.68	0.16	0.82	0.1	0.03
LSAI worker (%)	0.52	0.26	0.24	0.18	0.003
Smallholder (%)	0.71	0.17	0.84	0.1	0.04
Ethnic groups in village	8.46	3.31	8	2.92	0.67
Population in village	570.43	1078	234.91	312.6	0.68
Village size (hectares)	413	579.19	1112.56	2069.41	0.90
Village has public good (%) ¹²	0.77	0.44	0.63	0.5	0.41
Organic carbon (%)	0.79	0.53	0.56	0.29	0.11
pH levels	4.84	0.43	4.95	0.54	0.54
Soil trace elements (ppm)	0.26	0.28	0.22	0.25	0.73
Individuals	445		487		
Number of villages	13		16		

Notes: 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.

from each headwoman or headman). The soil samples were analysed by the Zambia Agriculture Research Institute, the official research institute of the Ministry of Agriculture in Zambia.¹⁵ Pairwise correlations of villages being *near* a LSAI or *–further* and the soil quality indicators do not yield any significant differences. Finally recall that we selected villages close to a main road to rule out any systematic differences in access to infrastructure and markets. Thus based on the summary statistics presented in Table 1, we can conclude that the village level characteristics are mainly balanced.

A potential problem for our empirical analysis is that the locations of the LSAIs were not randomly selected. Being market oriented, they are established in regions where the investors expected to yield high returns on their investments. This non-random location may give rise to biased estimates if the level of trust and reciprocity in surrounding communities is a determinant of where LSAIs are established. Note that the share of villages which were approached by LSAIs

Providing information on a households' current asset is easier for households as they are often aware of the assets in their possession and the amounts of assets reported can often be verified by the enumerators.

In addition, we use night lights data for the year 2013 as a proxy for the level of economic activity in the villages. The use of night lights data has gained prominence in recent empirical literature estimating economic growth (Henderson *et al.*, 2012).

¹⁵ The soil samples were tested for their levels of organic carbon, calcium chloride and pH. They were also tested for trace elements of potassium, phosphorus, sodium, calcium, magnesium, zinc and iron. Figure A.2 in Appendix A presents correspondence with the institute.

for land is low and similar in both village groups (approximately 17%). This shows that the *_further* villages are a good counterfactual since the LSAIs could equally have been established close to the *_further* villages.

Moreover, ZDA facilitates land acquisition through the local government, traditional leaders and the Commissioner of Lands. They allocate land to investors based on a detailed project proposal with clear indication of the agricultural activities they intend to implement and associated requirements regarding irrigation, types of crops or livestock, land size, location etc. Among the criteria that the ZDA's land allocation agencies apply to identify 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.¹⁶

Still, we are aware that our approach is not without problems when it comes to identifying the causal effects of LSAIs on trust and reciprocity. In particular, we lack information on pre-investment levels of trust and reciprocity in the villages. To mitigate the problem of data unavailability, we compare village-level characteristics that have been identified as key determinants of social capital in other studies and that could have potentially influenced village-level trust and reciprocity prior to the establishment of the LSAIs. First, we compare economic development and access to infrastructure prior to the establishment of the LSAIs by using night lights data from the year 2000 and by comparing the distances with roads and rail across *_near* and *_further* villages. A number of studies have found a positive correlation between economic development and social capital accumulation (see, for instance, Narayan and Pritchett, 1999; Grootaert, 1999). Within our study setting, we find evidence of differences in the presence of night lights neither in the villages nor in five-kilometre radii around the villages. In fact we are unable to detect the presence of night lights across both sets of villages, which hints at the low levels of economic activity in both regions prior to the set-up of the LSAIs. Furthermore, we do not find that distance to the railway line or main roads differ across *_near* and *_further* villages (Table 2). This indicates that economic activity and development is not likely to have affected the levels of trust and reciprocity differently across the two study settings.

Next, we examine whether there are any significant differences across environmental factors such as rainfall and temperature in *_near* and *_further* villages. Extreme weather and catastrophic events are likely to strengthen social capital within communities by bringing them together (Adger, 2003; Paul *et al.*, 2016). Table 2 shows that these pre-investment variables are balanced across both sets of villages. Distance to the nearest water source or line appears to be balanced across *_near* and *_further* villages, which signifies that any forms of collective action that might have arisen to manage these natural resources should be similar across these village types (see Pretty and Ward (2001) for a discussion on social capital and natural resources). Furthermore there is no evidence for differences in the population density across the study villages, which suggests that the levels of connectedness are similar.

Naturally, the 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-hectare large LSAIs in random locations around the country. It would measure trust and reciprocity in communities in

¹⁶ Interviews were conducted with the Investment Promotion Officer at the ZDA and confirmed in talks with the Director of Policy and Planning, ZDA. More information about our correspondence with the ZDA is available upon request. In addition, 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 social capital either.

Table 2. *Pre-Investment Characteristics¹⁷ across near and further Villages.*

Variable	<i>near villages</i>		<i>farther villages</i>		<i>p-values</i>
	Mean	SD	Mean	SD	
Night lights 2000 (pixel)	0.00	0.00	0.00	0.00	—
Night lights 2000 (5-km buffer)	0.00	0.00	0.00	0.00	—
Population density (pixel)	5.54	0.52	5.50	0.52	0.85
Population density (5-km buffer)	5.54	0.51	5.50	0.52	0.74
Mean monthly rainfall (pixel)	80.05	5.59	81.29	3.32	0.47
Mean monthly rainfall (5-km buffer)	80.18	5.73	81.26	3.05	0.51
Mean monthly maximum temperature (pixel)	30.08	1.32	30.47	0.49	0.98
Mean monthly maximum temperature (5-km buffer)	30.08	1.25	30.42	0.50	0.86
Distance to nearest road	1.54	2.14	0.49	0.61	0.20
Distance to nearest water line	1.79	1.83	1.97	1.13	0.33
Distance to nearest rail	63.82	65.45	71.90	77.57	0.20

Notes: All datasets were collected prior to the establishment of the LSAs.

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 approach 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 LSAs and trust and reciprocity in neighbouring village communities.

2. 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 variants of Berg *et al.* (1995)’s trust game to measure social capital, consisting of trust and reciprocity (also referred to as ‘trustworthiness’).

Fehr (2009) reviews literature on trust and finds that trust is a unique form of behaviour.¹⁸ Likewise, Rabin (1993), Dufwenberg and Kirchsteiger (2004) and Falk and Fischbacher (2006) provide intention-based models that make preferences for reciprocity explicit. Trust and reciprocity are often included in definitions of social capital as they are functionally essential for

¹⁷ The night lights data for the years 2000 and 2013 are sourced from the National Oceanic and Atmospheric Association’s National Centre for Environmental Information (NOAA-NCEI). The 2000 data is obtained by calculating the average of the two ‘Average Visible, Stable Lights & Cloud Free Coverages’ data files.

The population density data is from the year 2000 and was compiled by the Center for International Earth Science Information Network (CIESEN).

The precipitation and temperature data are sourced from the WorldClim database. They show the mean monthly maximum temperature and precipitation for the period between 1960 and 1990.

The elevation data is from the Consultative Group on International Agricultural Research- Consortium for Spatial Information (CGIAR-CSI), SRTM30 dataset collected in 2000.

The distance variables are vectors lines that were originally compiled for the Digital Chart of the World in 1992. All grid data have a high resolution of 30 seconds. The elevation, land cover, roads, railroads, water line, climate and population density data were all downloaded from the DIVA-GIS website: www.diva-gis.org/gdata.

¹⁸ There is an extensive literature on the economics of trust, which provides evidence that trust is *not* merely an investment decision constituted by risk preferences and beliefs regarding the trustworthiness of the other party (see, e.g., Bohnet and Zeckhauser, 2004; Cox, 2004; Eckel and Wilson, 2004; Kosfeld *et al.*, 2005; Ashraf *et al.*, 2006; Fehr, 2009; Houser *et al.*, 2010; Etang *et al.*, 2011). According to this literature, components that constitute trust are: unconditional kindness, betrayal aversion, risk preferences, beliefs regarding the unconditional kindness of the others and beliefs regarding the reciprocity preferences of others. Unconditional kindness may be further disentangled into different forms of altruism (Andreoni, 1990) and distributional preferences (Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000; Charness and Rabin, 2002).

members of groups to achieve mutually beneficial arrangements in a world of incomplete contracts (see, for instance, Sobel, 1985; Kranton, 1996; Sobel, 2005).

Taking our study setting into account, we simplified the trust game and elicited trust and reciprocity through the use of the sequential PD (Clark and Sefton, 2001; Khadjavi and Lange, 2013).¹⁹ Given our context in rural Zambia involving a high number of illiterate participants, we decided in favour of the sequential PD. This was done to establish the highest level of simplicity of the game while still being able to measure trust and reciprocity. 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.²⁰ The experiments were administered from mid-August to the end of September 2015.

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 groups. Each group was accompanied by two Zambian research assistants (always one male and one female). The instructions for the sequential PD were then presented to the respective group and read aloud by the same research assistants throughout all experiments.²¹

In the black group, individuals made the first decision (move) to trust or not to trust an anonymous random participant from the green group. Figure 2 illustrates the decision sheet that members from the black group received. The individuals in the green group made two decisions in a strategy method design that were contingent on the first mover's choice.²² The results from the first movers determine the level of intra-village trust, while the results from the second movers indicate reciprocal behaviour, pay-off maximisation or altruism. To ensure that illiterate individuals were able to make incentivised decisions, the decisions were based on easily identifiable colours (neon *pink* or neon *yellow*) and the possible pay-offs from a decision were represented by pictures of the associated banknotes.²³ In the sequential PD, participants could earn between 5 and 50 Zambian Kwacha depending on their decisions: 40 Kwacha for each player was the pay-off in the event of mutual co-operation, 30 Kwacha for each player in the event of mutual defection, while 50 Kwacha was the 'temptation pay-off' and 5 Kwacha was the 'sucker pay-off'.²⁴ The payments were made to villagers after their participation in all parts of the

¹⁹ 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 PD and were not pre-announced. They should therefore not have any influence on the data reported in this article. We aim to discuss these games in future companion articles.

²⁰ 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.

²¹ Although English is the official language in Zambia, 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. Instructions in Bemba and Nyanja are available upon request.

²² The strategy method was introduced by Selten (1967). Analyses by Brandts and Charness (2011) and Fischbacher *et al.* (2012) suggest no systematic differences between the strategy method and the direct-response method. The decision sheet of player 2 can be found in Appendix A, Figure A.3.

²³ To avoid any framing effects, we were careful to select colours that do not have any political or cultural meanings that could bias the decisions made in the experiment. The neon colours (pink, yellow, green) and black used in the decision sheets are all neutral colours that do not have any political connotations in Zambia.

²⁴ These labels for the different pay-offs can be found in the seminal contribution on the PD by Rapoport and Chammah (1965). Our calibration, such as the 'fear' and 'greed' components as discussed by Ahn *et al.* (2001), is well aligned with the PD literature (Ahn *et al.*, 2001; Clark and Sefton, 2001; Khadjavi and Lange, 2013).

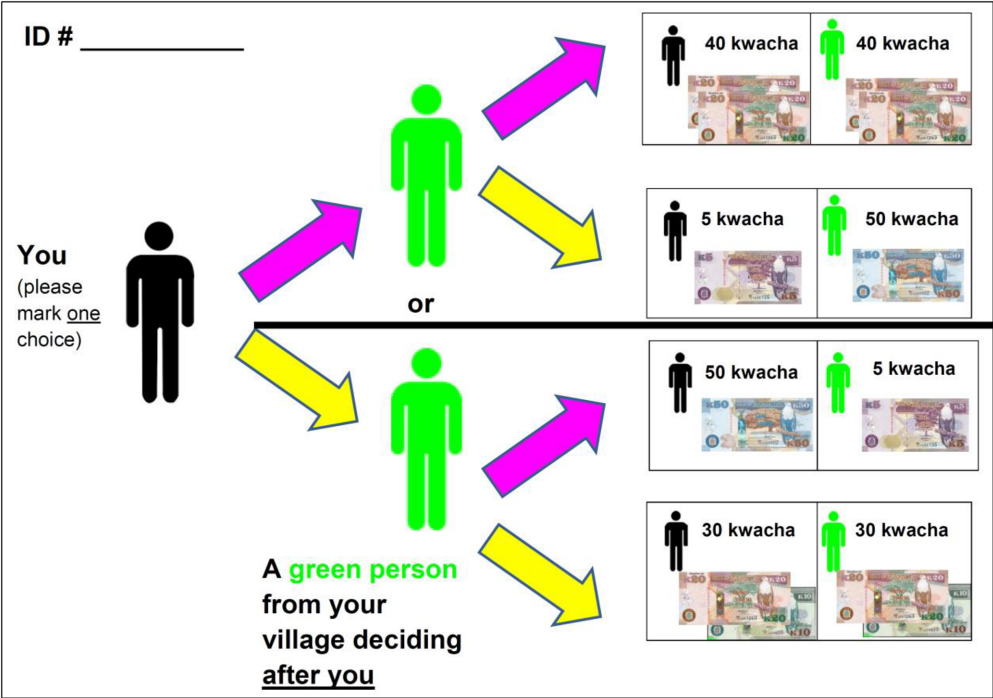


Fig. 2. Decision Sheet for Members of the Black Group as the First Mover in the PD.

study (this includes individual *ex post* surveys and leisure time between the activities) that lasted approximately four hours. Including a show-up fee of 5 Kwacha, participants earned 119.72 Kwacha (13.30 USD) on average for participating in all three tasks. The average monthly per capita expenditure for rural small-scale households was estimated at 153 Kwacha by the *Zambian Central Statistical Office* at the time of the experiment (CSO, 2016). Hence, the stakes in our sequential PD can be regarded as fairly large as the sucker pay-off of 5 Kwacha was equivalent to the daily expenditure of an average adult engaged in smallholder agriculture in rural Zambia, whereas the 50 Kwacha temptation pay-off could sustain the same adult for ten days.

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. 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 yet been called out to ensure that participants did not communicate before partaking in the experiment. After participants had made their decisions, they were asked to go to a second waiting area.

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 headwomen 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 individuals over the age of 16 years (who were eligible for the National Registration Card) 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—answered by village headmen or headwomen—gathered information on institutional arrangements, land tenure systems, soil quality and interactions with outsiders.²⁵ 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.

3. Hypotheses and Results

We first develop a set of hypotheses that elaborate how—and through which mechanisms—the exposure to LSAIs might affect the trust and reciprocity of local communities in their vicinity (Subsection 3.1). Against the background of these hypotheses, we present the results of our experimental investigation, first discussing first-mover trust in the sequential PD (Subsection 3.2), and then analysing reciprocal strategies of second movers (Subsection 3.3). Subsection 3.4 discusses robustness checks. Finally, we discuss the outcome of the natural field measure and how it compares with the lab-in-the-field experimental measure (Subsection 3.5).

3.1. *Hypotheses*

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:²⁶

²⁵ In four cases in which the headman or headwoman was absent, the community questionnaires were answered by the deputy village headman, chairperson or school head teacher.

²⁶ Social capital of smallholders may also be affected by displacements or resettlement (Lesorogol, 2005) and through a leadership effect that 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 ZDA 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' trust and reciprocity, 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

3.1.1. *Market exposure and individualism*

When an LSAI is established in the proximity of a smallholder community, the increased exposure to modern agricultural techniques and the profit-seeking business model of the LSAI may raise smallholders' awareness of the opportunities that arise from engaging in more market-oriented activities. Smallholders may seek to put their land to more intensive use after observing the agricultural technologies used by the LSAI. This self-regarding behaviour, which places the smallholders' interests above those of the community, clashes with the customary land system in which property rights are inexistent and land is governed through informal institutions in which and reciprocity are vital.

Evidence for increasing individualism is provided in a qualitative study conducted in rural Zambia by Kajoba (1994). Smallholders who are exposed to market opportunities and modern agricultural implements such as ox-drawn ploughs and tractors cultivate their land more intensively and become less reliant on communal land arrangements. As a result, smallholders fence off their plots and choose to do away with customary land tenure as they opt in favour of more individual land arrangements. An analogous process is observed by Lesorogol (2005), who studies the behaviour of Samburu pastoralists in Northern Kenya who advocate for the conversion of communal ranches to individual land holdings after they have been exposed to agricultural societies and formal institutions. She finds that pastoralists whose communal land has been privatised are less cooperative in a public goods game and in day-to-day activities. Communities in Peru with individual formal property rights are also found to be less co-operative than communities with joint formal property rights (Braaten, 2014). In a similar vein, a recent study by Cardenas *et al.* (2017) find that rice-growing communities in China, Colombia, Nepal and Thailand that have a higher proportion of members who are actively involved in the outside economy are more likely to opt out of investing in a public good in risky situations. Additionally community members whose agricultural practices are more integrated in the broader economy reduce the amount of their investments into public goods. The authors thus argue that market integration may enhance bridging social capital with others in the broader economy but this might come at the cost of bonding social capital with other community members.

A well-established literature discusses the mechanisms through which exposure to market-oriented systems crowds out cooperation and reduces it to a narrow form of self-interest (Hirschman, 1982; Bowles, 1998; Fourcade and Healy, 2007).²⁷ In line with this literature and the empirical studies discussed above, we posit that the establishment of LSAIs may cause smallholders to become more self-regarding. Consequently, we hypothesise that, due to a rise in individualism, the levels of trust and reciprocity in the *near* villages may be lower than in the *further* villages.

3.1.2. *Reputation building, gift exchange and reciprocal behaviour*

As argued by various authors (e.g., Hirschman, 1982; Bowles 1998), market exposure may result in pro-social behaviour. Hirschman (1982), for example, points out the importance of developing reputation building traits such as honesty and punctuality for the smooth functioning of markets. The importance of signalling a good reputation in market transactions is highlighted by Ensminger (2004) who finds that Orma pastoralists in Northern Kenya who earn wages or income

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 concerns of an income effect across the study villages.

²⁷ For further readings on markets, morality and crowding out of intrinsic motivation, see Gneezy *et al.* (2011), Bowles and Polania-Reyes (2012) and Bowles (2016).

from trading behave more fair-mindedly than pastoralists who do not directly engage in market exchange. As demonstrated by Ensminger (2004), smallholders may internalise these norms and apply them in similar settings within their communities. This mechanism may lead to an increase in the levels of reciprocity among smallholders that engage in employment relationships with these investments. We therefore hypothesise that, as a result of reputation building, reciprocity in the *near* villages may be higher than in the *further* villages.

Specifically, smallholders employed on LSAIs may internalise norms such as reliability and learn to build a reputation for reciprocity. Such a reputation is beneficial for repeated interactions in gift-exchange relationships with LSAI employers (Akerlof, 1982; Sobel, 1985; Fehr *et al.*, 1993; Sobel, 2005). Consequently, reciprocal behaviour of LSAI-employed smallholders may be more pronounced than the behaviour of non-employed smallholders, and reciprocal behaviour may become more pronounced the longer the gift exchange relationships last.²⁸

3.1.3. *Communal coping and trust*

If smallholders in a village community perceive the materialisation of an LSAI close to their village as a threat, for instance to their farm land, or if they are uncertain about what to make of this new powerful ‘neighbour’, they may band together as a way of dealing with the LSAIs close to their communities. The perception of LSAIs as a threat could result in more frequent community meetings or other forms of personal interaction that raise the levels of trust and more generally of social capital within 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’. Studies that have analysed trust and social cohesion in post-conflict societies (Bellows and Miguel, 2009; Gilligan *et al.*, 2013; Jennings and Sanchez-Pages, 2017) provide evidence on how social capital increases through collective actions undertaken to confront adversity. Based on these findings, we expect that intra-village trust in *near* villages is likely to increase due to communal coping that arises if smallholders regard LSAIs as a threat.

In the social psychology literature, trust has been found to rise as a by-product of uncertainty (see, for example, Kollock, 1994; Yamagishi and Yamagishi, 1994; Cook, 2005). This occurs in situations in which actors are not able to detect their partners’ intentions, particularly when there is an incentive to act dishonestly on the part of the partner (Yamagishi and Yamagishi, 1994). Within the setting explored in our study, smallholders may believe that LSAIs have incentives to encroach and acquire land that has traditionally been used by their communities even when LSAIs report that they will only acquire land that has been provided by the state. This uncertainty might lead smallholders to collectively devise a coping strategy when dealing with the LSAI. This collective action that arises as a response to uncertainty or the perception of being threatened reduces social distance among members of the community and raises levels of trust.

This trust-enhancing component that accompanies reductions in social distance is well laid out in Fukuyama (1995)’s seminal contribution on trust in which he argues that people are more likely to trust others with whom they interact regularly. Empirical evidence for this hypothesis is provided by Etang *et al.* (2011), who investigate how social distance (measured by village membership) affects trust-based decisions. They find that trust in fellow villagers exceeds trust in other villagers in rural Cameroon. Buchan *et al.* (2006) and Charness and Gneezy (2008) provide

²⁸ A greater propensity for reciprocal behaviour may in principle also stem from an adjustment of unconditional kindness or reciprocity preferences. As we will show below, the workplace relationships are unlikely an inspiration for such adjustments in our setting.

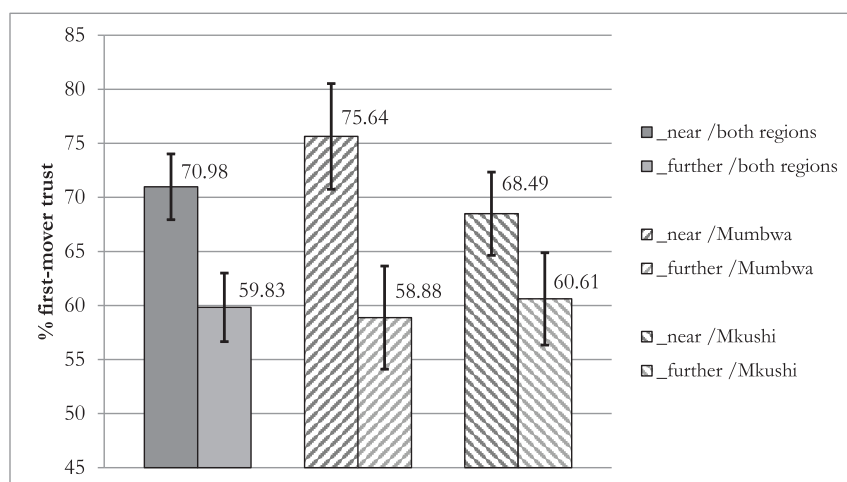


Fig. 3. *Village Proximity to the LSAI and First-Mover Trust in the Sequential PD.*

Notes: Error bars depict ± 1 SE.

similar evidence for the effect of social distance on trust and dictator game giving in laboratory experiments.

Based on these findings, a straightforward mechanism is that communal coping that arises from uncertainty or adversity decreases the social distance in *_near* villages. Lower social distance between village members in turn increases intra-village trust. Accordingly, if communal coping occurs in the *_near* villages next to the LSAIs, it should lead to increased levels of intra-village trust amongst smallholders compared with *_further* villages.

3.2. Results: First-Mover Trust

The results depicted in Figure 3 indicate that smallholders living in *_near* villages have higher levels of intra-village trust than those in *_further* villages. Pooling the data from both regions, the level of first-mover trust in the sequential PD is 70.98% in *_near* villages compared with 59.83% in *_further* villages. Employing a (two-sided) chi-squared test for a first-glance analysis, we find that this difference is statistically significant (p -value = 0.012).

Next, we are interested in seeing whether this effect is similarly present in each of the two regions, Mumbwa and Mkushi. In Mumbwa the propensities to trust in *_near* villages is 75.64% while in *_further* villages it is 58.88%. This difference is statistically significant at $p = 0.018$. In Mkushi the propensities to trust are 68.49% and 60.61% in *_near* and *_further* villages respectively—this difference goes in the expected and similar direction as in Mumbwa, yet the p -value of the (two-sided) test is only 0.169. That is, looking at the two regions separately, we see a consistent picture, yet the Mkushi result by itself is not significant at conventional statistical levels which may be due to effectively halving the sample. Note however that the intra-village trust levels across the two regions of *_near* villages (75.54% and 68.49%) and *_further* villages (58.88% and 60.61%) provide a remarkably similar picture.

In our study we collected a number of important control variables and the first-glance result of first-mover trust above needs to be substantiated by a regression analysis. In all estimations

Table 3. *Regression Analysis of First-Mover Trust.*

Independent variables	Logit regression		
	Dependent variable: trust		
	(1)	(2)	(3)
	Parsimonious specification	Parsimonious specification, same <i>n</i> as full model	Full model
<i>near</i> village (dummy, 1 = yes)	0.112** (0.048)	0.129** (0.054)	0.092* (0.054)
Age (continuous)			0.016 (0.085)
Male (dummy, 1 = yes)			−0.020 (0.060)
Married (dummy, 1 = yes)			0.021 (0.049)
Education in years (continuous)			0.007 (0.014)
Literacy (continuous)			−0.024 (0.033)
LSAI worker (dummy, 1 = yes)			0.118* (0.062)
Migrant after LSAI was set up			0.045 (0.098)
Household head (dummy, 1 = yes)			−0.073 (0.079)
Own hectares (continuous)			0.004 (0.004)
Household sells crops			0.044 (0.064)
Village area (continuous)			0.014 (0.016)
Land title (dummy, 1 = yes)			−0.016 (0.060)
Ethnicity			−0.003 (0.003)
Asset index based on pca			−0.186 (0.270)
Region	No	No	Yes
Crops	No	No	Yes
Soil	No	No	Yes
Observations	463	366	366
Villages	29	29	29

Notes: 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 cluster the standard errors at the village level. Table 3 presents the results. It is crucial that we take the structure of the data into account and control for socio-economic observables. As is natural from field work like this study at hand, some control variables are missing for some participants. For this reason—and as suggested by a reviewer—we estimate two parsimonious logit regressions: one using all 463 observations (Column I) and one using the 366 participants for which all control variables are available (Column II). Both estimations yield the result that first-mover trust is greater in *near* villages (at the 5% level). The full model in Column III confirms this result for trust. In the full model we control for a large number of observable characteristics of our participants. We also find a marginally significant effect for LSAI workers to show more intra-village trust than non-LSAI workers. One possible explanation for this effect

might be that LSAI workers are especially interested in the village's position on dealing with the LSAI, including the LSAI's wages and work conditions. Hence, LSAI workers might be more likely to attend village meetings to discuss the topic, which fosters their intra-village trust. All other characteristics, including age, gender, marital status and migration to the village after the LSAI was established, remain statistically insignificant.

As described in the sections above, the first trip of our field research, which 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.²⁹ In addition, neither the research support letter by the provincial government nor the questionnaires used for the study focused on 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.

Within these villages, there was a general perception of uncertainty and disgruntlement mostly caused by the belief that the LSAIs did not pay wages that were high enough. More than 90% 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) where this topic had been discussed. While the villagers from the *_further* villages also met frequently to discuss different topics, there was no common topic that 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 band together. Overall, this provides support for the communal coping mechanism. Note that the support for communal coping does not imply a rejection of the individualism mechanism. Rather, it may be that we measure a composite effect in which the communal coping mechanism dominates.

3.3. Results: Second-Mover Reciprocity

The decision making of the second movers in the sequential PD involved two choices in a strategy method design: (i) co-operation (pink choice) or defection (yellow choice) in the case of first-mover trust and (ii) co-operation or defection in the case of first-mover mistrust. In order to analyse the decisions of second movers, we formulate four strategies: first, *reciprocity* when second movers answer co-operation with co-operation and defection with defection; secondly, *pay-off maximisation*, which is characterised by defection in both cases; thirdly, *altruism*, which occurs when second movers co-operate in both cases; and fourthly, a seemingly *irrational strategy* of answering co-operation with defection and defection with co-operation.

We find similar rates for all strategies in *_near* and *_further* villages; none of the differences is statistically significant. Reciprocity varies between 35% and 38%, altruism varies between 19% and 17% and pay-off maximisation between 29% and 32%. The remaining 14% were second

²⁹ The support letter states that we are interested in measuring social capital, but not to what end. It neither explains what social capital is, makes any mention of LSAIs, nor of our hypotheses that smallholders' social capital is affected by proximity to market-oriented institutions such as LSAIs.

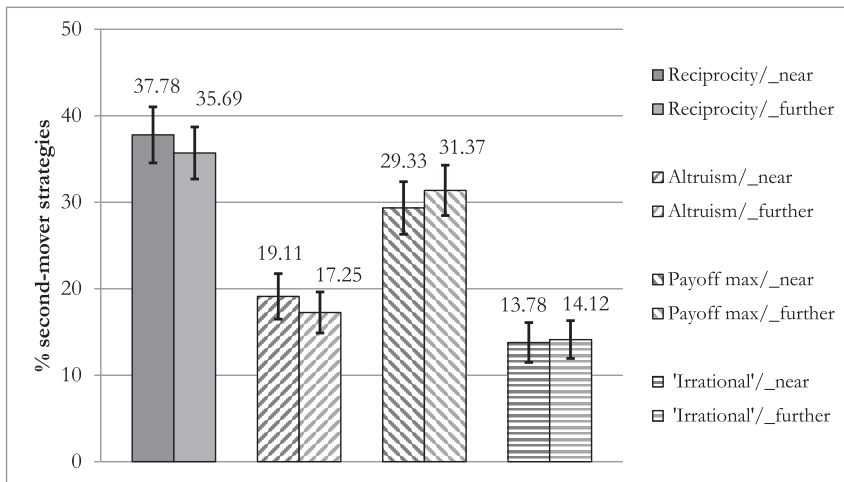


Fig. 4. *Second-Mover Strategies in _near and _further Villages.*

Notes: Error bars depict ± 1 SE.

movers with a seemingly irrational strategy. Figure 4 displays these respective propensities. Thus, we do not find a direct effect of the proximity of large-scale agricultural investments on the propensity to play a certain strategy.

Next, we aim to investigate whether building a reputation for reciprocity is relevant for LSAI workers. Indeed, we find that the share of reciprocity among LSAI workers is 42.62% and thereby significantly greater than the share among non-workers (32.29%). This difference is significant at p -value = 0.025 (chi-squared test).

In principle, the significantly greater propensity of LSAI workers to reciprocate in our sequential PD may stem from changes in reciprocating trust with kindness (i.e., positive reciprocity), reciprocating mistrust with unkindness (negative reciprocity) or both. In accordance with the idea of building a reputation of workers in an employer–employee relationship (Sobel, 1985), we regard it as more important for reputation building to reciprocate trust with kindness than to reciprocate mistrust with unkindness. Positive reciprocity builds a reliability reputation while negative reciprocity builds a punishment reputation. To disentangle these two forms of reciprocity we analyse whether the main effect depends on positive or negative reciprocity.

We find that the main effect of greater reciprocity of LSAI workers stems from positive reciprocity. The propensity of positive reciprocity—conditional on negative reciprocity—is significantly greater among LSAI workers (62.40%) compared with non-workers (48.42%). A (two-sided) chi-squared test reports that this difference is significant at $p = 0.015$. The propensity of LSAI workers for negative reciprocity—conditional on positive reciprocity—is 70.91% compared with 63.89% for non-workers. This difference is not significant at conventional levels ($p = 0.239$). Figure 5 depicts these results.

Again, we complement our first-glance chi-squared tests with a regression analysis for second movers' reciprocity. Table 4 provides the results.

We find that the reciprocity effect remains statistically significant and robust to changes in the regression specification. We therefore observe that reciprocal behaviour is more pronounced for

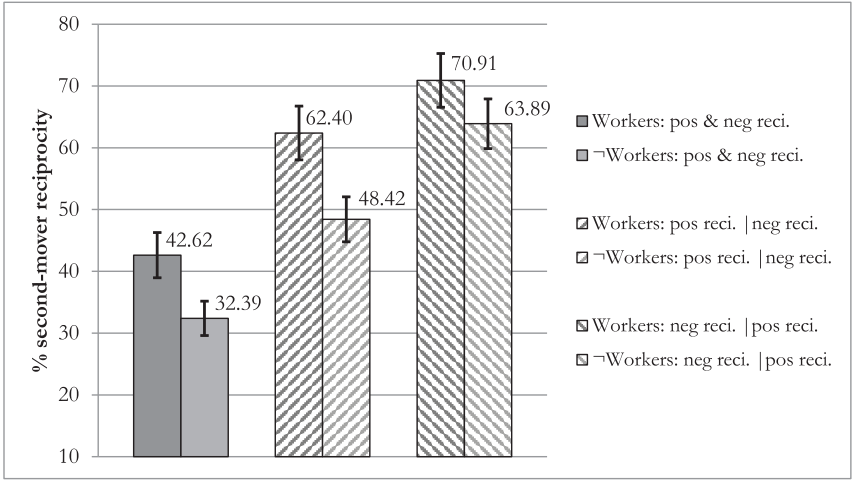


Fig. 5. Positive and Negative Reciprocity of LSAI Workers and Non-Workers.
Notes: Error bars depict ± 1 SE.

smallholders who worked on a large-scale farm than for comparable smallholders. This finding is consistent with the gift exchange, reputation building mechanism (Akerlof, 1982; Fehr *et al.*, 1993) and with reciprocal behaviour carrying over from one situation to others (as described in the learning section of Sobel, 2005).

A natural follow-up question that arises is whether the level of reciprocity varies with the duration of employment on the LSAI farm. 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 a logit regression) between second-mover reciprocity and the length of employment yields a positive and significant effect ($p < 0.05$). When controlling for village location, gender, age, recent migration to the village and years of education, the effect remains statistically significant at the 5% level (the estimation results can be found in Table A.4 in Appendix A). The propensity to reciprocate is about 50% higher for LSAI workers who have been employed for more than a year compared with those who were employed less than three months (an increase from 30% to 50%). Figure 6 visualises the effect. It also shows the propensities of other second-mover strategies—altruism, pay-off maximisation and ‘irrational’ strategies—for different lengths of employment. While we find a significant increase of reciprocity over time, there are no statistically significant changes for any other strategy. Hence, we find evidence that reciprocity of long-term employees is significantly greater than that of short-term employees.³⁰

Of course, we cannot fully rule out reverse causality. For instance, it could be that workers who are not reciprocating trust, and thus do not develop a reputation for trustworthiness and reliability, do not reach long-term employment and are dismissed beforehand. If selection by dismissing non-reciprocating workers is occurring, our finding would nevertheless be in line with the reputation

³⁰ As a control measure and for completeness, we also analysed first-mover trust for different lengths of employment. Significant differences cannot be detected for trust – that is, a pairwise correlation (and similarly a logit regression) does not yield a significant effect for first-mover trust. Figure A.4 depicts first-mover trust for different lengths of employment.

Table 4. *Regression Analysis of Second-Mover Reciprocity.*

Independent variables	Logit regression		
	Dependent variable: reciprocal strategy		
	(1)	(2)	(3)
	Parsimonious specification	Parsimonious specification same <i>n</i> as full model	Full model
<i>near</i> village (dummy, 1 = yes)	−0.003 (0.042)	−0.004 (0.044)	0.014 (0.053)
LSAI worker (dummy, 1 = yes)	0.102** (0.044)	0.137*** (0.048)	0.129** (0.062)
Age (continuous)			0.057 (0.092)
Male (dummy, 1 = yes)			−0.043 (0.069)
Married (dummy, 1 = yes)			−0.016 (0.049)
Education in years (continuous)			−0.002 (0.011)
Literacy (continuous)			−0.011 (0.032)
Migrant after LSAI was set up			0.019 (0.061)
Household head (dummy, 1 = yes)			0.028 (0.070)
Own hectares (continuous)			−0.002 (0.004)
Household sells crops (dummy, 1 = yes)			0.095 (0.062)
Village area (continuous)			−0.025** (0.012)
Land title (dummy, 1 = yes)			0.047 (0.081)
Ethnicity			−0.001 (0.002)
Asset index based on pca			−0.004 (0.173)
Region	No	No	Yes
Crops	No	No	Yes
Soil	No	No	Yes
Observations	480	380	380
Villages	29	29	29

Notes: 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.

building hypothesis that gift exchange, employment relationships, and reciprocal behaviour go hand in hand (Akerlof, 1982; Fehr *et al.*, 1993).

In our debriefing 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 employed, workers were usually first offered short-term contracts that could be renewed for the next harvesting (high labour demand) season depending on their performance. Some of the key traits demanded of the workers were that they were punctual, reliable and hard working.

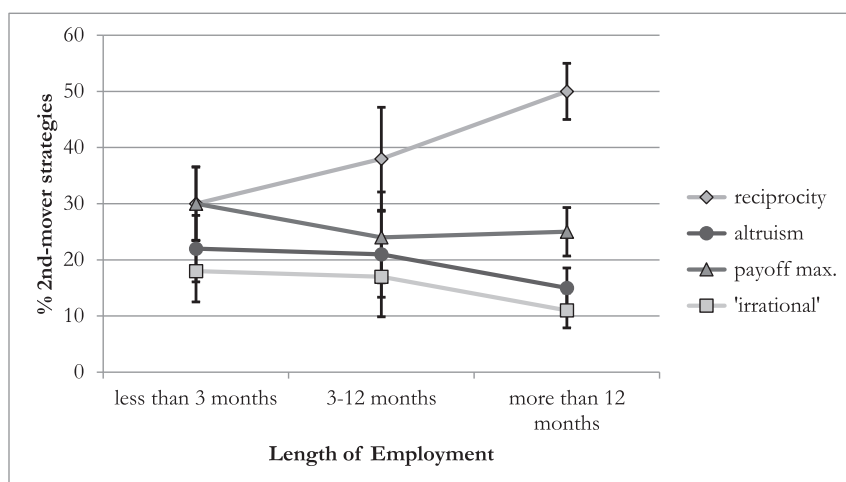


Fig. 6. *Second-Mover Strategies and Length of Employment of LSAI Workers.*

Notes: Error bars depict ± 1 SE.

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 building if they are to secure a contract for the next harvesting season or even a permanent contract. As discussed in other studies (e.g., Ensminger, 2004; Sobel, 2005), reputation-enhancing reciprocal behaviour may be internalised as norms by workers and applied in their village settings.

3.4. *Alternative Mechanisms*

Not having a pure randomisation strategy reduces our ability to make strong causal statements on the results presented above. Another likely explanation that could be driving the results presented in Subsections 3.2 and 3.3 is that the LSAIs act as a pull factor by attracting smallholders that seek employment. To ensure that the results are not driven by new migrants to the village, we exclude all recent migrants from the analysis and find that the effect for trust in *near* vs. *further* villages and the effect for reciprocity of LSAI workers are robust to this test. The effect for trust of LSAI workers turns from slightly above to slightly below the 10% significance level, with no major changes in the point estimate. These results are reported in Table A.7.

As an alternative mechanism, one may wonder whether our finding on reciprocity stems from an income effect for LSAI workers instead. To investigate this alternative mechanism, we compare the socio-economic characteristics of LSAI workers with other villagers that do not have any experience on LSAIs. From Table A.3, it is clear that LSAI workers own fewer assets and have smaller 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 outcomes observed in Tables 3 and 4.

In addition, as a validation exercise on whether proximity to the LSAI is really driving the results on first-mover trust and second-mover reciprocity, we use a *continuous* variable that measures distance from the LSAI. The results are reported in Tables A.5 and A.6 in the Appendix; they are fully consistent with the findings using the dummy variable.

3.5. *Natural Field Measure*

In addition to the lab-in-the-field experimental measure, we set up a natural field measure that compared the governance of public goods across the study villages. Drawing on Harrison and List (2004, p. 1014)'s definition of a natural field experiment as 'an experiment that occurs in an environment where subjects naturally undertake tasks and are unaware that they are participating in an experiment', we bestowed both sets of villages with a public good, but did not inform them that we would return to the villages to measure the governance of these public goods a year later.

This natural field measure had two objectives: (i) to provide independent evidence on the effect of LSAs on villagers' social capital; and (ii) to validate the lab-in-the-field experiment. Narayan and Pritchett (1999, p. 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 d.light D20 solar power 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.³¹ It is manufactured to meet the needs of poor people in the developing world, being very simple to handle and robust in extreme weather conditions. Once fully charged, the solar systems can provide lighting for seven to 15 hours and can charge four to five simple mobile phones per day. In mid-July 2016 we returned to the villages for an unannounced visit to examine the status of the solar power systems.

The solar power systems were bestowed in each village only after all lab-in-the-field games had been completed and the administration of the household surveys was coming to an end.³² We followed a script that amongst others stated that the solar power system was provided by our research team (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 power system was given to the whole community and invited the respective headman or headwoman to receive the solar power system on behalf of the community members. We demonstrated how to operate the solar power 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 system 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

³¹ 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% of all participants in our study did not have access to the electricity grid. 65.63% reported to use battery-powered torches for lighting followed by 28.26% who reported using candles. This is also confirmed by the 2013 and 2000 night lights data in Tables 1 and 2. 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. Although 79.51% of them reported owning a mobile phone (these are almost always simple and affordable mobile phones to make phone calls or send text messages, 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 on foot or by bicycle. Hence, the public good can serve as a source of electricity for charging mobile phones free and close by.

³² 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.

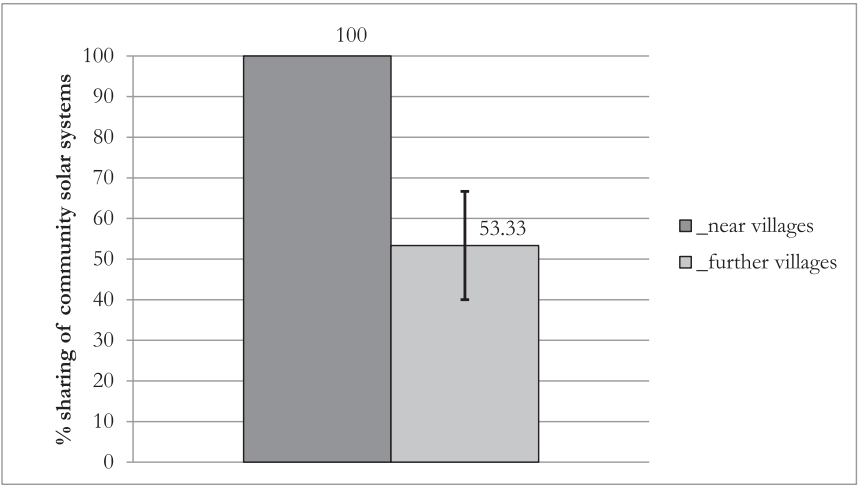


Fig. 7. *Sharing of Community Solar Power Systems and Proximity to LSAs.*
Notes: Error bars depict ± 1 SE.

study participants, all village headmen or headwomen confirmed that they would use the solar power system for the good of the community and acknowledged that they had understood all the information provided.

We expected heterogeneity concerning the community solar power system along two dimensions. First, we were interested in how many systems were still present and working in the villages (and not sold, lost, stolen or broken, for instance). Secondly, we were interested in whether the public good nature of the system was maintained almost a year after or whether it had been privatised (assumably by the headman or headwoman). 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 power systems were still present and working in the villages including all of their parts.³³ Along the second dimension we indeed found several systems that were privatised by the headman or headwoman, while others were shared either by means of using the lamps at village gatherings, by allowing community members to charge their mobile phones free, or both. The sorting into two broad categories—privatised and shared—and into various degrees of sharing was done by interviewing multiple random individuals from the villages independently, interviewing the headmen and headwomen, 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 privatised and shared solar power systems reveal a significant difference between *_near* and *_further* villages ($p = 0.011$, chi-squared test test). Strikingly, sharing occurred in all *_near* villages, whereas the systems were

³³ One solar power 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 four observations are missing.

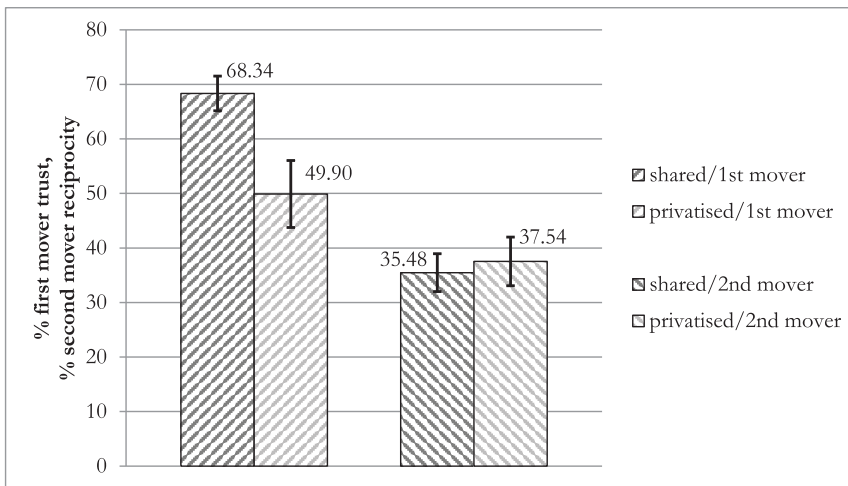


Fig. 8. *Lab-in-the-Field and Natural Field Measures.*

Notes: Error bars depict ± 1 SE.

privatised in almost half the *–further* villages.³⁴ The high level of sharing of the public good observed in near villages can be regarded as an indication of high levels of social capital since earlier studies point out the strong correlation between the management of resources that are treated as common property and social capital (e.g., Narayan and Pritchett, 1999; Grootaert, 1999). Our finding is also in line with the results of the lab-in-the-field experiment that reveal higher trust for *–near* villages. However, the results on the sharing of the public good should be regarded as suggestive due to the low number of 25 observations.

Next, as a simple validation exercise, we pool all villages and test for a correlation between the measures of trust and reciprocity in the lab-in-the-field experiment and the natural field measure. It turns out that the propensity to trust indeed correlates with the extent to which solar power systems are shared in the village. While the average propensity to trust is 49.9% in the seven villages in which the systems were fully privatised a year later, it is 68.3% 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 reciprocate does not differ between the two categories of villages (37.5% for privatised and 35.5% for shared solar systems). This is to be expected as the reciprocity effect is driven by repeated interactions in the gift exchange relationship between LSAI employers and their employees whereas the sharing of the public good and increase in intra-village trust is driven by reductions in social distance among all smallholders in the villages. Figure 8 provides an overview of these results.

In summary, we find that our natural field measure of social capital, i.e., sharing a public good, correlates significantly with one of the lab-in-the-field experimental measures, i.e., first-mover trust in the sequential PD. 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 (e.g.,

³⁴ Comparing the headmen and headwomen characteristics in Table A.2, we have no reason to believe that the headmen were significantly different across the *–near* and *–further* villages. This confirms that the differences in the sharing of the solar power systems are driven by village-level social capital and not village heads' characteristics.

Narayan and Pritchett, 1999; Bouma *et al.*, 2008). Our natural field measure therefore provides some external validity for our findings from the lab-in-the-field experiment.³⁵

4. Conclusion

The latest wave of LSAs 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 article, we provide first insights into the impacts of LSAs on key aspects of social capital, which is not directly observable yet highly important for economic development (Putnam, 1993; Knack and Keefer, 1997).

Using both a lab-in-the-field experiment and a natural field measure, we examine whether intra-village levels of trust and reciprocity among smallholders are affected by neighbouring LSAs. We formulate several hypotheses based on the literature (Arrow, 1972; Kajoba, 1994; Lyons *et al.*, 1998; Ensminger, 2004), which argue that village communities may adjust their behaviour when exposed to market-oriented systems such as those that characterise LSAs. We indeed find evidence in favour of the communal coping and the reputation hypotheses. Smallholders in villages close to LSAs are uncertain and jointly discuss the arrival of the investors, causing them to trust each other more than those in villages further away. Likewise, villagers who have entered an employee–employer relationship with LSAs are more likely to reciprocate trust—an effect that intensifies with the duration of the work relationship. This finding is consistent with the gift-exchange, reputation-building mechanism. Our field measure regarding the governance of a public good—a community solar power system—points in the same direction of greater trust and reciprocity in communities neighbouring LSAs.

Despite some minor differences, the two LSAs selected for this study are largely representative of other LSAs that are operational in Zambia. Our findings may hence carry over to the entire country. More caution should be taken in generalising our results to other LSAs around the world. This is particularly true since some LSAs have had unambiguously negative effects on surrounding communities—for example, through the eviction of smallholders, which inspired the term ‘land grab’. Future research may take a closer look at different employment modes on large-scale farms that foster positive externalities. The establishment of LSAs constitutes only one of many examples in which traditional communities are exposed to market-oriented systems in the course of economic development and structural transformation (for more literature on this overarching topic, see Henrich *et al.*, 2001; 2004; 2010; Tracer, 2004; Ensminger and Henrich, 2014). While the overall effects of market exposure are likely to differ from case to case, the transmission mechanisms identified for the case of LSAs may also be relevant in similar settings. We therefore encourage further research on social and behavioural factors that may interact with market exposure and economic development around the world.

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³⁵ Similar approaches for behaviour in different domains such as common pool resources, (charitable) giving and cheating are discussed by Levitt and List (2007), Stoop *et al.* (2012), Stoop (2014), Potters and Stoop (2016), Cohn and Maréchal (2018) and Galizzi and Navarro-Martinez (2019).

Additional Supporting Information may be found in the online version of this article:

Online Appendix Replication Package

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