Land Rental Markets: Experimental Evidence from Kenya*

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Abstract

In much of Sub-Saharan Africa, land markets operate far from perfectly, with widespread consequences for rural economic life. In one of the first field experiments on land markets, we induce land market participation in Kenya by subsidizing agricultural rentals. We study who selects in, what renters do differently to owners, and the effects on agricultural and owner outcomes. The induced rentals increase equity in land allocation, by reallocating plots to younger, more entrepreneurial farmers, who own fewer plots; and the rentals persist beyond the subsidy period. Renters increase output and value added on the rented plot—by more than the effect of an unconditional cash transfer to owners—and they do so by increasing commercial crop cultivation and non-labor inputs, not by supplying more labor to the plot. While owners cultivate less land under the subsidy, their production on other plots does not change and their non-agricultural labor decreases.

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1 Introduction

Agriculture is the main source of livelihood for more than 50% of households in Sub-Saharan Africa, yet markets in its key input, land, function far from perfectly. Rental markets are often sparse, while sales markets are often almost non-existent, such that in many settings more than 90% of plots are farmed by their original owner (Deininger et al., 2017).[1] This absence of reallocation of land is often considered a major obstacle to increasing agricultural productivity and economic development, with far-reaching consequences for the economics lives of the poor. While efforts to encourage land market participation are growing, thinking through their potential effects requires understanding who selects into land markets at the margin, and what are the effects of doing so.

An active debate on land market frictions has centered on their effects on three sets of outcomes: productive efficiency, equity, and structural transformation. On efficiency, one recent set of studies documents wide dispersions in productivity and argues that improvements in sales and rental markets would generate significant output gains, by reallocating land toward more productive farmers (Restuccia and Santaeulalia-Llopis, 2017; Chen et al., 2021), while another argues that measurement error and unobserved heterogeneity explain a large fraction of the dispersion in measured productivity (Gollin and Udry, 2021). On equity, land markets may equalize access to land, inducing a transfer of land toward land-poor households (Ali et al., 2015), or they may foster "land-grabs", where wealthy households with deep pockets acquire land, increasing inequality (Jayne et al., 2016). On structural transformation, land markets untie landowners from their land; does this push them out of agriculture and into other economic activities, or are the constraints elsewhere (Gollin, 2021)?

This paper provides experimental evidence to this debate. It presents results from a randomized controlled trial (RCT) in Western Kenya in which we offer landowners subsidies to rent out one of their plots, thus inducing marginal land rentals. While a prominent literature, including recent RCTs, has focused on improving land property rights in Sub-Saharan Africa (see, e.g., Besley, 1995; Goldstein et al., 2018), experimental evidence on increasing land market participation is virtually non-existent.[2] Our design allows us to identify who selects into land markets, how renters compare to owners, how agricultural choices on the rented plots differ, and how owners' outcomes, such as food security, non-farm labor and migration, change once they rent out their land. In turn,

[1] In Europe and in the USA, in contrast, rental markets for agricultural land are typically very active, with a substantial proportion of agricultural land being rented – 80% in France, 60% in Germany, 46% in Italy (L et al., 2021) and 40% in the USA (USDA 2017 Census of Agriculture).

[2] Improving tenure may increase investment and productivity for many reasons beyond fostering gains from trade, including lowering the risk of expropriation, favorable credit access via collateral channel and reducing the need for unproductive "guard labor" (Besley and Ghatak, 2010).

the answers speak not only to the importance of frictions in land markets, but also to frictions in markets for other inputs, such as labor, credit, and management.

We induce rentals in a setting where land rental markets do operate, but imperfectly, as it is often the case in Sub-Saharan Africa (Christiaensen, 2017). Farmers report multiple sources of frictions, including search costs, land disputes, concerns about soil exploitation, and transaction costs. The rental subsidy paid to landowners in the experiment aims to compensate the owners for part of these frictions, and hence potentially increase the gains from, and the volume of, trade. While it is likely that induced rentals would increase efficiency, it is certainly not a given – the subsidy may induce experimentation, or, if too large, may induce trades known ex-ante to be inefficient.

The experimental design aims to induce marginal rentals which would not occur absent the subsidy. For this purpose, we conducted a listing with plot owners in 161 villages in Western Kenya. We first listed the planned use of each plot for the upcoming season (cultivating, fallowing, renting out), and then we asked owners about their interest in a subsidy to rent out one additional plot, among those they were not planning to rent out. 17% of eligible owners expressed interest in the subsidy, which was worth approximately 30% of the average rental price in the village and payable upfront for rentals of up to three crop seasons (one and a half years). Interested farmers own more land, leave a higher share of their plots unused, and mention cash needs and lack of inputs for cultivation as primary reasons for their interest in the rental subsidy. Throughout the paper, we refer to the plot eligible for the subsidy as the *Target Plot*. After conducting a baseline survey with 521 owners interested in the rental subsidy, we randomized who was assigned to receive it. In addition to the control group and the rental subsidy group, we allocated one-third of the plot owners to an unconditional cash transfer group, which enables us to benchmark the income effect of the rental subsidy.

The rental subsidy achieved its goal. It led to a large and prolonged increase in the likelihood that the Target Plot was rented out. While 23% of owners in the control group rented out, 69% did so in the rental subsidy group, a 46 percentage point (p.p.) effect which was consistent across the three agricultural seasons in which the subsidy was offered. Moreover, the effect on rentals persisted in the fourth and fifth season of the study, when rentals were no longer subsidized, with 58% of owners in the rental subsidy group continuing to rent out, almost always to the same renter. This persistence beyond the subsidized period is consistent with the subsidy overcoming fixed costs in the rental market, such as search or learning costs, rather than per-period costs. It is also in line with the listing exercise, when farmers reported that the rental market was thin on both sides, with difficulties finding both those interested in renting in and those interested in renting out.

Comparing the characteristics of Target Plot managers across treatment groups identifies the differences between owners and renters, for rentals induced by the subsidy. The comparison shows the distributional effects of land rental markets and provides a first indication of why the plot is rented out and what the renter might do differently. Using data from the baseline survey, renters owned 1.9 fewer plots than owners on average, compared to a control mean of 3.2, and had similar household sizes. Promoting land rental markets thus increased equity in land use and reduced dispersion in labor-land ratios, rather than increasing concentration of land among wealthier households. Renters were also 7.6 years younger on average, almost exclusively male, and more educated than owners. They do not appear to have been renting in because they were more food insecure – if anything, they were less likely to have experienced hunger than owner households – but they were potentially more entrepreneurial, devoting a greater fraction of their plots to cash crops, and being more likely to have borrowed.

Four follow-up surveys with plot managers, at the end of each of the next four crop seasons after the baseline season, allow us to identify the effects of the interventions on agricultural production on the Target Plot. Both the rental subsidy and the unconditional cash transfer increased the likelihood that the plot was cultivated by a similar amount (+6-8 p.p from a control mean of 82%). However, while the unconditional cash transfer increased maize cultivation, the rental subsidy induced cultivation of commercial crops (+10 p.p. from a control mean of 9%), consistent with the finding that the rentals induced a land transfer toward younger, more educated, and potentially more entrepreneurial farmers, who are willing to engage in more commercially oriented agriculture.

Digging into differences in agricultural inputs and outputs, treatment-on-treated (TOT) analysis show that the rental subsidy increased the value of non-labor inputs on the Target Plot (seeds, fertilizer, chemicals) by $14 (42% of the control mean), while there was no significant effect on labor, both household and hired, despite renter households cultivating fewer plots overall. The value of harvest increased by $31.5 (47%), and combing this with effects on inputs, there was an increase of $23 in value added, a result robust to a wide range of valuations of household labor (Agness et al., 2022). These treatment effects of the rental subsidy were much larger, and significantly different, than those of unconditional cash transfer, which were mostly small. Finally, two rounds of soil testing demonstrate that the rental subsidy had no significant impact on a soil quality index (TOT=-0.04 s.d.), a potential cost of more intensive cultivation, though the estimate is somewhat noisy (s.e.=0.07).

Finally, comparing owner outcomes across treatment groups in the four follow-up surveys identifies effects on owners' food security and structural transformation, as well as spillovers to the cultivation of their other plots. Neither treatment displaced renting out of other (non-Target) plots, which occurred rarely, and for which we estimate precise zero effects. Moreover, there is little evidence of meaningful spillovers on other agricultural outcomes. However, the rental subsidy did affect the non-agricultural economic activity of owners, leading to 9.1 *fewer* person-days per season of non-agricultural work. This decrease is inconsistent with land market participation leading to structural transformation by untying labor from the land, but consistent with seasonal income effects on labor supply (Fink et al., 2020) – as is consistent with the negative but insignificant effect of the cash drop. The rental subsidy also led to owners owning slightly less livestock, but otherwise had no detectable effect on food security, a non-land wealth index, or household finances.

What do these effects tell us about the size of frictions in the land market, and their interactions with frictions in other input markets? It is well understood that, if all the other markets worked, land market incompleteness by itself would not generate distortions (Singh et al., 1986; Jones et al., 2020). Contrary to other work (see, e.g., Holden et al., 2010a), it does not appear that the changes in outcomes arose because labor market frictions meant that renters, who had higher labor-land ratios, faced lower costs of labor and hence could employ more labor on the rented plot. Rather, the increase in non-labor inputs and in value added are consistent with renters having better access to capital and, possibly, higher management skills. In other words, the land market frictions appear to be interacting with credit and management frictions, rather than labor market frictions.

Another common argument for efficiency gains from land markets is that they may reduce plot fractionalization, generating economies of scale through combining contiguous plots and reducing commuting times. In two recent papers, Foster and Rosenzweig (2022) provides an analysis of economies of scale among Indian farms and Bryan et al. (2019) conducts a lab-in-the field experiment using market design to foster land consolidation in Uganda. In our experiment, the rental subsidy treatment induced increases in inputs, output, and value added *despite* a lack of land consolidation. If anything, renters were more likely to come from different villages and less likely to manage other plots near the Target Plot. Another large literature on land market participation focuses on the efficiency costs of sharecropping, a contract under which the rent is paid as a fraction of the harvest (see, e.g., Burchardi et al., 2019 for a recent experiment varying the tenant's output share). While widespread in other settings, especially in South Asia, in our setting there is no sharecropping.

This paper brings experimental evidence to the debate about the gains from land reallocation across farmers in developing countries, which so far has been based on observational studies (among many others, see, e.g., Deininger et al., 2008; Jin and Jayne, 2013), quantitative analyses (e.g., Adamopoulos et al., 2021) or institutional reforms to rental market restrictions (e.g., Chari et al., 2021 in China; Chen et al., 2021 in Ethiopia).[3] Our experiment provides a proof of concept of the feasibility of field experiments on the important and delicate topic of land leasing, as well as illustrating the distributional and efficiency effects of inducing land market participation on the margin. The intervention, a conditional rental subsidy, is purposefully agnostic about which sources of land market friction it relaxes, and indeed could relax several (e.g., it may cover search or transaction costs or induce some owners to rent out even if they perceive a risk of land disputes). We are interested in marginal rentals, those which face the smallest barriers. We do not aim to unbundle the role of each of the potential frictions. While a simple back of the envelope suggests that the monetary benefits of the rental subsidy are larger than its cost, there may be more cost-effective ways to improve the functioning of land markets at scale. More research is needed to identify scalable interventions in this domain. We elaborate on limitations of our study and areas for future research in the conclusion.

The remainder of the paper is organized as follows. Section 2 describes the study setting. Section 3 presents the experimental design. Section 4 provides an overview of the experimental analysis. Section 5 describes the effects of the rental subsidy on the likelihood of renting out the Target Plot. Section 6 studies the distributional effects of the experimentally induced land rentals. Section 7 presents treatment effects on agricultural outcomes on the Target Plot. Section 8 reports treatment effects on owners of the Target Plot, including outcomes on their non-Target Plots and non-agricultural outcomes, such as food security and labor supply. Section 9 concludes.

2 Setting: agriculture, property rights, and land rental markets in Western Kenya

Agriculture. Agriculture comprises more than 20% of Kenya's Gross Domestic Product (GDP) and employs more than 40% of the national workforce and more than 70% of Kenya's rural population. We conduct our experiment in Western Kenya, a predominantly rural region. Kenya's agricultural sector is dominated by small-scale rainfed farming, with smallholders pro-

[3] Recent papers on rental markets of other factors include Bassi et al. (2021), which shows that rental market interactions allow small firms in Uganda to increase their effective scale and mechanize production, and Caunedo and Kala (2021), which presents the results of an experiment that subsidizes access to agricultural rental equipment markets in India.

ducing approximately 75% of the country's total food production, with most farmers primarily producing for their own consumption. In our data, the median plot size across all plots managed by the farmers is 0.5 acres, with the median household owning 3 plots and a total of 1.3 acres of land.[4] Agricultural production follows two main cropping seasons: a long rain season from mid-March through July/August, and a short rain season from October through December. The main staple crop is maize, while commercial crops include groundnuts, sugarcane, and tobacco. 9% of farmers in our data leave at least one of their plots fallow in the baseline crop seasons and approximately half of the farmers report that they cannot afford inputs as the reason for keeping the plot idle.

Property Rights. Historically, land in Kenya has been communally owned, with the customary tenure system characterized by groups of individuals belonging to a clan or an ethnic community holding the rights to the land. However, since independence in 1963, the government's legal and policy framework of land tenure has fostered private ownership, regarded by the government as the tenure regime most suited to promote agricultural productivity. Today, communal land holdings remain prevalent mostly in the arid and semi-arid northern regions, as well as in the areas populated by the Maasai in the South. Individual property rights are prevalent in the other regions of the country, including in Western Kenya, where we conduct our study. Private property rights are imperfect in rural areas, as some farmers do not hold certificates of ownership, and land disputes over competing claims to land often occur (Holden et al., 2010b).

In our study, farmers own 92% of all the plots they manage. The remaining share comprises of plots that are either rented in from someone else or obtained for free from family members to cultivate crops. Owners mostly acquired their plots through inheritance (92%). Some plots, however, were purchased (8%). The majority of farmers report having either a certificate of title (53%) or a certificate of customary ownership (17%), while 5% have only a certificate of occupancy, and 24% do not have any documents certifying land ownership.

Land Rental Markets. Recent work documents that land rental markets operate in many African countries (see, e.g., Ali et al., 2015; Christiaensen, 2017; Deininger et al., 2017). This is also true in Kenya. Our listing data suggests that 4% of households are renting out some land, and among owners interested in the subsidy, this share is 10%.[5] Rental contracts usually include an upfront cash payment and a rental period of 1 to 2 years, covering 2 to 4 agricultural seasons. The average size of the plots rented out is 1 acre and the average rental price per acre per season is $37.8

[4] Section 3.4 presents an overview of our primary data sources.

[5] In our context, as it is often the case, we may underestimate the overall engagement in land rental market as landowners residing outside the villages are not captured by our surveys (Deininger et al., 2017).

(median $30). The rental price varies, both within and across villages, with a standard deviation of $32.3 across villages, suggesting that land markets are not subject to a binding price norm, unlike labor markets in many settings (Kaur, 2019). Another friction of labor markets which appears to be missing from rental markets is stigma, which never came up in our focus groups nor qualitative survey questions about why people do not rent in or out. While rental markets are active in our context, their functioning is constrained by institutional factors and policy restrictions. Perceived threats of uncompensated expropriation and that property rights are still not fully documented both contribute to lower land market participation. In our data, owners perceive several barriers to renting out: search costs associated with finding a renter (57%), concerns about soil exploitation from renters (51%), fear of land disputes (41%), and costs associated with rental contracts, such as fees to the village chief (22%). Renters also perceive several risks and costs associated with renting in, which include: potential land disputes and eviction risk before harvest (36%), asymmetric information over the quality of the rented land resulting in low yields (31%), time and resources required to learn how to best farm the rented land (37%), and costs associated to the rented plots being far from the homestead (33%).

3 Experimental design

In this section, we describe the study design, including sample selection, intervention details, randomization strategy, data collection, and balance. Figure 1 presents a timeline of the field and survey activities. To implement the study, and to induce trades in a notoriously complex and sensitive market, we had to make important decisions about critical aspects of the design, such as the identification of potential compliers, both in terms of owners and plots, the timeline and duration of the intervention, the amount of the subsidy, and the conditions for its disbursement. Below, we discuss some of the key trade-offs in these decisions and the rationales for our choices.

3.1 Farmer listing and sample selection

After a small-scale pilot in four villages during the first half of 2019, field activities for the main evaluation began in July 2019, towards the end of the 2019 Long Rains crop season. Enumerators visited 161 villages in four West Kenyan counties (Bungoma, Kakamega, Migori and Siaya) and conducted a brief listing module with 7,613 plot owners. Each respondent answered a short section on demographics, and listed each of their owned plots. For each of these plots, we asked questions on size, distance from the respondent's house, and use —cultivation, fallowing, and renting out —for both the 2019 Long Rains season, which had just ended, and the upcoming 2019 Short Rains season.

At the end of the listing survey, we introduced the rental subsidy program to respondents and elicited their interest in the subsidy. We asked whether the respondent would be interested in receiving a subsidy ("top up") for renting out one plot among those she was not already planning to rent out (based on the answers in the listing). For ethical considerations, only owners with at least two plots (N=5,485) were eligible for the subsidy. We provide further details on the rental subsidy in Section 3.2.

In the listing, 878 of the 5,485 eligible owners (16.8%) expressed interest in the rental subsidy. Appendix A presents a comparison between owners interested in the subsidy and the rest of the eligible owners. Compared to those who did not express interest for the rental subsidy, interested owners own more land and are more likely to both rent out their plots and leave them fallow. Interested owners are also more likely to be male and own a phone. There is no difference in the likelihood to cultivate commercial crops across the interested and non-interested groups. The main reasons for being interested in renting out an additional plot are needing cash (78%), not having sufficient inputs to cultivate the plot (16%) and could not hire sufficient labor to cultivate the plot (15%). As we discuss more in detail in Section 3.4, we then conducted a baseline survey with 521 of the owners interested in the rental survey. This is the main sample for the study.

In the listing, each of the interested owners identified one plot they would be interested in renting out should they receive the rental subsidy. In the rest of the paper, we refer to this plot as the '*Target Plot*.' For our research design, it is crucial to identify this plot before the randomization and the rentals take place: this step allows us to compare plots that are similar ex ante, but are then exposed to different treatments during the experiment and, as we will see later, experience different likelihoods of being rented; i.e. it gives us a plot-level counterfactual. At the end of the listing, our enumerators conducted a GPS measurement of each plot's size. Section 3.5 presents a comparison of Target vs non-Target Plots, using data from our baseline survey, which we introduce later.

We emphasize that this sampling procedure aimed to identify likely compliers: owners who had not yet rented out the Target Plot, but who would rent it out should they receive the rental subsidy. The timing of the listing and of the baseline was in line with this goal. We completed the listing activities in the last pre-intervention harvest season (2019 Long Rains) and offered the rental subsidy to the selected households shortly thereafter (more details below). Running the listing earlier would have likely reduced compliance, as we would have identified many plots as eligible for the rental subsidy that eventually would have been rented regardless. Going too late would have reduced the chances that owners interested in the subsidy could find a renter for the soon-to-start season.

3.2 Interventions: the rental subsidy and the unconditional cash transfer

The main treatment of interest is the rental subsidy. To account for income effects, we are also interested in comparing the rental subsidy to an unconditional cash transfer. In this section, we discuss the details of each intervention.

Rental subsidy value and duration. Owners randomly selected into the rental subsidy group received the subsidy if they rented out the Target Plot, which we identified in the listing. The rental subsidy was worth approximately 30% of the average rental price and was expressed in per-acre terms.[6] We collected the average rental price in each village through a brief community survey ran before the listing. In most villages, rental prices were between \$30 and \$40 per acre per season. We set on a subsidy of approximately 30% of the rental price because initial qualitative fieldwork suggested this would ensure a sufficient amount of interested owners. Smaller subsidies may have led to an excessively small number of compliers; higher subsidies did not seem to induce much additional supply (i.e., the elasticity seemed small above the chosen rate).

We placed no restrictions on who the plot could be rented out to, beyond it being someone outside of the immediate family of the owner. We did not want to restrict the choice of renter for two reasons: first, so that our intervention was as close as possible to a pure monetary incentive, without further restrictions whose effects would be hard to quantify; and second, because pilot work suggested rental markets were thin with substantial search costs, suggesting that restrictions on the set of potential renters may have led to little renting out. This decision to not restrict the set of potential renters made it infeasible to have a counterfactual for those renting in, and hence to observe treatment effects on them, a point we return to later.

We offered the subsidy for up to three crop seasons. As we discuss later (Section 5.2), this duration is in line with the average duration of non-incentivized rentals. We announced that we would be paying the rental subsidy at the same time of the renters' payment. Since in multi-season contracts it is often the case that the renter pays the owner upfront for the entire duration of the

[6] This per-acre rate was based on the average Target Plot size between the one reported by the plot owner and the one measured with GPS, both of which were recorded before the announcement of the subsidy and hence were unlikely to be biased upwards for strategic reasons. We averaged over the two measures for two reasons. First, both measures suffer from measurement error, and averaging them may remove some of the noise. Second, we did not want to run the risk of discouraging the owner and reducing compliance in those cases where the self-reported size was higher. On average, self-reported plot sizes were approximately 20% higher than GPS ones. In the rest of the paper, we use this average measurement when referring to Target Plot size, except in Appendix Table B.1, where we use the size reported by the owner when comparing Target Plots to non-Target plots, for which we don't have GPS measurement.

contract, we also paid the rental subsidy upfront for all seasons in these cases. Payment of the rental subsidy occurred mostly via mobile money, with a handful of payments made in cash.

Rental subsidy verification. A natural concern is that owners in the rental subsidy group may try to misrepresent the rental status of the plot to receive the subsidy. We put in place several measures to mitigate this concern. First, we required written confirmation of the rental agreement by the local chief, including the signatures of two witnesses. In most of these cases, we paid a small token to the chief ($1.5). We factor in this amount when computing the amount for the unconditional cash transfer treatment, which we describe below. This chief confirmation step significantly raised the cost of cheating for the owner because the document would give rights to another person to claim the harvest on the plot. We thus considered the chief confirmation to be an important step for the validity of the experimental design. It is also possible that the chief confirmation raised security for the parties involved in the transaction and thus may affect their behavior, e.g., increasing the renter's willingness to invest on their plot. We return to this point in Section 4.3 when we discuss our estimation strategy.

Second, our enumerators also conducted an extensive verification with both the owner and the renter before disbursing the payment. The verification checked for consistency in the rental terms reported by the two parties.

In Section 5.2, we also show that the basic terms of the rentals (price, duration, relationship between the owner and the renter) are similar across rentals that occurred in the three treatment groups. This adds further confidence that our intervention induces real rentals. Of course, while we are confident that these measures reduced cheating, we cannot claim they eliminated it completely. We also monitored the rentals on a continuous basis and indeed detected a couple of fraudulent cases. Finally, we observe that any remaining cheating would inflate the measured effects of the rental subsidy on rental probability, but it would reduce the treatment-on-treated effects on agricultural outcomes (e.g., the effects of receiving the rental subsidy on input use).

Unconditional cash transfer. We compare the effects of the rental subsidy with those of an unconditional cash transfer designed to match the size of the rental subsidy. As with the rental subsidy, the per-season value of the unconditional cash transfer was based on the Target Plot's size. We also calibrated the number of seasons for which we offered the cash transfer on the distribution of the number of seasons in the rental subsidy group. Section 5.1 provides more details on this point. Payment of the unconditional cash transfer occurred mostly via mobile money, with a handful of payments made in cash.

3.3 Randomization

We randomized the 521 owners included in the study into three groups: rental subsidy, unconditional cash transfer, and control. We performed the randomization in five waves. Within each wave, we stratified the randomization by county, intended Target Plot use reported by the owner in the listing for the upcoming crop season (66% cultivating vs 34% fallowing or undecided), and plot group size.

As we discuss in Section 7, we leverage stratification by the intended use of the Target Plot in some of the analysis. Whether the owner was planning to cultivate the Target Plot in the upcoming 2019 Short Rain season is a strong, though not perfect, predictor of the actual cultivation status, especially in the first seasons of the experiment. This assists us in investigating the intensive vs. extensive margins of response to the treatments, for instance when analyzing the impact on the likelihood of cultivation and on crop choice. For the rest of the paper, we refer to the stratum where the owner was planning to cultivate the Target Plot as stratum C and to the stratum where the owner was not planning to cultivate as stratum NC [7].

3.4 Data collection

Our data collection strategy includes a baseline survey at the end of the 2019 Long Rains (season 0) and follow-up data collection for four crop seasons: 2019 Short Rains (season 1), 2020 Long Rains (season 2), 2020 Short Rains (season 3), and 2021 Long Rains (season 4).

Baseline owner survey. Shortly after the listing and while harvesting of the 2019 Long Rains (i.e., the last pre-intervention seasons) was ongoing, we conducted a baseline household survey with the 521 owners included in the study sample. The baseline survey collected information on demographics, agricultural activities for the previous two crop seasons (2019 Long Rains and 2018 Short Rains) on each plot owned or managed by the respondent (including the Target Plot), non-agricultural activities, food security, assets, and access to financial markets.[8]

Baseline renter survey. At the beginning of the first experimental season (2019 Short Rains), we collected information on all rentals of the Target Plot in our sample (both in treatments and in control). In this season, 212 Target Plots were rented out. We then conducted a survey with the renters of each Target Plot, which included similar questions to the baseline owner survey:

[7] Appendix B.2 presents a comparison of stratum C versus Stratum NC on two sets of outcomes: owner demographics and socio-economic variables and Target Plot baseline characteristics (Table B.2).

[8] The experiment required conducting the randomization and offering the subsidies before the 2019 Short Rains crop season started. For this reason, we opted to conduct the listing and the owner baseline while harvesting for the 2019 Long Rains was still ongoing. Therefore, we are missing information on harvest amount for a large portion of the sample. We did however collect information on harvest amount in the previous season, i.e., the 2018 Short Rains crop season.

demographics, agricultural activities by plot for the previous two crop seasons for each plot owned or managed by the respondent in those seasons, non-agricultural activities, food security, assets, and financial markets.

Follow-up surveys. At the end of each of the four crop seasons (the three seasons eligible for the rental subsidy plus an additional one), we conducted a round of follow-up surveys. We asked questions about agricultural activities on the Target Plot to the managers of the Target Plot during that season: the owner if the plot was not rented out and the renter if it was rented out. In addition, regardless of whether they were managing the Target Plot, we asked the owners questions about their other plots, non-agricultural activities, food security, assets, and household finances.[9] We also collected information on whether the Target Plot was rented out in crop season 5 (2021 Short Rains), even though we did not conduct a full follow-up survey then.[10] Due to COVID-19, we conducted phone interviews for the second half of follow-up round 1 and the entire follow-up round 2.[11]

Soil samples. At the end of crop season 1 (2019 Short Rains) and crop season 4 (2021 Long Rains), we collected soil samples from the Target Plots. Kenyan laboratories analyzed the samples to measure several soil nutrients (nitrogen, phosphorous, potassium, organic matter, and the pH level of the soil). Following Burchardi et al. (2019), we constructed a soil quality index by first standardizing each measurement into a z-score, taking the mean of each plot's z-scores and then standardizing again against the control group.

3.5 Baseline Analysis: Target Plot characteristics and randomization balance

In this section, we use the baseline data for two purposes. First, to provide a comparison of the characteristics of the group of plots, leveraging collected baseline data from both the Target Plot and the other non-Target plots. Second, to discuss baseline balance on owner demographic

[9] In about 12% of the follow-up surveys, the harvesting on the Target Plot was not completed when the enumerator visited. In this case, we recorded the planned harvest amount and then in many cases verify the actual amount, either with ad hoc phone calls or in subsequent survey rounds. After this verification process, we are left with approximately 6% of plots with a non-verified planned harvest amount. In Section 7.3, we show that results on harvest value and value added are robust to controlling for a dummy for non-verified planned harvest (Appendix Tables E.5 and E.6). Finally, if the crop cycle does not match the standard rain season cycle, we divide the harvest amount evenly across all the rain seasons in which cultivation occurred.

[10] We collected this information in the follow-up survey we conducted at the end of season 4 (2021 Long Rains).

[11] In season 1, we also attempted to conduct a crop-cutting exercise for the most common major crops in our setting: maize, beans, groundnuts. We aimed to conduct the field visits shortly before harvesting. However, the harvesting time of various crops was quite spread out across multiple weeks, or even months. As a result, we ended up running the crop cutting only for maize. Even for maize, however, we missed approximately 25% of the plots growing this crop, due to early harvesting. For more plots, harvesting was already partially ongoing by the time of our visit. We ended up collecting (often incomplete) crop-cutting data in only 227 of the 521 plots in the sample. In addition, many other implementation challenges emerged when implementing this task in the field. Therefore, we opted not to continue this exercise in subsequent seasons.

and socio-economic variables, Target Plot agricultural variables and non-Target Plots' agricultural variables.

3.5.1 Comparing the Target Plots to other plots

Appendix B.1 presents a comparison of baseline characteristics for Target versus non-Target plots. Table B.1 documents that, overall, Target Plots are similar to non-Target Plots in terms of observable characteristics: size, location in the same village as where the respondent lives, and likelihood of being irrigated. The only observable difference is that Target plots are somewhat less likely to have a sandy-clay type of soil (difference significant at 10%). From the perspective of agricultural use, Target Plots are significantly less likely to be cultivated at baseline (the 2019 Long Rains), as well as in the previous agricultural season (the 2018 Short Rains), and more likely to be rented out in both seasons. These effects are significant at 1% and are consistent with the fact that owners were asked to identify a plot that they would be interested in renting out, conditional on receiving the subsidy. Finally, Target Plots are also slightly less likely to be cultivated with commercial crops at baseline (difference significant at 10%) and the average value of hired labor employed on these plots is higher compared to non-Target plots (difference significant at 1%).

3.5.2 Balance

Appendix Table B.3 presents the balance of baseline covariates on owner demographic and socio-economic variables, as well as Target Plot and non-Target plot characteristics. While the randomization achieved balance overall, a few variables are unbalanced. The control group appears to have higher likelihood of erosion and lower value of inputs and hired labor at baseline compared to both the rental subsidy and the cash transfer groups. These effects are significant at 5%. As we discuss in Section 4.3, we use ANCOVA specifications that control for value of baseline outcomes. Finally, the unbalance of a few baseline variables in the control group does not affect the comparisons between the rental subsidy and the unconditional cash transfer, as the two treatment groups are overall well balanced.

3.6 Attrition

Overall, attrition rates are low, with survey completion rates of at least 91% and above 95% for most rounds (Appendix Table E.8). However, there is some differential attrition by group: the unconditional cash transfer group has a significantly higher completion rate than control (+3 p.p.) in the follow-up surveys with Target Plot managers (Panel B) and the rental subsidy group has a significantly lower completion rate (-5 p.p.) than control for soil tests (Panel C) and owner follow-up surveys (Panel D). Given the low rates of attrition, any bias induced by differential attrition is unlikely to dramatically influence our results. To examine the extent of any bias in our results, we follow Lee (2009) and construct bounded treatment estimates for attrition. Appendix Tables E.9 and E.10 present these results.

4 Experimental analysis: overview

The experimental analysis focuses on treatment effects on four groups of outcomes. We begin by documenting the effect of treatments on the likelihood that the Target Plot is rented out. Second, we then look at the distributional effects of land rental markets, comparing the characteristics of owners to renters for the rentals induced by the subsidy. Third, we examine how rental subsidies (and unconditional cash transfers) affect agricultural production on the Target Plot, including crop choice, investment, output, and soil quality. Finally, we study treatment effects on the owners, including agricultural outcomes on their non-Target plots and non-agricultural outcomes, such as food security and labor supply.

4.1 Target Plot: rentals

We examine the impact of the treatments on the likelihood that the Target Plot is rented out:

$$TargetPlotRentedOut_{is}^{t} = \beta_0 + \beta_1 RentalSubsidy_i + \beta_2 CashTransfer_i + \delta x_i^0 + \eta_s + \eta^t + \epsilon_i^t, \quad (1)$$

where the outcome is a dummy for whether the Target Plot i is rented out in crop season $t = 1, 2, 3, 4, 5$, η^t is a vector of crop-season fixed effects, η_s is a vector of strata fixed effects, x_i^0 is a vector of baseline controls that includes the size of the Target Plot and the value of the outcome variable in the two pre-experimental seasons for which we have data (2018 Long Rains and 2019 Short Rains). Data comes mostly from the follow-up surveys.[12] In a handful of cases, we collected information on the rental status even if we could not conduct a full follow-up survey for the plot.

We present these results both by season and pooling across seasons. Importantly, we have information on the rental status of the Target Plot in crop seasons 4 and 5, which enables us to test whether rental relationships induced by the treatment persisted after the rental subsidy intervention ended (in season 3). We also examine whether renting out the Target Plot may substitute for renting out other plots.

[12] We collect data on rentals for the upcoming season 5 in the follow-up survey we conduct at the end of season 4.

4.2 Target Plot: manager characteristics

The treatment may affect who manages the Target Plot, and thus the manager's observable characteristics. We are interested in whether rentals change manager characteristics such as demographics (e.g., age, gender, education), wealth (agricultural land owned, non-land wealth), baseline use of agricultural inputs, and agricultural productivity.

We study whether rentals induce changes in *baseline* characteristics of the Target Plot managers. For this purpose, we use two sources of data. If the Target Plot manager (in the first season) is the owner, we use information from baseline owner survey, which we collected toward the end of the 2019 Long Rains (i.e., the last season before the intervention began); if the Target Plot manager is a renter, we use information from the baseline renter survey, conducted at the very beginning of the 2019 Short Rains, right after the rental began. Our analysis thus explores whether, by affecting rental probabilities, the rental subsidy may change baseline characteristics of managers of the Target Plot through a treatment effect on the identity of the manager.[13]

We examine the impact of the treatments on the baseline characteristics of the person managing the Target Plot in the first treated season. We present ITT and LATE results. The ITT regression model is:

$$x_{is}^{Manager} = \beta_0 + \beta_1 RentalSubsidy_i + \beta_2 CashTransfer_i + \delta x_i^0 + \eta_s + \epsilon_i, \tag{2}$$

where $x_{is}^{Manager}$ is the characteristic of the renter if the Target Plot is rented out and of the owner otherwise, x_i^0 is the value of the owner characteristic from the baseline owner survey (equal to the dependent variable $x_i^{Manager}$ if the Target Plot is not rented out), and the rest of the notation follows Equation 1. We are primarily interested in β_1, the ITT effect of the rental subsidy on manager characteristics, but we also report ITT effects of the cash transfer for completeness, β_2, since the cash transfer appears to have had a small effect on renting out (and hence on who the manager is).

We are primarily interested in the LATE of renting the plot on manager characteristics. For this purpose, we estimate:

$$x_{is}^{Manager} = \gamma_0 + \gamma_1 TargetPlotRentedOut_i + \gamma_2 CashTransfer_i + \delta x_i^0 + \eta_s + \epsilon_i, \tag{3}$$

where we instrument $TargetPlotRentedOut_i$ with the treatment assignment $RentalSubsidy_i$. The exclusion restriction is that the treatment changes the identity of the Target Plot manager (and

[13]For obvious reasons, we ran the owner baseline survey at the end of season 0 and the renter baseline survey at the inception of season 1, as soon as the rentals were agreed. Most of the analysis of manager characteristics focuses time-invariant characteristics or on production choices for season 0, which are unlikely to be affected by this difference in timing. Finally, since managing the Target Plot may have treatment effects on some of the characteristics of interest, we cannot conduct the same analysis for later experimental seasons.

thus her baseline characteristics) only by affecting the probability of a rental. This assumption seems uncontroversial in this case.

4.3 Target Plot: agricultural outcomes

We use information from the four rounds of follow-up surveys with the Target Plot managers to study the treatment effects on Target Plot outcomes: cultivation rates (vs leaving the plot idle), crop choice, input value, harvest value, and value added. We also examine the impact on soil quality, using results from the soil sample laboratory analysis. The ITT regressions is thus:

$$y_{is}^{t} = \beta_0 + \beta_1 RentalSubsidy_i + \beta_2 CashTransfer_i + \delta x_i^0 + \eta_s + \eta^t + \epsilon_i^t, \tag{4}$$

where the notation follows Equation 1, except that we have Target Plot outcomes for four seasons, not five.[14] We cluster standard errors by Target Plot. For continuous outcomes, we focus on winsorized (1%) outcomes in levels on the inverse hyperbolic sine (IHS) transformation of the total outcome across rounds.[15].

Since there is imperfect compliance in the treatments, we also estimate the Treatment-on-Treated (TOT). As paying a rental subsidy in season t may affect rental status and other plot outcomes in season $t + 1$, we consider as endogenous variables dummies capturing whether the respondent received any rental subsidy or unconditional cash transfer payment during the study (as opposed to season-specific payment status), and we use the treatment assignment as an instrument. Section 5 provides more details on take up by crop season and thus on the interpretation of the TOT. Since payment of the rental subsidy was conditional on the chief confirmation of the renter (see Section 3.2), the TOT would include any potential effect of the confirmation on agricultural outcomes in the Target Plot.

The estimating equation for the TOT is thus:

$$y_{is}^{t} = \gamma_0 + \gamma_1 RentalSubsidyPaid_i + \gamma_2 CashTransferPaid_i + \delta x_i^0 + \eta_s + \eta^t + \epsilon_i^t. \tag{5}$$

There are two different questions we can answer directly through these TOT coefficients. First, what is the effect of a reduction in rental frictions, which result from the payment of the conditional subsidy to the owners? This is given by γ_1, and includes both the effect of the induced rentals,

[14] For cultivation and crop choices, we use baseline values from 2019 Long Rains and 2018 Short Rains; for inputs and labor, baseline values from the 2019 Long Rains (we did not collect detailed input data for 2018 Short Rains); for harvest, baseline values from the 2018 Short Rains (we ran the baseline survey while the 2019 Long Rains harvesting was ongoing, in order to leave those owners who were subsequently assigned to the conditional subsidy group enough time to find renters); for value added, we control for inputs and labor from the 2019 Long Rains and harvest value from the 2018 Short Rains. We also control for Target Plot size.

[15] Season-specific outcomes contain sizable shares of zeros (e.g., mostly because some plots are not cultivated in certain seasons) and, thus, we cannot use IHS in that case (Bellemare and Wichman, 2020)

plus an income effect to owners of the subsidy (which may be in part passed through to renters), for both marginal and inframarginal rentals of the Target Plot. Second, as a policy question, how does the effect of a dollar spent on rental subsidies compare to the effect of a dollar spent on unconditional cash transfers to owners? This is simply the comparison of γ_1 to γ_2, noting that the set of compliers is not the same in the two treatment groups.[16] A third question of interest would be what is the effect of the rentals induced by the subsidy, absent any income effects the subsidy induces? As is common in conditional subsidy designs, we cannot study the LATE of the actual rental status of the Target Plot, because the exclusion restriction fails: the rental subsidy may affect the Target Plot outcomes not only by inducing rentals, but also because of an income effect, on both marginal and inframarginal rentals. However, we can bound this effect from above and below under plausible assumptions.[17]

Finally, we also present IV quantile treatment analysis, where we again instrument whether the respondent received any rental subsidy or unconditional cash transfer with the treatment assignment.

4.4 Owner outcomes

We use information from the four rounds of follow-up surveys to study the effect of the treatment on Target Plot owners. Regardless of whether they managed the Target Plot in a given season, we asked the owners questions on agricultural outcomes on their non-Target Plots, food security, non-agricultural activities, assets and amenities, and household finances.

Non-Target Plot outcomes. For the analysis of outcomes on non-Target Plots, we reshape our data at the plot level and run the following regression (and its TOT equivalent):

$$y_{pis}^{t} = \beta_0 + \beta_1 RentalSubsidy_i + \beta_2 CashTransfer_i + \delta x_i^0 + \eta_s + \eta^t + \epsilon_p^t, \quad (6)$$

[16] Since there is essentially perfect compliance on the unconditional cash transfer, the comparison of γ_1 to γ_2 is also a lower bound of the effect of the rental subsidy payment *controlling for the income effect* under the plausible assumptions that the income effect on the outcome of interest (e.g., inputs on the Target Plot): i) is (weakly) stronger when the owner, who receives the payment, does not rent out the plot; ii) goes in the same direction for those who do not take up the rental subsidy as for those who do.

[17] We can bound the LATE of renting out the target plot, absent the income effect of the subsidy, as follows. First, comparing the rental subsidy group to the control group gives the effect of rentals on compliers, plus income effects on compliers and always takers, as shown in Figure (XX). Second, comparing the rental subsidy group instead to the cash drop group gives the effect of rentals on compliers, minus the income effect on never takers (plus any effect of the income effect potentially being passed through to compliers in the rental subsidy group —a negative income effect on the owner and a positive one on the renter). Assuming that income effects have the same average sign in these three groups (always takers, compliers, and never takers), we therefore can partially identify the treatment effect of renting out as lying in the interval between two LATEs, both of which instrument renting out by the rental subsidy: 1) in a comparison between rental subsidy and control groups, and 2) in a comparison between rental subsidy and cash drop groups. In practice, IV estimates when using a dummy for whether the Target Plot is rented as endogenous variable are about 40% larger than when using the dummy for whether the rental subsidy was paid (i.e. the TOT results in we present in the paper).

where we consider outcomes for non-Target Plot p of owner i in crop season t. The rest of the notation follows the previous equations. Standard errors are clustered at the owner level. We only measure outcomes of non-Target Plots if the owner manages them, not if she rents them out (because we do not interview the renters of non-Target Plots). Therefore, we first report treatment effects on the likelihood that the non-Target Plot is rented out and then we report treatment effects on other non-Target Plot outcomes (cultivation, crop choice, inputs, output, and value added) only if the plot is not rented out.

Other owner outcomes. For the analysis of other owner outcomes, the estimation follows the specifications presented in Section 4.3, except that the index i now refers to Target Plot owners (not to the Target Plot).

We cannot conduct a similar analysis for renters because we only observe them once they rent in the Target Plot and, therefore, we do not have a counterfactual for them. Alternative experimental designs that would have allowed us to obtain renter counterfactuals were not feasible for logistical or budgetary reasons.[18] We elaborate on this point in the Conclusion, where we discuss avenues for future research.

5 Do subsidies increase Target Plot rentals?

This section studies take up of the treatments and their effects on the likelihood that the Target Plot is rented out.

5.1 Take up of the treatments

Rental subsidy take up. 70.3% of Target Plot owners eligible for the rental subsidy took it up. The two main reasons for not taking up the subsidy were that the owner either changed her mind and decided to cultivate the Target Plot or that she could not find a renter. Of those who took it up, 76% received the rental subsidy for three seasons, 18.2% for two seasons, and 5.8% for one season.

The vast majority of owners who took up the rental subsidy for multiple seasons had the same rental agreement throughout the seasons. A handful of owners first rented out the plot for one or two seasons (and received the subsidy for those seasons) and then completed a different rental agreement for one or two additional seasons, for which they received additional rental subsidies. In general, we paid the rental subsidies at the beginning of the seasons. Since those renters who

[18]For instance, one alternative would be to restrict the sample to Target Plots where the owner had already identified potential renters, but we were concerned this may lead to a small treatment effect on the likelihood of renting out the Target Plot. Another design would identify lists of potential renters in each village and randomize rental subsidies at the cluster-level, but this was not possible with our budget.

rented for multiple seasons typically paid the entire rent at the beginning of the first season, we then also paid the rental subsidy for multiple seasons at the beginning of the first season.

Unconditional cash transfer take up. The take up of the unconditional transfer was nearly universal (99%). To determine the number of seasons for which the household received the transfer, we matched the distribution of the number of seasons for the rental subsidy, randomizing the allocation within each county-cultivation-plan strata. As a result, of the owners who took up the unconditional transfer, 82% received it for three seasons, 12.8% for two seasons, and 5.2% for one season.[19] Since we needed to perform this matching after observing the realization of rentals in the rental subsidy group, we typically made payments in the unconditional cash transfer group a few days after the disbursement of rental subsidy payments.

5.2 Treatment effects on Target Plot rentals

Target Plot rentals in the intervention seasons. The rental subsidy treatment led to a large increase in the likelihood that the Target Plot was rented out. Figure 2 demonstrates that in the three seasons in which treatment households where eligible for the rental subsidy, the likelihood of rentals increased by 45-47 percentage points, from a control mean of 0.22-0.24. The unconditional cash transfer also had a positive effect on rentals, but this is much smaller (5-8 p.p.) and non-significant. Appendix Table C.1 presents regression results and also shows that the impact of rentals was similar in strata C and NC.

While we conducted our sampling to identify potential compliers (see Section 3.1), our intervention still exhibits imperfect compliance. This arises for two reasons. First, some treatment owners did not take up the rental subsidy (see Section 5.1), either because they turned out not to be interested or because they could not find a renter. Second, some control owners ended up renting out the Target Plot, even if in the listing they had mentioned they were not going to rent it out [20]. While not perfect, it is nevertheless crucial for the rest of our analysis that we induced a sizable difference across treatment groups in the likelihood of renting out the Target Plot.

We cannot identify pass-through of the subsidy to the renter, as we do not have a counterfactual rental price for a given plot, absent the subsidy. For compliers this is clear - the rental does not happen absent the subsidy, and hence the price cannot be observed in the control group. For owners who end up renting out regardless of the subsidy (always takers), in principle we could identify pass through if we could reliably predict such owners in the control group, and hence

[19] We also match the timing of payment (upfront or by season) for those eligible for multiple seasons with the analog distribution in the rental subsidy. The small discrepancy from the rental subsidy distribution arises because some rental subsidy owners found a renter and took up the subsidy after we had performed the matching.

[20] During the listing, some of these owners had not yet decided how to use the Target Plot for the upcoming season

identify them in the rental subsidy group, but we are not able to do so. Alternatively, we could make non-experimental estimates of pass through, for example by making strong assumptions about the similarity of rentals in treatment and control groups, but we are reluctant to do so, especially given substantial variation in rental prices across plots overall.

Increased rentals of Target Plots did not crowd out renting out of other plots owned by the treatment households. Table 4 shows that the rental treatment did not affect the likelihood of renting out non-Target Plots. We provide further discussion in Section 8.

Target Plot rentals after the rental subsidies end. The treatment effect of rental subsidies on Target Plot rentals persisted after the intervention ended. From our last follow-up survey, which we conducted at the end of season 4 (2021 Long Rains), we collected information on rentals in season 4 and in the upcoming season 5. The treatment effect is still very large, 34-38 p.p., though slightly smaller than in the intervention seasons. Almost all of these rentals were with the same renters who managed the plot in seasons 1 to 3.

This persistence suggests that the subsidy may have helped foster long-term relationships between owners and renters. This effect could operate through multiple channels. First, the subsidies may have helped cover fixed search, transaction, or land preparation costs, consistent with the barriers to renting reported during the listing exercise, reported in Section 2. Second, if the gains from renting are unknown and subject to learning, the subsidy may have induced experimentation, and hence affected renting in subsequent seasons, too. On the owner's side, there could be uncertainty about what rent they can charge, the effect of renting out on their soil quality, or risks of expropriation. On the renter's side, if passed through to the renter, the subsidy may have encouraged learning about the quality of the plot and how to best farm it. As we discussed in the Introduction, we do not aim to identify the exact sources of frictions in the rental markets. Nevertheless, we observe that the persistence of treatment effects after the subsidies ended is inconsistent with frictions that only feature per-period costs. The majority of owners who rented out the Target Plot reported being willing to do so again and having not had problems with the renters, ruling out the alternative hypothesis that the persistence in rentals reflects difficulties in evicting tenants. In the fourth endline, we asked owners who were currently renting out "Would you rent out the plot again to this renter?". 96% responded yes, and most no's were because the owner wanted to cultivate the plot themselves. Moreover, all but one owners reported having had no security issues with the Target Plot, and all owners reported that renters had stuck to the payment terms originally agreed to for the rental contract.

Characteristics of rentals in treatment vs. control group. Table C.2 compares the characteristics of the rentals observed in the rental subsidy group against those that occurred in the unconditional cash transfer and in the control group. The table focuses on the set of Target Plots which were rented out in season 1 (2019 Short Rains) and compares baseline characteristics of these plots, as well as characteristics of the renters and of the rental contracts. 212 Target Plots were rented out, 57% of which in the rental subsidy group. Overall, the Target Plots rented out were similar across the two groups. However, Target Plots that were rented out by owners in the unconditional cash transfer and control group were significantly more likely to have been previously rented out, consistent with rental subsidies inducing new rentals. The rental contracts induced by the subsidy were similar to those that occurred in the unconditional cash transfer and control group: they were characterized by a similar duration and by a similar rental price. However, renters in the rental subsidy group were significantly less likely to have rented in the Target Plot before (difference significant at 5%). Overall, these results suggest that the rental subsidies successfully induced new rentals and that the rental contracts were comparable to those naturally occurring in this context, both in terms of characteristics of the plots rented out and of features of the contracts.

6 The distributional effects of land rentals

In this section, we study the distributional effects of the land rentals induced by our rental subsidy. We compare the characteristics of households who rent in the Target Plots to those of households who rent out the Target Plots. Our contribution, relative to existing descriptive studies, is that our results give the distributional effects of a *marginal* change in land rental market frictions. Do those renting in own less land? Are they younger and more entrepreneurial? Are they richer or poorer than the original owners?

To answer these questions, we compare the baseline characteristics of the manager of the Target Plot in the first season across treatment groups (the Intent To Treat), and also use the rental subsidy treatment to instrument for the plot being rented out (the Local Average Treatment Effect), as described above in equations and respectively. We consider effects on three sets of outcomes: (i) demographics and education, (ii) agricultural land and practices, and (iii) food security, wealth and finance. Results are reported in Table 1.

6.1 Demographics and education

Households renting in are the same size as households renting out, on average, but the heads of their households are younger, much more likely to be male, and more educated. Column 1 of

Panel A, Table 1 shows no meaningful effect of renting out on household size: there is a local average treatment effect of renting out of 0.21, indicating that on average households induced by the subsidy to rent out (compliers) had 0.21 fewer members that those who they rented out to. Column 2 shows that, among complier households, heads of households renting in were much younger than those renting out – 7.9 years younger, on average. Column 3 shows, interestingly, that the vast majority of household heads renting in under the subsidy were male – the local average treatment effect is 25 p.p., on a control mean of 69% of households. Thus rental markets in this setting appear to redistribute agricultural land from women to men; however, we cannot say whether this increases or decreases gender equality, in terms of wellbeing – for example, if female headed households are labor constrained, renting out the Target Plot may benefit them. Lastly, consistent with their being younger, among complier households, those renting in are substantially more likely to have finished high school, with a 14 p.p. effect on a control mean of 0.24.[21]

6.2 Agricultural land and practices

Those renting in own substantially less land than those renting out and are more likely to already be renting in other plots. Column 1 of Panel B, Table 1, shows that among the rentals induced by the rental subsidy, those renting in own 1.9 fewer plots on average than those renting out, compared with a control group mean of 3.2 plots owned on average. In Table D.2 we show that this corresponds to 1.5 fewer acres, from a control mean of 2.1. This is a large effect, and together with the null effect on household size, shows that households renting in have a substantially higher labor-to-land ratio than those renting out. Consistent with this, Column 2 shows that those renting in during our experiment are 30 p.p. more likely to already be renting in a plot, compared to a control mean of 7% of owners, although more than half of the renters are new renters, in that that they did not rent in a plot the previous year.

In terms of what they do with their land, Column 3 shows a higher, but insignificant, share of plots cultivated with cash crops among renters. Overall there is relatively little cash crop cultivation, with control group managers planting cash crops on only 11% of their cultivated plots on average. The local average treatment effect on the share of cultivated plots having cash crops is 5 p.p., an almost 50 percent increase, suggesting that those renting in have higher prevalence of cash crop cultivation, but this result is noisy and should be interpreted with caution.

Households renting in are more likely than owner households to live in a different village than the Target Plot. Column 4 shows that, in the control group, the Target Plot is outside the

[21] These findings, on the gender and education of renters vs. owners, are qualitatively similar if we focus on the person reported to "in charge of taking agricultural decisions of the target plot" (which coincides with the HH head in 84% of cases for the manager survey), rather than the household head.

owner household's village in just 5% of cases. The local average treatment effect shows that, among induced rentals, the Target Plot is 19 p.p. more likely to be outside of the village of the household renting in the Target Plot than the village of the household renting it out. One argument for efficiency gains from land markets is that they may reduce plot fractionalization, reducing commuting times and allowing economies of scale through combining contiguous plots. While our data does not fully allow us to speak to impacts on fractionalization, our results suggest that our intervention did not reduce it, consistent with our intervention inducing marginal rentals on a small proportion of local plots.[22]

6.3 Food security, wealth, and finance

One hypothesis for why people may rent in agricultural land is that they are food insecure and wish to cultivate more land for personal consumption. Column 1 of Panel C, Table 1, does not support this hypothesis in our setting – if anything, those renting in were *less* likely to have experienced a hunger period in the last 12 months than those renting out, with a local average treatment effect of -13 p.p. on a control mean of 33%.

We also do not see large differences in wealth between owners and renters. Column 2 reports treatment effects on a wealth index, reflecting (non-land) assets and household amenities. The index is the principal component of a vector of 16 common assets and 6 common household amenities, standardized in the control group. The point estimate is -.24 standard deviations of the control group mean, showing that those renting in are somewhat poorer on average, but the result in not significant.

Another hypothesis for why farmers may rent out is that they face a relatively high interest rate between planting time, when they receive rent if they rent out, and harvest time, when they receive their yield if they farm the plot themselves. For example, they may have short-run, pressing consumption or investment needs and may not be able to borrow from other sources to finance them. Column 3 shows that those induced by the rental subsidy to rent in are 24 p.p. more likely to have had borrowed or in the last 12 months than those they rent from, compared to a control mean of 62%. Column 4 shows there is no significant difference between those renting in and renting out, in whether they would be able to finance a 5k Ksh ($50) emergency expenditure from their own savings. The estimate however is relatively imprecise, such that we can only reject a difference of more than 23 p.p., compared to a point estimate of 9 p.p.. These results cannot be leveraged to reject or accept the hypothesis that renters face a lower interest rate from planting

[22]Bryan et al., 2019 considers the question of de-fractionalization of agricultural plots among agricultural farmers, arguing that it is best thought of as a mechanism design problem, since the market is thin and preferences of a farmer to sell or rent out a particular plot may well depend on their ability to buy or rent in another plot.

to harvest time, but they do suggest that farmers induced to rent out may indeed be marginally more cash constrained.

The results on manager characteristics are mostly robust to Lee Bounds, (Appendix Table D.1). Appendix Table then D.2 presents additional results: we highlight that renters were less likely to have completed agricultural training, but reported marginally significant higher output per acre than owners on the plots they cultivated at baseline.

6.4 Distributional effects of rentals: discussion

The marginal transactions induced by the experiment led to a reallocation of land away from those who own lots of land, towards those who own little. Thus, the reduced land rental market frictions increased equity in land use, consistent with one strand of the observational literature on land markets (see, e.g., Jin and Jayne, 2013; Chamberlin and Ricker-Gilbert, 2016; Deininger et al., 2017). Since there was no difference in average household sizes between renters and owners, the rentals also reduced dispersion in labor-land ratios.

The analysis of other characteristics reveals a more nuanced picture of the distributional effects of the marginal rentals induced by the experiment. Renter households were substantially younger, almost exclusively male headed, and more educated than owner households (these findings are in line with some other studies, e.g., Ali et al., 2015). They do not appear to have chosen to rent in due to relatively higher food insecurity – if anything they were less likely to have experienced hunger than owner households. Renters were potentially more entrepreneurial, however, devoting a greater fraction of their plots to cash crops, and being more likely to have borrowed.

From a simple comparison of their baseline characteristics, it is unclear whether renters would be more productive cultivating the Target Plot than owners. On the one hand, renters have a higher labor-land ratio and are younger and more educated. On the other hand, they are more likely to live in a different village than the Target Plot, and they may have less experience, both in farming in general (being younger) and especially in cultivating the Target Plot. In the next section we harness the experimental design to answer this question.

7 Treatment effects on the Target Plot

In this section, we study the treatment effects of the interventions on Target Plot outcomes. We present results on four groups of outcomes: *i)* the plot manager's decision to cultivate the plot (vs leaving it idle); *ii)* crop choice; *iii)* value of inputs, harvest, and value added; *iv)* soil quality. The first three utilize data from the manager follow-up surveys, while the last utilizes laboratory analysis of soil samples.

7.1 Cultivation of the Target Plot

As we discussed in Section 2, a sizable share of plots are left uncultivated. Over the four experimental seasons, 18% of the Target Plots are idle on average. Short Rains crop seasons have a higher rate of fallowing than Long Rains (24% vs 12%). Column 1 in Table 2 shows that both the rental subsidy and the unconditional cash transfer increase the likelihood of cultivation, by 8 p.p. and 6 p.p. respectively (from a control mean of 82%). The two treatment effects are statistically indistinguishable both in the ITT (Panel A) and in TOT (Panel B). Appendix Table E.12 shows that the treatment effect on cultivation rates is nil in the stratum where owners reported they were planning to cultivate the Target Plot in the first experimental season (Stratum C), while it is very large in the stratum where owners reported they were not planning to cultivate it (Stratum NC).

These two facts – that a sizable share of Target Plots is uncultivated and that the interventions affect cultivation rates – matter for the interpretation of the treatment effects on other Target Plot outcomes, like crop choice, inputs, and output. To avoid selection concerns, we present treatment effects on *unconditional* outcomes, i.e., taking a value of zero, as opposed to missing, if the Target Plot was not cultivated in that season. However, we will also discuss several additional results which strongly suggest that changes in Target Plot outcomes are driven in part by intensive-margin adjustments, not just by the extensive margin of cultivation.

7.2 Crop choice

Columns 2 and 3 in Table 2 show that the treatments alter the Target Plot's crop portfolio. We focus on two dummies capturing cultivation of maize, the most important consumption crop in the study areas, and cultivation of any of the most important commercial crops (groundnuts, sugarcane, tobacco). Across the four follow-up surveys, the control mean is 0.69 for maize and 0.09 for commercial crops. The rental subsidy increases commercial crop cultivation significantly by 0.07 in the ITT and 0.1 in the TOT, while it has no effect on maize cultivation. The cash drop, in contrary, increases the likelihood of maize cultivation (0.05), but not of commercial crops. T-tests suggest that the difference in the treatment effects between the two groups is significant.[23] Appendix Table E.1 shows that these results are robust to alternative specifications where we vary the list of baseline controls, including specifications without any baseline control or with controls selected from all Target Plot variables via post-double-selection (Belloni et al., 2014).

[23] We also find small and insignificant treatment effects on beans, the second most common consumption crop in the study area (grown by 17% of households in the control group).

The patterns of substitution from maize to commercial crops are particularly transparent in Stratum C, where, as we discussed above, there is no treatment effect on cultivation rates relative to control. Appendix Table E.12 shows that the rental subsidy reduces cultivation of maize and increases cultivation of commercial crops, while the unconditional cash transfer has no impact. In the NC stratum, both treatments increase the unconditional likelihoods of both maize and commercial crop cultivation, reflecting the increase in cultivation rates of the Target Plot. These patterns appear to be quite similar in the four follow-up seasons, except for the fact that in the first season the TOT of the rental subsidy has a larger treatment effect on cultivation rates (Appendix Figure E.2, panels (a)-(c)).

7.3 Inputs, output, and value added

We examine treatment effects on the total value of inputs (seeds, fertilizer and chemicals), household and hired labor, harvest, and value added (i.e., harvest value minus all the previously mentioned production costs) on the Target Plot.

Since large shares of output are not sold, and sizable shares of inputs are not purchased, we compute average prices of each crop and input by round-county and compute the values by multiplying the price by the relevant quantity. Following Agness et al. (2022), in our preferred specification we price household labor at 60% of the wage of hired labor, but we also present robustness to alternative valuations (see Figure E.1). Table 3 presents the main results, first with pooled season-level observations (odd columns) and then with the IHS of the total value of the variable across seasons (even columns, 2-8).

Inputs and Labor. The rental subsidy significantly increases the value of agricultural inputs on the Target Plot, while the cash drop has a smaller and noisy positive effect (Table 3, cols 1-2). The TOT effect of the rental subsidy is \$13.9 (s.e.=4.5), from a control mean of \$33, in the level specification and 0.34 (s.e.=0.13) in the IHS specification. The TOT coefficients are significantly different between the two treatments (p=0.01-0.08 in the TOT). Treatment effects on the value of hired and household labor are small and insignificant for both interventions (cols 3-6).

In Appendix Table E.11, we also include results on the value and use of individual non-labor inputs used on the Target Plot. While both rental subsidy and cash drop increase the use of seeds, the TOT effect of rental subsidy is significantly higher than that of cash drop (\$10.5 vs \$3.6, p-value=0.01). Rental subsidy participants also increase their use of inorganic fertilizers and pesticides, while decreasing their use of compost (on net, the combined value of fertilizer increases in the rental subsidy group). Finally, in the rental subsidy group there is also a small increase in the likelihood of using pesticides. [24]

Harvest value and value added. Treatment effects for harvest value on the Target Plot follow the same patterns as agricultural inputs. The rental subsidy significantly increases harvest value, while the cash drop has a smaller and noisy positive effect (cols 7-8). The TOT of the rental subsidy is \$44.3 (s.e.=13.7) in the level specification, from a control mean of \$96.3, and 0.39 (s.e.=0.15) in the IHS specification. The TOT coefficients are significantly different between the two treatments (p=0.01-0.04 in the TOT).

In turn, there is a significant treatment effect of the rental subsidy on value added (col. 9). The TOT is \$21.4 (s.e.=10.7), from a control mean of -\$6.4.[25] The treatment effect of unconditional cash transfer is small (TOT -\$0.9), insignificant, and differs significantly from the rental subsidy effect (p=0.03). The results are robust to using alternative valuations of the household labor (Appendix Figure E.1). [26]

We also examine treatment effects on total factor productivity (TFP) on the Target Plot. Before presenting the results, we highlight several important caveats: i) consistent with Gollin and Udry (2021), we assume that Target Plot net revenues (harvest value minus the value of non-labor inputs) follow a Cobb-Douglas production function in land and labor. However, the assumption of a common production function is particularly problematic in our setting, given that treatment changed crop portfolios; ii) the TFP is defined only when the plot is cultivated, which is potentially problematic, given that treatments affect selection into cultivation; iii) since our data does not include credible instruments for input use, we cannot estimate the production function and we instead calibrate it using factor shares that Gollin and Udry (2021) estimate in Uganda. With these caveats in mind, we present treatment effects on TFP in Appendix Table E.14. In the TOT, the rental subsidy increases TFP by 36% of the mean (+6.1 from a control mean of 16.9). The results are robust when restricting the sample to Stratum C (where there was no treatment effect on the likelihood of cultivation) and when using alternative calibrations from Tanzania (Gollin and Udry, 2021), Malawi (Restuccia and Santaeulalia-Llopis, 2017) and the U.S. (Valentinyi and Herrendorf, 2008).

Appendix Tables E.2-E.6 show that the results on inputs, harvest, and value added are robust to alternative specifications where we vary the list of baseline controls: TOT coefficients of the rental

[24] Appendix Table E.11 also includes results on use of farm equipment. There is a small increase in ox-plough usage for both rental subsidy and cash drop, however, both estimates are noisy and not significantly different from each other. There is no effect on tractor use.

[25] Since value added takes negative values, we do not report the IHS specification for this outcome.

[26] The control mean of value added depends heavily on how we value household labor: -\$36 when valuing household labor at the same wage than hired labor, \$1 at 60% (our baseline specification), and \$41 when valuing it at zero. The result is consistent with recent papers, e.g., Anagol et al. (2017); Bold et al. (2021).

subsidies remain large and significant across specifications, and consistently higher than cash drop TOT coefficients. Additionally, results for harvest value and value added are robust to controlling for a dummy capturing non-verified planned harvests (see discussion in Section 3.4). The results are also mostly robust to Lee Bounds (Appendix Tables E.9 and E.10). Finally, Appendix Figure E.2 suggest that the rental subsidy TOT coefficients on non-labor inputs decrease over the four follow-up seasons (panel (d)), while the effects on labor inputs, harvest value and value added appear to increase (panels (e)-(h)), though the coefficients for individual seasons are somewhat noisy. We speculate this may be due to renters learning how to better cultivate the Target Plot over time, although other factors, like crop choices, could also be responsible for these trends.

Extensive and intensive margin responses. Our analysis has focused on treatment effects on unconditional outcomes, as opposed to restricting analysis to cultivated plots, because conditioning on cultivation would have introduced selection concerns. However, two observations suggest that changes in Target Plot outcomes are driven in part by intensive-margin adjustments, not just by the extensive margin of cultivation. First, the rental subsidy and unconditional cash drop treatments have similar effects on cultivation rates, but different effects on agricultural inputs, harvest, and value added. Second, we find similar treatment effects on these outcomes, though noisier, in the C stratum, even if there is no treatment effect on cultivation rates in this stratum (see Appendix Table E.13 for details).

Quantile regressions. The consistency between the specifications in levels and with IHS suggests that the previous results are not driven by outliers. The quantile regressions in Appendix E.3.6 shed further light on the distributional impact of the treatments. For input value, harvest value, and value added, the rental subsidy TOT coefficients become positive and significant around the median and they are mostly increasing in percentiles. The rental subsidy appears to have a negative effect in the lowest percentiles (5-10). Finally, the difference between rental subsidy and cash drop is large and sizable above the median, though we are somewhat underpowered to detect it. The value of hired labor exhibits a similar pattern to the above outcomes, though less pronounced. The treatment effect on the value of household labor is instead quite flat and noisy throughout the distribution.

Measurement. Before concluding this section, we discuss several points related to outcome measurement. In a recent paper, Aragón et al. (2022) suggests that using the plot as a unit of analysis, as opposed to the farm, may lead to excess measurement error. This affects the extent of measured dispersion and measured misallocation. However, our analysis does not rely on measures of dispersion. For our purpose, the presence of excess measurement error at the plot-level relative to the farm-level may increase standard errors, thus reducing the precision of our estimates, but it would not affect estimation of the treatment effect coefficients.

However, concerns related to measurement may arise if renters were more likely than owners to over-report input use and harvest on the Target Plot. Several considerations mitigate this concern. First, renters did not have a financial incentive to misreport outcomes at the end of the season, since the rental subsidy did not depend on plot use.[27] Second, treatment effects on cultivation and crop choice (e.g., the treatment effect on commercial crop cultivation) are unlikely to suffer from this problem. Third, among owners in our sample, we examine the relationship between the size of owners' farms and the reported input use and output on the Target Plot at baseline. Owners with more plots, for whom the Target Plot thus covers a more marginal portion of the overall agricultural production, report *higher* values of inputs and output on the Target Plot.[28] This runs against the idea that owners with a lot of land may underreport quantities on their marginal plots. Since, in our sample, renters own less land than owners, this measurement error in reporting would thus lead to a downward bias in the treatment effects of rental subsidies on inputs and harvest in the Target Plot.

7.4 Soil quality

As discussed in Section 3.4, we collected soil results for each Target Plot. Following Burchardi et al. (2019), we constructed a soil quality index based on the results of the soil tests. This index combines measurements of nitrogen, phosphorous, potassium, organic matter, and the pH level of the soil by first standardizing each measurement into a z-score, taking the mean of the plot's z-scores and then standardizing again against the control group.

The results in Column 10 of Table 3, indicate there are no significant soil quality differences across the treatments and the control group when pooling together the two seasons. While there is a small insignificant deterioration in measured soil quality under the rental subsidy, TOT coefficient of -0.02, this is not significant. Table E.7 shows robustness to alternative specifications and Table E.15 presents results for each nutrient of the index. In Appendix Figure E.2 panel (i), TOT results are shown separately for each season in which we conducted soil testing (i.e., season 1 and 4) and suggests that the rental subsidy treatment may decrease soil quality after four seasons.

[27] This is different from Burchardi et al. (2019), where the incentive to misreport output varied with the tenant's output share treatment.

[28] The average value of agricultural inputs per acre is 54.3 USD and the coefficient on the number of cultivated plots is 12.8, significant at the 1% level, which suggests that an extra plot cultivated, on average, increases the value of agricultural inputs per acre by 24%. The average value of harvest per acre is 57.7 USD and the coefficient on the number of cultivated plots is 19.1, significant at the 5% level, which corresponds to an average increase by 33% for an extra plot cultivated.

7.5 Treatment effects on the Target Plot: discussion

The rental subsidy and the unconditional cash transfers have similar treatment effects on the likelihood that the Target Plot is cultivated. However, only the rental subsidy induces a shift toward commercial crops and a significant increase in inputs and output. The differences in the effects of the two treatments are significant and more precisely estimated in the TOT, which accounts for the lower compliance rate in the rental subsidy than in the unconditional cash drop.

The shift toward commercial crops is consistent with the analysis of manager characteristics presented in Section 5: plot rentals bring in managers who are younger and more educated, grow commercial crops on a larger share of their plots and, at least suggestively, are more entrepreneurial. These managers may be more willing to try commercial crops on the plots they rent in.

Rental subsidies have larger treatment effects than unconditional cash transfers on crop choice (commercial crops' cultivation), inputs, and output in the Target Plot. This suggests that, for owners on the margin, inducing plot rentals may have stronger push towards market participation than supporting plot owners, in line with some of the reallocation arguments highlighted by recent literature. The statistically significant differences between the effects of rental subsidies and unconditional cash drops also assuage concerns from the baseline imbalances in the control group (see Section 3.5.2). These treatment effects differ from the results of longitudinal studies in Kenya by Yamano et al. (2010) and Muraoka et al. (2018), which find that land productivity and input use are lower in rented parcels, possibly due to worse unobservable land quality in rented plots.[29] Our results are in line with recent papers showing that property right reforms improved agricultural efficiency in China (Chari et al., 2021) and in Ethiopia (Chen et al., 2021), arguably because they increased the volume of rentals.

Treatment effects on inputs and output arose even if the amount of labor employed on the Target Plot was similar across treatment groups. If anything, renters reduced the amount of household labor (in stratum NC, see Appendix Table E.13). This is suggestive of surplus labor among marginal owners (Lewis et al., 1954; Breza et al., 2021). The increase in non-labor inputs and in value added are also consistent with owners having better access to capital and, possibly, higher management skills. Finally, the rental subsidy treatment improved outcomes even if it did not induce land consolidation (Foster and Rosenzweig, 2022; Bryan et al., 2019). If anything, renters were more likely reside in different villages and less likely to manage other plots nearby.

To layout the implications of the treatment effects on value added, it is useful to introduce a

[29] Other studies suggest that renters are more likely to be high-ability farmers (see, e.g., Deininger and Mpuga, 2003; Jin and Jayne, 2013; Chamberlin and Ricker-Gilbert, 2016), but do not attempt to measure the effects of the change from owner- to renter- management on parcel outcomes.

very simple framework and corresponding notation. Denote by Δ the gains from a rental absent any costly frictions, and by τ the value of frictions. Without the subsidy, rentals occur if $\Delta > \tau$. With the rental subsidy s, rentals occur if $\Delta + s > \tau$. Hence, for marginal trades, those induced by the subsidy, $\Delta \in (\tau - s, \tau]$. This framework, and the related calculations below, are extremely simplified, ignoring uncertainty and dynamics (fixed cost vs per period costs for frictions, learning), among other complexities. Drawing firmer conclusions would require measuring data in subsequent seasons, given that the relationships from the rental agreements persist beyond the two years (four seasons) in which we collected data. The positive effects on value added may continue, or alternatively the additional activity on Target Plots may begin to impair soil quality and reduce productivity.

With this notation in hand, we benchmark the treatment effects of the rental subsidy on value added in three different ways, under increasingly strong assumptions. First, we note that the treatment effect of renting out on value added is positive on average ($\Delta > 0$), so that the subsidy induces trades which increase productive efficiency, rather than reduce it, as might be the case if the subsidy s was very large.[30] Second, we compare value added among renters to the average rent they pay. The average per-season rental cost on the plots in our sample is \$25, and this roughly matches the level of value added among renters, when we value household labor at 60% of hired labor (Agness et al., 2022).[31] The similarity of these two amounts suggests that renters bare relatively little of any trade costs (τ), and that owners capture the majority of any surplus generated ($\Delta - \tau$), although we stress that we are ignoring dynamics and uncertainty here, which are likely to be important. Third, we can invert our condition for marginal trades to bound unobserved trade costs among marginal rentals, namely $\tau \in (\Delta, \Delta + s]$, although this exercise is speculative at best given the simplicity of the framework.

8 Treatment effects on Target Plot owners

In this section, we study treatment effects on Target Plot owners, paying particular attention to spillovers on agricultural production on their other plots, their non-agricultural labor supply, and measures of their wellbeing. In our follow-up surveys, we collect data on owners regardless of whether they are managing the Target Plot or renting it out. The surveys cover four agricultural seasons over two years, and the Target Plot accounted for one third of the owned plots for the

[30] Δ corresponds to the LATE of the rental subsidy on renting out. As discussed in Section 4.3, $\gamma_1 - \gamma_2$ —the (positive) difference between the TOT effects of the rental subsidy and of the cash drop —is a lower bound for this LATE under relatively weak assumptions.

[31] Alternative valuations of household labor result in different value added, both for renters and owners. As shown in Appendix Figure E.1, mean value added is -\$36 when valuing household labor at the same wage as hired labor, \$1 at 60% (our baseline specification), and \$41 when valuing it at zero.

average owner, so it is conceivable that we would pick up effects across a range of outcomes. We focus on two sets of outcomes: *i)* agricultural outcomes on non-Target Plots, reported in Table 4; and *ii)* owner-level outcomes, including food security, non-agricultural activities, livestock, and borrowing, reported in Table 5.

8.1 Non-Target Plots outcomes

Our data collection strategy enables us to study outcomes on most, but not all, of the owners' non-Target Plots: we only measure agricultural outcomes of non-Target Plots if the owner manages them, not if she rents them out (because we do not interview the renters of non-Target Plots). Therefore, we first report treatment effects on the likelihood that the non-Target Plot is rented out and then we report treatment effects on other plot outcomes, conditional on the plot not being rented out in that season.

Rentals of non-Target Plots. Column 1 of Table 4 shows that neither of the treatments affect the likelihood that the owner rents out a Non-Target Plot: the treatment coefficients are 0.01 (s.e.=0.01) from a control mean of 0.05.

This result has two implications. First, as we discussed in Section 5.2, the increased rentals of Target Plots in the rental subsidy treatment does not displace rentals of other plots. Second, the fact that rental rates of non-Target Plots are similar across treatment groups mitigates selection concerns in the analysis of other non-Target Plot outcomes, which we observe only when the plot is not rented out.

Cultivation, crop, inputs, and output on non-Target Plots. Columns 2-9 of Table 4 show treatment effects on other non-Target Plot outcomes, conditional on the owner managing the plot (i.e., not renting it out). There is some suggestive evidence that households may use some of the unconditional cash transfer to increase inputs in non-Target Plots and that owners in the rental subsidy group may reallocate labor from the Target Plot to their non-Target Plots. However, these effects are only marginally significant and, overall, the treatments do not have sizable effects on cultivation, crop choices, investments, and output in non-Target Plots. If owners were induced to rent out the Target Plot because of a lack of inputs, this suggests that they typically addressed the lack of inputs by mainly reducing inputs on the Target Plot, rather than across all plots. It also suggests that input constraints were perhaps not especially important - if owners had been seriously labor constrained, for example, we might have expected labor to increase on other plots. It is consistent with the constraint to owners increasing value added being managerial, rather than being on labor or monetary inputs.

8.2 Owner outcomes

We consider impacts of the experimental treatment on four sets of owner outcomes: *i)* labor supply outside off the farm, *ii)* household assets, *iii)* food security, and *iv)* household finance.

Labor supply. When households rent out the Target Plot, there are two main mechanisms which could affect their labor supply outside the household farm. First, they may have lower labor demand on their farm, freeing up labor which could then be used elsewhere, potentially acting as a push factor towards the household moving out of agriculture, and hence structural transformation. Second, there is an income effect, since the household receives more income early in the season, from rent, and then less income at harvest time, from a lower agricultural yield. The combined effect of these two mechanisms, both on agricultural labor on other farms and on non-agricultural labor, is thus ambiguous.

Column (1) of Table 5 shows little effect of the rental subsidy and the unconditional cash drop treatment on agricultural labor supply on non-household farms. Point estimates are less than one person-day over the agricultural season, and standard errors are small, ruling out an economically meaningful effect. Column (2), however, does show a meaningful effect of the rental subsidy on non-agricultural labor supply, with the TOT point estimate of 9.5 fewer person-days, on a control mean of 38.7 person-days. The TOT point estimate of the cash drop is also negative but smaller and insignificant, at 4.7 fewer person days. [32] These results suggest that the income effect dominates any labor supply effect, such that overall labor supply falls, and there is no evidence of any effect on structural transformation out of agriculture – if anything, the opposite. Consistent with this, Column (3) shows that there was no meaningful effect on anyone in the household working outside of the village, with a similar null result reported in the appendix for migration.

Household assets. Columns (4) and (5) of Table 5 report treatment effects on two sets of assets. First, on whether the household owns any livestock (oxen, cow, or bull), which is both an important form of savings in the area and also a productive investment, generating either dairy or inputs for agricultural production. Second, on the principal component of a standard list of household assets (excluding animals) and amenities, such as radios, televisions, motorbikes, metal roofs, and improved walls. We see a small negative effect of the TOT rental subsidy treatment on livestock, but no other effects on assets, suggesting that renting out did not have a transformative effect on households. We did not collect consumption data, in part because of the change in the seasonality of income induced by renting out would have made interpreting consumption results from any one point in time difficult, and it was infeasible to collect consumption data at high

[32] Splitting these results by different parts of the season, into harvest time, slack season, and planting time (not reported), shows no obvious pattern on the seasonality of labor supply outside of the household farm.

frequency.

Food security. The rental subsidy induced farmers to rent out one of their plots, and in turn reduce both the total land which they were cultivating and the land on which they were cultivating staple crops. Did this affect their household's food security? We report treatment effects on two related outcomes: stocks of maize from own production and experiencing periods of hunger.

Columns (6) and (7) report effects on whether the household had stocks of maize from their own production in the last 6 months, in Season 1 and Seasons 2-4 respectively. We aggregate Seasons 2-4 as their results are similar, and substantially different from Season 1. In Season 1, the subsidy led to an increase in the proportion of households who held a stock of maize from their own production. Two possible explanations are that the income effect of receiving income early in the season reduced the need to sell maize straight away, potentially enabling households to benefit from seasonal price fluctuations (Burke et al., 2018); or that households realized that upon renting out they would have less maize from the subsequent harvests, and they thus stored more. In contrast, during seasons 2-4 there was a reduction in maize stocks from own production in the last 6 months, consistent with a reduction in their production of maize.

Column (8) reports a dummy variable for whether the household experienced hunger episodes in any of the last six months. The control mean is relatively low, 0.16, and we do not find a significant effect, being able to reject an effect size of 6 p.p., suggesting that the treatments had minimal effect on food security, perhaps unsurprisingly given owners' relatively large landholdings.

Household finance. Both experimental treatments affected the amount and the timing of the household's liquidity. Among the rental subsidy compliers, incomes increased substantially at the start of the season (by the rent plus the subsidy), and yields reduced at harvest time. The cash drop also increased income somewhat at the start of the season. Despite these changes in income, we do not see meaningful effects either on whether the household would have 5k Ksh to cover an emergency expense, Column (9), nor on whether the household has borrowed in the last 6 months, Column (10).

8.3 Treatment effects on owners: discussion

The Target Plot accounted for one-third of the owner's land, on average, and the rental subsidy induced a 46 p.p. increase in the proportion of owners renting it out. Despite this, we see little to no effects on owners' agricultural production on other plots – neither on their decision to rent out or cultivate, nor on their input usage. This absence of spillovers is consistent with the set of treatment effects on agricultural outcomes on the Target Plot, which suggested that management and crop choice may have been the main barrier to achieving higher value added, rather than a lack of variable inputs such as labor.

We also see no substantial effects on measures of owners' well-being, including food security, assets and amenities, and household finances. Regarding labor supply away from the household farm, and the hypothesis that untying people from their land may induce structural transformation (Gottlieb and Grobovšek, 2019; Fernando, 2022), we find no change in working outside of the village or migration, and a *decrease* in non-agricultural labor. This finding contrasts results from papers land markets and structural transformation in China (see, e.g., Jin and Deininger, 2009 for panel data estimation and Adamopoulos et al., 2022 for quantitative evaluation) and suggest that, in our setting, marginal owners who rent out land may have more limited opportunities in the non-agricultural sector.

9 Conclusion

Agriculture is the main source of livelihood for the majority of the world's poor, and reallocation of its key input, land, is often rare. Across much of sub-Saharan Africa, for example, upwards of 90% of agricultural land use is determined by inheritance. These substantial land market frictions are argued to have important implications for the efficiency and equity of agriculture and are also central to many other economic aspects of rural life in developing countries. Understanding their implications is key for anticipating the effects of policies which encourage land market participation, such as land titling and land market registries and platforms.

In one of the first experiments on land markets, we study the effects of these land market frictions by incentivizing land rentals in Western Kenya. Offering incentives to landowners, of around 30% of the average rental rate, led to a large increase in the likelihood of them renting out a plot. Moreover, the increase persisted after the subsidy expired, consistent with fixed costs in the rental market.

Consistent with the argument that land rental markets can equalize access to land, renters owned fewer plots on average than owners while they had similar household sizes. They were also younger but not otherwise poorer or more food insecure. The renters increased commercial crop cultivation and non-labor inputs, achieving higher yields and ultimately higher value added. Despite having higher labor-to-land ratios, however, they did not supply more labor on the rented plot. The change in non-labor inputs and crop choice, rather than labor, suggests that in this setting, land market frictions interact with frictions in management and credit markets, rather than with frictions in labor markets. Finally, participating in land rental markets had no meaningful effect on the food security or other economic activities of landowners, who if anything did less non-agricultural work upon renting out.

Many rural development policies have the implicit or explicit goal of increasing land market participation. Such policies can have far-reaching implications for the lives of the rural poor, affecting things as diverse as agricultural productivity, labor markets, urbanization, and the ability to cope with risk. Many such effects will only be observed when policies are implemented at scale, when they are likely to induce general equilibrium effects. Our experiment is unable to capture such general equilibrium effects, nor spillovers to renters, and so care should be taken in drawing policy conclusions from it. Indeed, we think that identifying effects on renters, and general equilibrium effects, would be natural questions for future work, although ones which would require a substantially different design and larger budget, if addressed experimentally. For example, capturing both owner and renter counterfactuals simultaneously would require a much larger sample, as the seemingly large search costs make it infeasible to assign treatments after potential owner-renter pairs have been identified. With these caveats, we still think that several conclusions of our study are useful for policy in the setting, including the findings that rental markets equalize access to land, that renters achieve higher value added through switching to cash crops and using more inputs, and that labor does not seem to be a big constraint on the margin: renting out land does not unshackle owners from agriculture, and renters do not apply more labor on the plot.

The rental subsidies increase value added, indeed by more than the cost of the monetary subsidies. Since the additional trade costs incurred are unobservable, however, we cannot say whether the benefits of the subsidy outweighs its costs, even if the rentals persist after the subsidies end. There may also be more cost-effective ways to improve the functioning of land markets at scale. Our main goal was to induce marginal rentals. Doing so via a rental subsidy, rather than by targeting a particular friction, provides a monetary bound on the size of the frictions to be overcome, but may also overcome multiple frictions at once (e.g., it may cover search or transaction costs or induce some owners to rent out even if they perceive a risk of land disputes). Further work may aim to study specific frictions, including search costs (as in ongoing work in Rwanda by Karpe et al. (2019)), asymmetric information over land characteristics, renter moral hazard, and the risk of land disputes between owners and renters. This is an exciting direction for future research.

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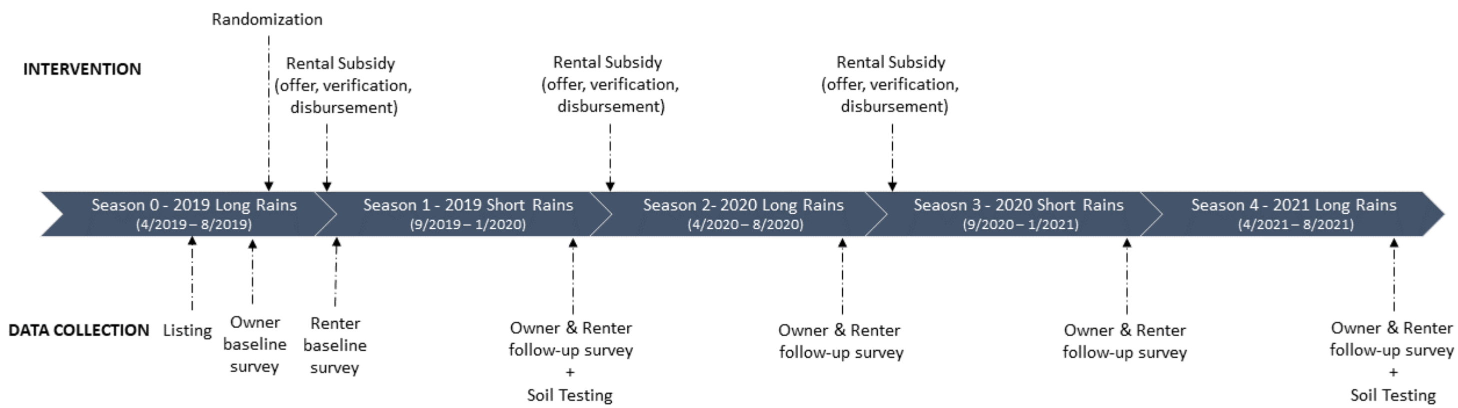
Figures

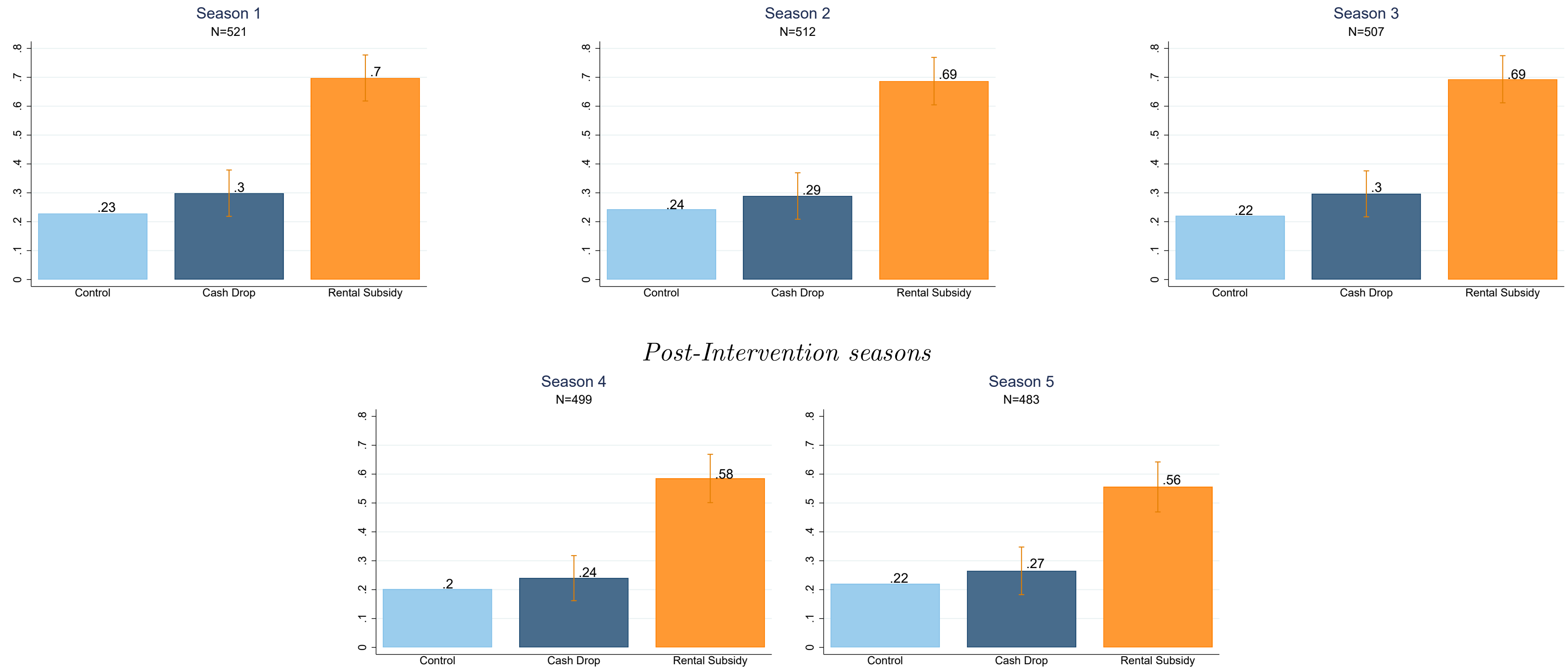
Figure 1: Intervention and data collection timeline



Notes: This figure details the key intervention and data collection activities across the life of the study. Activities are conducted within two annual agricultural seasons: Long Rains and Short Rains. Season 0 refers to the baseline period, while Seasons 1-4 are the seasons in which we collect follow-up data. We offer the treatments in Seasons 1-3. Intervention activities are those concerned with conducting the interventions and Data Collection activities are the main actions to measure their effects. The dotted arrows provide information on the sequence of activities and their approximate timing.

Figure 2: Target Plot Rentals

Intervention seasons



Notes: The figure reports the proportion of Target Plots rented out by treatment group by crop season. The rental subsidy was offered for up to three seasons (season 1 - 3). Data come from the follow-up surveys we run at the end of season 1 to 4 with the manager of the Target Plot. In the last round (season 4), we also ask about rentals for the upcoming season 5. The bars report 95 percent confidence intervals from a regression of renting out indicator on dummies for the treatment groups. The number of observations is equal to the study sample size in season 1 and the decreases due to attrition.

Tables

Table 1: Manager characteristics

	(1)	(2)	(3)	(4)
Panel A: Demographics and Education	Household Size	Age	Gender	High School Educated
ITT				
Rental Subsidy	0.10	-3.86***	0.12***	0.07*
	[0.25]	[1.24]	[0.04]	[0.04]
Cash Drop	-0.27	-1.42	0.09***	0.05
	[0.19]	[1.01]	[0.03]	[0.03]
p-value Rent = Cash	0.11	0.06	0.34	0.61
LATE				
Plot Rented	0.21	-7.85***	0.25***	0.14**
	[0.43]	[2.14]	[0.07]	[0.07]
Mean Y in Control Group	5.75	48.98	0.69	0.24
Observations	508	508	508	508
Panel B: Agricultural Land and Practices	N. Plots Owned	Rent In Plot(s)	S. Plots Cash Crops	Target Plot in Diff. Village
ITT				
Rental Subsidy	-0.92***	0.15***	0.02	0.09***
	[0.15]	[0.04]	[0.03]	[0.03]
Cash Drop	-0.17	0.04	-0.01	0.03
	[0.14]	[0.03]	[0.02]	[0.03]
p-value Rent = Cash	0.00	0.01	0.17	0.04
LATE				
Plot Rented	-1.89***	0.30***	0.05	0.19***
	[0.21]	[0.06]	[0.05]	[0.05]
Mean Y in Control Group	3.21	0.07	0.11	0.05
Observations	508	508	467	506
Panel C: Food Security, Wealth and Finance	Experienced Hunger	Non-Land Wealth	Borrowed	Emergency Savings
ITT				
Rental Subsidy	-0.06*	-0.12	0.12***	0.05
	[0.03]	[0.09]	[0.04]	[0.04]
Cash Drop	-0.03	0.08	0.03	0.06
	[0.03]	[0.09]	[0.04]	[0.04]
p-value Rent = Cash	0.34	0.04	0.03	0.85
LATE				
Plot Rented	-0.13**	-0.24	0.24***	0.09
	[0.06]	[0.17]	[0.07]	[0.07]
Mean Y in Control Group	0.33	-0.01	0.62	0.40
Observations	508	504	508	508

Notes: The table reports treatment effects on the characteristics of the target plot manager. The dependent variables correspond to the *baseline* characteristics of whomever is managing the Target Plot in the first endline season (2019 Short Rains): the owner if the plot is not rented out, in which case the data comes from the owner baseline survey, and the renter if the plot is rented out, in which case the data comes from the renter baseline survey (which was performed approximately a month later than the owner baseline survey). Panel A reports demographic and education characteristics: the number of household members (col. 1), the age of the household head (col. 2), and indicators equal to one if the household head is male (col. 3) and high school educated (col. 4). Panel B reports agricultural characteristics: the number of plots owned (col. 1), an indicator variable equal to one if the manager rents in any plots (col. 2), the share of cultivated plots which are cultivated with cash crops (col. 3, setting to missing if the number of crops cultivated is 0), and an indicator for whether the Target Plot was in a different village to their house (col. 4). Panel C reports food security, wealth, and finance: an indicator variable equal to one if they experienced a hunger period in the last 12 months (col. 1), the standardized principal component of a vector of assets and amenities (excluding land and livestock) (col. 2), and indicator variables equal to one if they have borrowed in the last 12 months (col. 3) and if they had enough savings to cover an emergency expenditure of 5,000 Ksh ($50) (col. 4). In the *ITT* sub-panels, we run an ANCOVA regression of the outcome on treatment dummies, controlling for baseline values of the outcome (noting that these will be equal to the outcome itself when the Target Plot is not rented out) and strata dummies (see Equation (6) in the paper). In the *LATE* sub-panels, we run an ANCOVA regression with the same controls, but we instrument the dummies for whether the Target Plot was rented out with the Rental Subsidy treatment, while controlling for the Cash Drop treatment (see Equation (6) in the paper). *p<0.1, **p<0.05, ***p<0.01.

Table 2: Target plot outcomes: plot use and crop choice

	Cultivated	Maize	Commercial
	(1)	(2)	(3)
ITT			
Rental Subsidy	0.06***	-0.01	0.07***
	[0.02]	[0.03]	[0.02]
Cash Drop	0.06***	0.05	0.02
	[0.02]	[0.03]	[0.02]
p-value Rent = Cash Paid	*0.90*	*0.05*	*0.02*
TOT			
Rental Subsidy Paid	0.08***	-0.01	0.10***
	[0.03]	[0.04]	[0.03]
Cash Drop Paid	0.06***	0.05	0.02
	[0.02]	[0.03]	[0.02]
p-value Rent = Cash Paid	*0.47*	*0.07*	*0.00*
Mean Y in Control Group	0.82	0.69	0.09
Observations	1,957	1,956	1,956

Notes: The table reports treatment effects on indicators equal to one if the Target Plot is cultivated (col. 1), cultivated with maize (col. 2), cultivated with commercial crops, i.e., groundnuts, sugarcane, tobacco (col. 3). Data come from follow-up surveys we run at the end of season 1 to 4 with the manager of the Target Plot. We pool observations from the four rounds of follow-up surveys. In the *ITT* Panel, we run an ANCOVA regression of the outcome on treatment dummies, controlling for baseline values of the outcome, plot size, survey round dummies, and strata dummies (see Equation (4) in the paper). In the *TOT* Panel, we run an ANCOVA regression with the same controls, but we instrument dummies for whether the respondent took up the treatment in any of the four seasons with the treatment assignment (see Equation (5) in the paper). We cluster standard errors by the target plot. *p<0.1, **p<0.05, ***p<0.01.

Table 3: Target plot outcomes: inputs and output

	Value of Inputs		Value of Household Labor		Value of Hired Labor		Harvest Value		Value Added	Soil Index
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ITT										
Rental Subsidy	10.1***	0.24**	-2.1	-0.02	3.0	0.08	32.4***	0.28**	15.6*	-0.02
	[3.4]	[0.11]	[2.5]	[0.11]	[2.1]	[0.16]	[10.4]	[0.12]	[8.1]	[0.06]
Cash Drop	3.5	0.14	3.2	0.07	1.8	0.06	12.7	0.10	-0.9	0.02
	[2.9]	[0.11]	[2.6]	[0.12]	[2.1]	[0.15]	[9.4]	[0.13]	[7.1]	[0.05]
p-value Rent = Cash Paid	*0.05*	*0.34*	*0.05*	*0.45*	*0.60*	*0.89*	*0.06*	*0.17*	*0.05*	*0.46*
TOT										
Rental Subsidy Paid	13.9***	0.34**	-2.9	-0.03	4.1	0.11	44.3***	0.39***	21.4**	-0.02
	[4.5]	[0.13]	[3.3]	[0.14]	[2.7]	[0.19]	[13.7]	[0.15]	[10.7]	[0.07]
Cash Drop Paid	3.6	0.14	3.2	0.07	1.8	0.06	12.7	0.10	-0.9	0.02
	[2.8]	[0.10]	[2.6]	[0.11]	[2.0]	[0.13]	[9.1]	[0.11]	[6.9]	[0.05]
p-value Rent = Cash Paid	*0.01*	*0.08*	*0.05*	*0.43*	*0.38*	*0.77*	*0.01*	*0.04*	*0.03*	*0.46*
Mean Y in Control Group	33.0	IHS	46.07	IHS	22.7	IHS	96.3	IHS	-6.4	-0.02
Observations	1,957	509	1,957	509	1,957	509	1,957	509	1,957	967

Notes: The table reports treatment effects on agricultural outcomes in the Target Plot. The dependent variables in cols. (1)-(9) come from follow-up surveys we run at the end of season 1 to 4 with the manager of the Target Plot and they are measured in USD. Inputs in columns (1-2) include seeds, fertilizer, and chemicals. We obtain the value of inputs (cols. 1-2) by multiplying the quantity of each input used on the Target Plot in that round by county-round average prices for each input and then summing up the values of all the inputs used in the Target Plot. The harvest value (cols. 7-8) is obtained in a similar way, summing across crops. We obtain the value of household labor (cols. 3-4) by multiplying the quantity of household labor used for each agricultural task (from land preparation to harvest disposal) by the county-round average wage for hired labor in that task, then adjusting by a factor of 0.6 (as recommended by Agness et al., 2022) and summing across all the tasks performed in the Target Plot. The soil index in col. (10) comes from two rounds of soil testing that we conducted at the end of season 1 and 4. The index combines 4 nutrients (nitrogen, potassium, phosphorus and organic carbon) as well as the pH value of the soil. The index is standardized against the control group. In the odd columns, we pool observations from the four rounds of follow-up surveys. In columns (1), (3), (5), (7) we winsorize the top 1%. In columns (9) and (10) we winsorize the top and bottom 1%. In columns (2), (4), (6), (8), the dependent variable is the inverse hyperbolic sine transformation (IHS) of the sum of the values for the variable by Target Plot across the four rounds. In the *ITT* Panel, we run an ANCOVA regression of the outcome on treatment dummies, controlling for baseline values of the outcome, plot size, survey round dummies, and strata dummies (see Equation (4) in the paper). In col. (10), we also control for laboratory fixed effect. In the *TOT* Panel, we run an ANCOVA regression with the same controls, but we instrument dummies for whether the respondent took up the treatment in any of the four seasons with the treatment assignment (see Equation (5) in the paper). We cluster standard errors by the target plot. *p<0.1, **p<0.05, ***p<0.01.

Table 4: Owner outcomes: non-Target plots

	Rented out	Cultivated	Maize	Commercial crops	Inputs	HH labor	Hired labor	Harvest	Value added
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ITT									
Rental Subsidy	0.01	0.01	0.02	-0.01	1.02	-0.17	1.69	5.78	1.75
	[0.01]	[0.02]	[0.02]	[0.01]	[1.77]	[1.92]	[1.19]	[8.05]	[7.11]
Cash Drop	0.00	-0.00	-0.00	0.00	3.33*	0.38	1.15	-1.69	-8.05
	[0.01]	[0.02]	[0.02]	[0.01]	[1.93]	[2.00]	[1.10]	[8.21]	[7.28]
p-value Rent = Cash	*0.63*	*0.60*	*0.34*	*0.23*	*0.24*	*0.78*	*0.66*	*0.40*	*0.21*
TOT									
Rental Subsidy Paid	0.01	0.01	0.02	-0.01	1.36	-0.22	2.25	7.72	2.33
	[0.01]	[0.02]	[0.03]	[0.01]	[2.32]	[2.53]	[1.55]	[10.56]	[9.37]
Cash Drop Paid	0.00	-0.00	-0.00	0.00	3.33*	0.38	1.14	-1.72	-8.08
	[0.01]	[0.02]	[0.02]	[0.01]	[1.90]	[1.98]	[1.09]	[8.10]	[7.19]
p-value Rent = Cash	*0.51*	*0.59*	*0.29*	*0.20*	*0.39*	*0.79*	*0.45*	*0.36*	*0.26*
Mean Y in Control Group	0.05	0.75	0.47	0.09	25.06	36.21	12.04	94.36	19.35
Observations	5,229	4,955	4,955	4,955	4,955	4,955	4,955	4,955	4,955

Notes: The table reports treatment effects on agricultural outcomes on the non-Target Plots. As opposed to other results, this table leverages a reshaped plot-level panel to generate results. Observations differ between Column (1) and Columns (2-9) as the rented out results is unconditional, while columns (2-9) only includes plots that were rented out. Details on the data sources and construction of the variables are included in the notes of Table 2 and Table 3. In the *ITT* Panel, we run an ANCOVA regression of the outcome on treatment dummies, controlling for baseline values of the outcome, plot size, survey round dummies, and strata dummies (see Equation (4) in the paper). In the *TOT* Panel, we run an ANCOVA regression with the same controls, but we instrument dummies for whether the respondent took up the treatment in any of the four seasons with the treatment assignment (see Equation (5) in the paper). We cluster standard errors by target plot owner. *p<0.1, **p<0.05, ***p<0.01.

Table 5: Owner outcomes

	Labor Supply			Assets		Food Security			Finance	
	Other Farms	Non - Agricultural	Worked Outside Village	Owns Livestock	Wealth Index	Maize (S1)	Maize (S2 - S4)	Experienced Hunger	Emergency Liquidity	Borrowed
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ITT										
Rental Subsidy	-0.54	-7.00*	-0.02	-0.04	0.15	0.10**	-0.06***	0.02	-0.02	-0.02
	[1.58]	[3.83]	[0.02]	[0.03]	[0.12]	[0.05]	[0.02]	[0.02]	[0.03]	[0.03]
Cash Drop	0.84	-4.66	-0.03	-0.02	0.11	0.05	-0.03*	0.02	-0.01	-0.05*
	[1.44]	[3.73]	[0.02]	[0.03]	[0.13]	[0.05]	[0.02]	[0.02]	[0.03]	[0.03]
p-value Rent = Cash	0.37	0.52	0.45	0.40	0.77	0.34	0.23	0.87	0.82	0.37
TOT										
Rental Subsidy Paid	-0.74	-9.52*	-0.02	-0.06	0.20	0.13**	-0.08***	0.03	-0.03	-0.03
	[2.08]	[5.07]	[0.03]	[0.04]	[0.16]	[0.06]	[0.03]	[0.03]	[0.04]	[0.04]
Cash Drop Paid	0.84	-4.66	-0.03	-0.02	0.11	0.05	-0.03*	0.02	-0.01	-0.05*
	[1.40]	[3.63]	[0.02]	[0.03]	[0.12]	[0.04]	[0.02]	[0.02]	[0.03]	[0.03]
p-value Rent = Cash	0.40	0.27	0.67	0.26	0.56	0.11	0.07	0.90	0.70	0.60
Mean Y in Control Group	9.16	38.71	0.18	0.64	-0.11	0.71	0.91	0.16	0.31	0.61
Observations	1985	1965	1967	1985	1979	503	1482	1984	1985	1985

Notes: The table reports treatment effects on the original owners of the Target Plot, for outcomes not relating to the household farm. The dependent variables come from follow-up surveys we ran at the end of seasons 1 to 4 with the original owner of the Target Plot, pooling observations across seasons unless otherwise specified. Columns (1) and (2) are the number of person-days worked in the past season off of the household farm, summed across household members, on non-household agricultural work and non-agricultural work respectively. Column (3) is an indicator variable for whether a member of the household worked outside the village. Columns (4) and (5) are measures of wealth, with (4) an indicator variable equal to one if the household owns and cows, bulls, or oxen, and (5) the standardized principal component of a vector of household assets and amenities (excluding land and livestock). Columns (6) through (8) pertain to food security: (6) and (7) are whether the household had any maize stocks from their own production in the last 6 months, in the first season and in the subsequent seasons, respectively (point estimates for by-season treatment effects are similar in seasons 2-4, hence pooling them, and opposite in sign to season 1); (8) is a dummy variable for whether the household experienced a hunger period in any of the last six months. Columns (9) and (10) are household finance variables. (9) is a dummy variable for whether the household would have 5k Ksh in savings available if an emergency expense arose, while (10) is a dummy variable for whether they have borrowed in the last 6 months. In the *ITT* Panel, we run an ANCOVA regression of the outcome on treatment dummies, controlling for baseline values of the outcome, survey round dummies, and strata dummies (see Equation (4) in the paper, except here the index i refers to Target Plot owners, rather than the Target Plot itself). In the *TOT* Panel, we run an ANCOVA regression with the same controls, but we instrument dummies for whether the respondent took up the treatment in any of the four seasons with the treatment assignment (see Equation (5) in the paper). We cluster standard errors by target plot owner. *p<0.1, **p<0.05, ***p<0.01.

Appendix

A Listing

Table A.1: Listing: Comparison of interested and non-interested individuals

	Interested		Not Interested		Difference	
	Mean	St.Dev.	Mean	St.Dev.	Beta	S.E.
Female	0.32	0.47	0.38	0.49	-.07***	(.01)
Age	50.76	14.98	49.33	15.78	.10	(.57)
Has a Phone	0.91	0.29	0.84	0.37	.06***	(.01)
No. Plots Owned	3.50	1.33	2.87	1.05	.66***	(.04)
Acres Owned (wins. 1%)	4.09	3.60	3.58	3.87	.44***	(.13)
Renting out at least one plot	0.09	0.28	0.03	0.16	.04***	(.01)
No. Plots Rented Out	0.10	0.35	0.03	0.20	.05***	(.01)
Share of plots fallowed	0.08	0.16	0.02	0.10	.04***	(.00)
Cultivates Commercial Crops	0.37	0.48	0.40	0.49	.00	(.01)
Observations	878		4,607		5,485	

Notes: The table presents a comparison of the respondents interested in a rental subsidy against the respondents who were not interested. The data comes from the listing survey. *Female* is a binary indicator equal to one if the respondent was female. *Cultivates Commercial Crops* is a dummy which equals one if a respondent declares they are cultivating groundnuts, tobacco or sugarcane on any of their owned plots. We winsorize only *Acres Owned* at the top 1%. The *Difference* columns are generated by an ANCOVA regression of each outcome on an interested dummy which includes village fixed effects. β is the estimated coefficient on the interested dummy and *S.E.* are the robust standard errors. *p<0.1, **p<0.05, ***p<0.01.

B Baseline Analysis

B.1 Target Plots vs Non Target Plots

Table B.1: Comparison Target Plots vs Non Target Plots

	Target Plot [T]	NON-Target Plots [NT]	[T-NT]	N
Plot Size	0.79	0.75	0.02	1,898
	(0.55)	(1.04)	(0.04)	
Respondent's homestead in different village than plot	0.01	0.03	-0.01	1,898
	(0.12)	(0.17)	(0.01)	
Sandy loam soil	0.54	0.53	0.01	1,898
	(0.50)	(0.50)	(0.01)	
Sandy clay soil	0.27	0.31	-0.03	1,898
	(0.44)	(0.46)	(0.01)***	
Irrigation dummy	0.06	0.05	0.01	1,898
	(0.23)	(0.22)	(0.01)	
Cultivated in 2019 long rains	0.60	0.79	-0.19	1,898
	(0.49)	(0.41)	(0.02)***	
Rented out in 2019 long rains	0.12	0.06	0.06	1,898
	(0.32)	(0.24)	(0.01)***	
Cultivated with maize in 2019 long rains	0.49	0.45	0.01	1,898
	(0.50)	(0.50)	(0.03)	
Cultivated with commercial crops in 2019 long rains	0.04	0.09	-0.04	1,898
	(0.20)	(0.29)	(0.01)***	
Value of agricultural inputs (excl. labor)	34.5	46.3	-9.4	1,883
	(71.7)	(284.9)	(7.4)	
Value of household labor	29.27	27.30	1.97	1,042
	(42.64)	(39.90)	(2.42)	
Value of hired labor	13.0	9.0	4.0	1,041
	(26.6)	(18.5)	(1.2)***	
Cultivated in 2018 short rains	0.54	0.69	-0.15	1,898
	(0.50)	(0.46)	(0.02)***	
Rented out in 2018 short rains	0.10	0.06	0.04	1,898
	(0.29)	(0.24)	(0.01)***	
Harvest value in in 2018 short rains	70.5	106.0	-22.8	1,898
	(185.2)	(743.3)	(16.1)	

Notes: The table presents a comparison of plot characteristics for Target Plots against non-target plots. The data comes from the owner baseline survey. *Plot Size* is the reported plot size, measured in acres. *Cultivated with commercial crops in 2019 long rains* is a binary indicator equal to one if the plot was cultivated with groundnuts, tobacco or sugarcane during the long rains 2019. Value of agricultural inputs, household labor, hired labor and harvest are expressed in USD (1 USD = 100 KSh) and winsorized at the top 1%. *Value of agricultural inputs (excl. labor)* is the value of any seeds, compost, chemical fertilizer, and pesticides used on the Target Plot. *Value of hired labor* is the number of hired-work days valued at the median reported wage. *Value of hired labor* is the number of household-member-work days valued at 60% of the median reported wage. The difference *[T-NT]* is the coefficient from a regression of each outcome on a binary indicator equal to one if the plot is the Target Plot, which includes owner fixed effects. P-values are reported in parentheses: *p<0.1, **p<0.05, ***p<0.01.

B.2 Stratum C vs Stratum NC

Table B.2: Comparison of Stratum C versus Stratum NC

	Plan to Cultivate [C]	Plan to Fallow [NC]	[C-NC]	N
Owner characteristics				
Age	50.08	51.34	-1.25	521
	(14.35)	(15.98)	(1.42)	
Male	0.70	0.70	0.00	521
	(0.46)	(0.46)	(0.04)	
Family Size	5.86	5.35	0.51	521
	(2.72)	(2.70)	(0.25)**	
High School Educated	0.24	0.22	0.01	521
	(0.43)	(0.42)	(0.04)	
Agricultural Training	0.29	0.32	-0.04	521
	(0.45)	(0.47)	(0.04)	
Total plots: total acres owned in 2019 long rains	2.52	2.64	-0.11	520
	(1.92)	(2.03)	(0.18)	
Have maize stocks from own production, last 12 months	0.70	0.68	0.01	521
	(0.46)	(0.47)	(0.04)	
Number person-days spent working on other farms, last 7 months	25.41	20.07	5.33	521
	(73.77)	(69.17)	(6.53)	
Number person-days spent on non-ag work, last 12 months	21.25	24.23	-2.98	521
	(31.73)	(34.48)	(3.09)	
Taken a loan in last 12 months	0.63	0.61	0.01	521
	(0.48)	(0.49)	(0.04)	
5k Ksh in emergency savings	0.34	0.45	-0.11	521
	(0.48)	(0.50)	(0.05)**	
Wealth index, assets- and amenities-based PCA	-0.05	0.09	-0.14	520
	(1.72)	(2.07)	(0.18)	
Target Plot characteristics				
Plot Size	0.71	0.73	-0.01	521
	(0.46)	(0.47)	(0.04)	
Sandy clay soil	0.29	0.22	0.07	521
	(0.46)	(0.41)	(0.04)*	
Erosion dummy	0.26	0.19	0.07	521
	(0.44)	(0.39)	(0.04)*	
Cultivated in 2019 long rains	0.73	0.36	0.36	521
	(0.45)	(0.48)	(0.04)***	
Rented out in 2019 long rains	0.13	0.08	0.05	521
	(0.34)	(0.28)	(0.03)*	
Cultivated with maize in 2019 long rains	0.60	0.29	0.31	521
	(0.49)	(0.46)	(0.04)***	
Cultivated with commercial crops in 2019 long rains	0.05	0.02	0.03	521
	(0.22)	(0.15)	(0.02)*	
Value of agricultural inputs (excl. labor)	40.3	23.4	16.90	517
	(74.1)	(65.5)	(6.30)***	
Value of household labor	36.04	16.34	19.69	521
	(44.50)	(35.54)	(3.58)***	
Value of hired labor	13.4	12.1	1.30	521
	(26.5)	(26.9)	(2.50)	
Cultivated in 2018 short rains	0.63	0.37	0.25	521
	(0.48)	(0.49)	(0.04)***	
Rented out in 2018 short rains	0.10	0.08	0.02	521
	(0.30)	(0.28)	(0.03)	
Harvest value in in 2018 short rains	87.3	38.3	49.00	521
	(208.1)	(124.9)	(14.60)***	

Notes: The table presents a comparison of owner and Target Plot characteristics for owners that, at baseline, were planning to cultivate the Target Plot for the next agricultural season (short rains 2019) against those who were either planning to leave it fallow or still undecided. The data comes from the owner baseline survey. *Male* is a binary indicator equal to one if the household head is male. *High School Educ household head* is a binary indicator equal to one if the highest level of education completed by the household head is high school or higher. *Agri Training household head* is a binary indicator equal to one if the household head received specific agricultural training in the past 3 years. *Total plots: total acres owned in 2019 long rains* is the sum of plot sizes across all plots owned at baseline, winsorized at the top 1%.*5k Ksh in emergency savings* is a binary indicator equal to one if the household had enough savings to cover an emergency expenditure of 5,000 Ksh

($50). *Wealth index, assets- and amenities-based PCA* is the standardized principal component of a vector of assets and amenities (excluding land and livestock). *Cultivated with commercial crops in 2019 long rains* is a binary indicator equal to one if the Target Plot was cultivated with groundnuts, tobacco or sugarcane during the long rains 2019. Value of agricultural inputs, household labor, hired labor and harvest are expressed in USD (1 USD = 100 KSh) and winsorized at the top 1%. *Value of agricultural inputs (excl. labor)* is the value of any seeds, compost, chemical fertilizer, and pesticides used on the Target Plot. *Value of hired labor* is the number of hired-work days valued at the median reported wage. *Value of hired labor* is the number of household-member-work days valued at 60% of the median reported wage. The difference *[C-NC]* is the coefficient from a regression of each outcome on a binary indicator equal to one if the household was planning to cultivate the Target Plot in the short rains 2019. P-values are reported in parentheses: *p<0.1, **p<0.05, ***p<0.01.

B.3 Balance

Table B.3: Balance

	Rental Subsidy [RS]	Cash Drop [CD]	Control [C]	[RS-CD]	[RS-C]	[CD-C]	N
A. Owners							
Age	49.38	51.81	50.34	-2.22	-0.95	1.40	521
	(15.19)	(15.19)	(14.38)	(1.60)	(1.64)	(1.61)	
Male	0.69	0.74	0.69	-0.06	-0.01	0.07	521
	(0.47)	(0.44)	(0.47)	(0.05)	(0.05)	(0.05)	
Family Size	5.37	5.83	5.85	-0.46	-0.42	0.06	521
	(2.83)	(2.71)	(2.61)	(0.30)	(0.30)	(0.28)	
High School Educated	0.26	0.21	0.23	0.05	0.01	-0.01	521
	(0.44)	(0.41)	(0.42)	(0.04)	(0.05)	(0.05)	
Agricultural Training	0.32	0.25	0.33	0.07	0.01	-0.06	521
	(0.47)	(0.44)	(0.47)	(0.05)	(0.05)	(0.05)	
Compare agricultural experience to avg. farmer (1-5)	2.84	2.78	2.89	0.04	-0.03	-0.10	521
	(0.89)	(0.82)	(0.92)	(0.09)	(0.09)	(0.09)	
No. plots owned in 2019 long rains	3.49	3.53	3.65	-0.05	-0.21	-0.15	521
	(1.28)	(1.34)	(1.29)	(0.14)	(0.14)	(0.14)	
Total plots: total acres owned in 2019 long rains	2.48	2.64	2.57	-0.17	-0.09	0.08	520
	(1.87)	(2.07)	(1.95)	(0.18)	(0.17)	(0.20)	
Have maize stocks from own production, last 12 months	0.69	0.70	0.68	0.00	0.01	0.01	521
	(0.46)	(0.46)	(0.47)	(0.04)	(0.04)	(0.05)	
Experienced a hunger period, last 12 months	0.34	0.36	0.37	-0.02	-0.04	-0.01	521
	(0.48)	(0.48)	(0.48)	(0.05)	(0.05)	(0.05)	
Own oxen or cow	0.69	0.67	0.61	0.02	0.07	0.05	521
	(0.46)	(0.47)	(0.49)	(0.05)	(0.05)	(0.05)	
Number person-days spent working on other farms, last 7 months	20.04	20.14	30.46	-1.62	-10.26	-8.90	521
	(70.39)	(56.06)	(86.67)	(6.68)	(8.78)	(6.98)	
Number person-days spent on non-ag work, last 12 months	20.90	20.21	25.68	1.06	-6.58	-6.76	521
	(31.16)	(31.62)	(35.05)	(3.22)	(3.53)*	(3.63)*	
Taken a loan in last 12 months	0.66	0.57	0.63	0.10	0.03	-0.06	521
	(0.48)	(0.50)	(0.48)	(0.05)*	(0.05)	(0.05)	
Total borrowed, last 12 months	53.0	88.8	69.5	-32.8	-23.1	14.9	521
	(123.6)	(233.4)	(145.9)	(19.1)*	(14.7)	(21.1)	
Participate in ROSCA	0.48	0.45	0.52	0.01	-0.04	-0.06	521
	(0.50)	(0.50)	(0.50)	(0.05)	(0.05)	(0.06)	
Have bank account	0.25	0.26	0.28	0.00	-0.03	-0.02	521
	(0.43)	(0.44)	(0.45)	(0.05)	(0.05)	(0.05)	
Total amount saved	64.3	74.1	78.7	-5.1	-16.8	-4.4	521
	(155.5)	(170.2)	(175.0)	(17.9)	(17.4)	(18.8)	
5k Ksh in emergency savings	0.38	0.34	0.41	0.03	-0.03	-0.06	521
	(0.49)	(0.48)	(0.49)	(0.05)	(0.05)	(0.05)	
Wealth index, assets- and amenities-based PCA	0.17	0.01	-0.18	0.15	0.33	0.21	520
	(2.07)	(1.79)	(1.65)	(0.22)	(0.19)*	(0.18)	
B. Target Plots							
Plot Size	0.71	0.76	0.69	-0.04	0.02	0.07	521
	(0.44)	(0.52)	(0.43)	(0.03)	(0.03)	(0.03)**	
Inherited	0.91	0.91	0.93	0.01	-0.02	-0.02	521
	(0.28)	(0.29)	(0.26)	(0.03)	(0.03)	(0.03)	
Certificate of title/customary ownership	0.76	0.67	0.67	0.10	0.10	0.00	521
	(0.43)	(0.47)	(0.47)	(0.05)**	(0.05)**	(0.05)	
Respondent's homestead in different village than plot	0.02	0.02	0.01	0.00	0.01	0.01	521
	(0.13)	(0.13)	(0.08)	(0.01)	(0.01)	(0.01)	
Sandy loam soil	0.53	0.53	0.55	-0.01	0.00	0.00	521
	(0.50)	(0.50)	(0.50)	(0.05)	(0.05)	(0.05)	
Sandy clay soil	0.27	0.26	0.26	0.02	0.01	-0.02	521
	(0.45)	(0.44)	(0.44)	(0.05)	(0.05)	(0.05)	
Soil quality index (1=poor, 2=fair, 3=good)	2.56	2.56	2.64	-0.01	-0.08	-0.07	521
	(0.54)	(0.53)	(0.53)	(0.06)	(0.06)	(0.05)	
Swampy/dry index (1=swampy, 2=mix, 3=dry)	2.42	2.39	2.41	0.03	-0.02	0.01	521
	(0.60)	(0.61)	(0.60)	(0.07)	(0.07)	(0.07)	
Erosion dummy	0.21	0.21	0.29	0.00	-0.07	-0.09	521
	(0.41)	(0.41)	(0.46)	(0.04)	(0.04)*	(0.04)**	
Irrigation dummy	0.05	0.05	0.07	0.00	-0.02	-0.01	521
	(0.21)	(0.22)	(0.26)	(0.02)	(0.02)	(0.03)	
Cultivated in 2019 long rains	0.63	0.60	0.57	0.04	0.06	0.04	521
	(0.48)	(0.49)	(0.50)	(0.05)	(0.05)	(0.05)	

	Rental Subsidy [RS]	Cash Drop [CD]	Control [C]	[RS-CD]	[RS-C]	[CD-C]	N
Rented out in 2019 long rains	0.13	0.10	0.12	0.03	0.01	-0.02	521
	(0.33)	(0.31)	(0.33)	(0.03)	(0.04)	(0.03)	
Cultivated with maize in 2019 long rains	0.53	0.49	0.46	0.05	0.07	0.03	521
	(0.50)	(0.50)	(0.50)	(0.05)	(0.05)	(0.05)	
Cultivated with commercial crops in 2019 long rains	0.04	0.05	0.04	-0.01	0.00	0.01	521
	(0.20)	(0.21)	(0.20)	(0.02)	(0.02)	(0.02)	
Value of agricultural inputs (excl. labor)	41.1	39.2	23.1	2.6	19.1	19.6	517
	(84.5)	(75.9)	(48.8)	(8.1)	(7.5)**	(6.7)***	
Value of household labor	32.10	26.28	29.47	6.82	4.70	-1.28	521
	(45.58)	(35.33)	(46.20)	(4.36)	(4.88)	(4.31)	
Value of hired labor	16.2	11.7	11.1	4.3	5.8	1.8	521
	(30.3)	(24.7)	(24.4)	(3.0)	(2.8)**	(2.7)	
Cultivated in 2018 short rains	0.53	0.56	0.53	-0.02	0.00	0.04	521
	(0.50)	(0.50)	(0.50)	(0.05)	(0.05)	(0.05)	
Rented out in 2018 short rains	0.09	0.09	0.10	0.01	-0.01	-0.01	521
	(0.29)	(0.29)	(0.30)	(0.03)	(0.03)	(0.03)	
Harvest value in in 2018 short rains	72.5	86.4	52.8	-10.0	16.1	27.0	521
	(169.5)	(232.3)	(141.4)	(20.9)	(16.8)	(21.0)	
C. Non-target Plots							
Owned in 2019 long rains	2.49	2.53	2.65	-0.05	-0.21	-0.15	521
	(1.28)	(1.34)	(1.29)	(0.14)	(0.14)	(0.14)	
Total acres owned in 2019 long rains	1.77	1.88	1.89	-0.12	-0.11	0.00	520
	(1.69)	(1.83)	(1.75)	(0.18)	(0.17)	(0.19)	
Rented out in 2019 long rains	0.10	0.15	0.22	-0.05	-0.12	-0.06	521
	(0.34)	(0.44)	(0.53)	(0.04)	(0.05)**	(0.05)	
Cultivated in 2019 long rains	2.10	1.94	2.18	0.17	-0.10	-0.27	521
	(1.33)	(1.21)	(1.25)	(0.13)	(0.14)	(0.13)**	
Cultivated with maize in 2019 long rains	1.15	1.16	1.26	-0.03	-0.13	-0.12	521
	(0.97)	(0.88)	(0.97)	(0.10)	(0.10)	(0.09)	
Cultivated with commercial crops in 2019 long rains	0.27	0.20	0.23	0.07	0.04	-0.01	521
	(0.52)	(0.44)	(0.55)	(0.05)	(0.06)	(0.06)	
Value of agricultural inputs (excl. labor)	140.0	102.7	96.7	39.0	45.9	11.5	518
	(294.6)	(249.5)	(188.6)	(26.6)	(26.2)*	(23.3)	
Value of household labor	28.90	24.53	28.48	3.59	2.57	-3.85	521
	(44.86)	(32.44)	(41.50)	(4.34)	(4.80)	(4.11)	
Value of hired labor	8.8	9.6	8.8	-1.7	-0.2	1.5	520
	(17.2)	(19.8)	(18.5)	(2.2)	(1.9)	(2.1)	
Cultivated in 2018 short rains	1.85	1.71	1.87	0.16	-0.05	-0.20	521
	(1.32)	(1.23)	(1.31)	(0.13)	(0.14)	(0.14)	
Harvest value in in 2018 short rains	231.9	295.7	281.3	-50.2	-32.3	3.2	521
	(603.1)	(842.8)	(825.8)	(83.4)	(70.6)	(89.8)	

Notes: The table presents the baseline balance for owners' socio-demographic characteristics and non-agricultural outcomes (Panel A), Target Plots (Panel B) and Non-target plots (Panel C). The data comes from the owner baseline survey. *Panel A: Male* is a binary indicator equal to one if the household head is male. *High School Educ household head* is a binary indicator equal to one if the highest level of education completed by the household head is high school or higher. *Agri Training household head* is a binary indicator equal to one if the household head received specific agricultural training in the past 3 years. *Compare agricultural experience to avg. farmer* comes from a question asking owners to assess their experience relative to the average farmer in their village on a 5-point scale, from "much less experience" to "much more experience". *Own oxen or cow* is a binary indicator equal to one if the household owns any cows or oxens. *5k Ksh in emergency savings* is a binary indicator equal to one if the household had enough savings to cover an emergency expenditure of 5,000 Ksh ($50). *Wealth index, assets- and amenities-based PCA* is the standardized principal component of a vector of assets and amenities (excluding land and livestock). *Panel B: Plot size* is the average between plot size reported by the owner and plot size measured at baseline by enumerators using hand-held GPS devices. The unit is acres. *Certificate of title/customary ownership* is a binary indicator equal to one if the owner has either a certificate of title or of customary ownership for the Target Plot. *Cultivated with commercial crops in 2019 long rains* is a binary indicator equal to one if the Target Plot was cultivated with groundnuts, tobacco or sugarcane during the long rains 2019. Value of agricultural inputs, household labor, hired labor and harvest are expressed in USD (1 USD = 100 KSh) and winsorized at the top 1%. *Value of agricultural inputs (excl. labor)* is the value of any seeds, compost, chemical fertilizer, and pesticides used on the Target Plot. *Value of hired labor* is the number of hired-work days valued at the median reported wage. *Value of hired labor* is the number of household-member-work days valued at 60% of the median reported wage. *Panel C:Owned in 2019 long rains* and *Rented out in 2019 long rains* is the number of non-target plots owned and rented out at baseline, respectively. *Total acres owned in 2019 long rains* is the sum of self-reported plot sizes across all non-target plots and is winsorized at the top 1%. *Cultivated in 2019 long rains* and *Cultivated in 2018 short rains* is the total number of non-target plots cultivated at baseline (2019 long rains) and in the previous agricultural season (2018 short rains) , respectively. *Cultivated with commercial crops in 2019 long rains* is the total number of non-target plots cultivated with groundnuts, tobacco or sugarcane during the long rains 2019. Value of agricultural inputs, household labor, hired labor, and harvest is the sum of the respective values across all non-target plots. They are expressed in USD (1 USD = 100 KSh) and winsorized at the top 1%. P-values are based on specifications which include strata fixed effects. *p<0.1, **p<0.05, ***p<0.01.

C Target plot rentals

Table C.1: Target Plot Rented Out

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Rental Subsidy	0.46***	0.44***	0.47***	0.38***	0.34***	0.42***	0.43***	0.42***
	[0.05]	[0.05]	[0.05]	[0.05]	[0.05]	[0.04]	[0.05]	[0.06]
Cash Drop	0.07	0.05	0.08	0.03	0.05	0.06	0.05	0.07
	[0.05]	[0.05]	[0.05]	[0.05]	[0.05]	[0.04]	[0.05]	[0.06]
p-value Rent= Cash	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Crop Season	1	2	3	4	5	All	All	All
Strata	All	All	All	All	All	All	C	NC
Mean Y in Control Group	0.23	0.24	0.22	0.20	0.22	0.22	0.21	0.24
Observations	521	512	507	499	483	2,522	1,656	866

Notes: The table reports the treatment effects on the likelihood the Target Plot is rented out. Data come from follow-up surveys we run at the end of season 1 to 4 with the manager of the Target Plot. Data for Season 5 (col. 5) comes from responses collected at the end of Season 4. The stratum was created based on a Target Plot's likelihood to be Cultivated (C) or Not Cultivated (NC) during the first season of the study (see Section 3.3 in the Paper for more details). We run an ANCOVA regression of the rented out dummy on treatment dummies and include strata dummies for all columns. Columns 6-8 also includes survey round dummies. We utilize robust standard errors for columns 1-5 and we cluster standard errors by the target plot for columns 6-8. *p<0.1, **p<0.05, ***p<0.01.

Table C.2: Comparison of rentals across treatment groups

	Rental Subsidy [RS]	Cash Drop & Control [CD&C]	[RS-(CD&C)]
Target Plot characteristics			
Plot size (avg reported-GPS)	0.77	0.78	-0.01
	(0.48)	(0.54)	(0.07)
Sandy loam soil	0.57	0.59	-0.01
	(0.50)	(0.50)	(0.07)
Sandy clay soil	0.25	0.22	0.03
	(0.43)	(0.41)	(0.06)
Soil quality index (1=poor, 2=fair, 3=good)	2.56	2.59	-0.03
	(0.56)	(0.54)	(0.08)
Swampy/dry index (1=swampy, 2=mix, 3=dry)	2.42	2.52	-0.10
	(0.62)	(0.58)	(0.08)
Erosion dummy	0.23	0.28	-0.06
	(0.42)	(0.45)	(0.06)
Irrigation dummy	0.05	0.07	-0.02
	(0.22)	(0.25)	(0.03)
Formal certificate available	0.82	0.77	0.05
	(0.38)	(0.42)	(0.06)
Rented out at any point in 2019	0.22	0.33	-0.11
	(0.41)	(0.47)	(0.06)*
Renters and rental contracts			
Rental contract duration (months)	20.63	21.29	-0.66
	(16.42)	(16.08)	(2.32)
Cash amount agreed for rental contract	93.3	95.7	-2.4
	(87.1)	(111.4)	(14.5)
Taken a loan to rent in	0.08	0.05	0.03
	(0.27)	(0.21)	(0.03)
TPlot: respondent's homestead in different village than plot	0.21	0.21	0.00
	(0.41)	(0.41)	(0.06)
Renter is a family member	0.35	0.27	0.08
	(0.48)	(0.45)	(0.07)
Rented in before from same owner	0.19	0.27	-0.08
	(0.39)	(0.45)	(0.06)
Rented the Target Plot before	0.16	0.29	-0.13
	(0.37)	(0.46)	(0.06)**
Renting in other plots at baseline (2019 long rains)	0.29	0.34	-0.04
	(0.46)	(0.48)	(0.07)
Observations	120	92	212

Notes: The table presents a comparison of Target Plot rentals concluded in the *Rental Subsidy* group against those that occurred in the *Cash Drop* and *Control* group. The sample is based the subset of Target Plots which were rented out in the first experimental season, the short rains 2019. The data in the first panel comes from the owner survey and reports average Target Plots characteristics for the rented plots. *Target Plot: Size (avg reported-GPS* is the average between plot size reported by the owner and plot size measured at baseline by enumerators using hand-held GPS devices. The unit is acres. *Target Plot: formal certificate available* is a binary indicator equal to one if the owner has a formal certificate of ownership over the Target Plot. *Target Plot: rented out at any point in 2019* is a binary indicator equal to one if the Target Plot was rented out at baseline, at any point during 2019, before the first experimental season, the short rains 2019. The data in the second panel comes from the renter baseline survey and reports average renters and contract characteristics. Reported characteristics are for the rental contracts started or in place during the short rains 2019. The difference *[RS-(CD & C)]* is the coefficient from a regression of each outcome on a binary indicator equal to one if the owner belongs to the *Rental Subsidy* group. P-values are reported in parentheses: *p<0.1, **p<0.05, ***p<0.01.

D Manager Characteristics

Table D.1: Manager Characteristics: Lee Bounds

	Households Size	Age	Gender	High School Educated	N. Plots Owned	Rent In Plot(s)	S. Plots Cash Crops	Target Plot in Diff. Village	Experienced Hunger	Non-Land Wealth	Borrowed	Emergency Savings
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
ITT												
Rental Subsidy	0.10 [0.25] 0.08 [0.25] 0.11 [0.25]	-3.86*** [1.24] -3.93*** [1.24] -3.75*** [1.24]	0.12*** [0.04] 0.12*** [0.04] 0.13*** [0.04]	0.07* [0.04] 0.06* [0.04] 0.07* [0.04]	-0.92*** [0.15] -0.94*** [0.15] -0.91*** [0.15]	0.15*** [0.04] 0.15*** [0.04] 0.15*** [0.04]	0.02 [0.03] 0.02 [0.02] 0.02 [0.03]	0.09*** [0.03] 0.09*** [0.03] 0.09*** [0.03]	-0.06* [0.03] -0.07* [0.03] -0.06* [0.03]	-0.12 [0.09] -0.13 [0.09] -0.12 [0.09]	0.12*** [0.04] 0.12*** [0.04] 0.12*** [0.04]	0.05 [0.04] 0.05 [0.04] 0.05 [0.04]
Cash Drop	-0.27 [0.19] -0.35* [0.19] -0.24 [0.19]	-1.42 [1.01] -1.77* [1.02] -1.26 [1.02]	0.09*** [0.03] 0.08*** [0.03] 0.09*** [0.03]	0.05 [0.03] 0.04 [0.03] 0.06* [0.03]	-0.17 [0.14] -0.26* [0.14] -0.11 [0.14]	0.04 [0.03] 0.02 [0.03] 0.04 [0.03]	-0.01 [0.02] -0.03 [0.02] -0.01 [0.02]	0.03 [0.03] 0.01 [0.02] 0.03 [0.03]	-0.03 [0.03] -0.04 [0.03] -0.03 [0.03]	0.08 [0.09] 0.01 [0.08] 0.09 [0.09]	0.03 [0.04] 0.03 [0.04] 0.03 [0.04]	0.06 [0.04] 0.05 [0.04] 0.06* [0.04]
p-value Rent = Cash	*0.11* *0.07* *0.14*	*0.06* *0.09* *0.05*	*0.34* *0.29* *0.41*	*0.61* *0.59* *0.74*	*0.00* *0.00* *0.00*	*0.01* *0.00* *0.01*	*0.17* *0.07* *0.18*	*0.04* *0.01* *0.04*	*0.34* *0.43* *0.39*	*0.04* *0.09* *0.03*	*0.03* *0.04* *0.03*	*0.85* *0.93* *0.76*
LATE												
Plot Rented	0.21 [0.43] 0.15 [0.42] 0.23 [0.43]	-7.85*** [2.14] -7.94*** [2.13] -7.68*** [2.14]	0.25*** [0.07] 0.25*** [0.07] 0.26*** [0.07]	0.14** [0.07] 0.13* [0.07] 0.14** [0.07]	-1.89*** [0.21] -1.92*** [0.21] -1.85*** [0.21]	0.30*** [0.06] 0.30*** [0.06] 0.30*** [0.06]	0.05 [0.05] 0.03 [0.04] 0.05 [0.05]	0.19*** [0.05] 0.18*** [0.05] 0.19*** [0.05]	-0.13** [0.06] -0.13** [0.06] -0.13** [0.06]	-0.24 [0.17] -0.27* [0.16] -0.24 [0.17]	0.24*** [0.07] 0.25*** [0.07] 0.25*** [0.07]	0.09 [0.07] 0.09 [0.07] 0.11 [0.07]
Mean Y in Control Group	5.75 5.75 5.75	48.98 48.98 48.98	0.69 0.69 0.69	0.24 0.24 0.24	3.21 3.21 3.21	0.07 0.07 0.07	0.11 0.11 0.11	0.05 0.05 0.05	0.33 0.33 0.33	-0.01 -0.01 -0.01	0.62 0.62 0.62	0.4 0.4 0.4
Observations	508 503 503	508 503 503	508 503 503	508 503 503	508 503 503	508 503 503	467 463 462	506 501 501	508 503 503	504 499 499	508 503 503	508 503 503

Notes: The table reports the bounded treatment effects following Lee (2009), with bounds created for each variable by trimming the top and bottom of the rental subsidy and cash drop group, as these groups had the lowest attrition. For each cell in the table, results are ordered as following: unbounded, lower bound and upper bound. Details on the data sources and construction of the variables are included in the notes of Table 1. In the *ITT* sub-panel, we run an ANCOVA regression of the outcome on treatment dummies, controlling for baseline values of the outcome (noting that these will be equal to the outcome itself when the Target Plot is not rented out) and strata dummies (see Equation (6) in the paper). In the *LATE* sub-panel, we run an ANCOVA regression with the same controls, but we instrument the dummies for whether the Target Plot was rented out with the Rental Subsidy treatment, while controlling for the Cash Drop treatment (see Equation (6) in the paper). *p<0.1, **p<0.05, ***p<0.01.

Table D.2: Manager characteristics: Additional results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Agricultural Training	Agricultural Experience	Acres Owned	Input per Acre	Output per Acre	Maize Stock	Owns Livestock	Rented Out Land	Total Savings	Lent Money	Emergency Savings
ITT											
Rental Subsidy	-0.07	0.03	-0.71***	31.13	9.23	-0.01	-0.07	-0.06**	17.91	0.00	0.03
	[0.04]	[0.08]	[0.15]	[175.29]	[50.74]	[0.04]	[0.05]	[0.02]	[21.77]	[0.04]	[0.03]
Cash Drop	0.05	0.11	0.06	-105.10	-45.73	0.01	-0.01	-0.02	13.97	-0.01	0.00
	[0.04]	[0.07]	[0.16]	[120.89]	[48.78]	[0.03]	[0.04]	[0.02]	[22.88]	[0.03]	[0.03]
p-value Rent = Cash	0.01	0.33	0.00	0.37	0.08	0.70	0.16	0.13	0.88	0.79	0.41
LATE											
Plot Rented	-0.14*	0.05	-1.47***	87.44	21.32	-0.02	-0.15*	-0.11***	36.29	0.01	0.06
	[0.08]	[0.15]	[0.24]	[408.36]	[98.68]	[0.07]	[0.08]	[0.04]	[38.18]	[0.08]	[0.05]
Mean Y in Control Group	0.27	2.83	2.13	167.72	150.35	0.70	0.63	0.10	96.12	0.40	0.85
Observations	508	508	496	386	422	508	508	508	508	508	508

Notes: The table reports treatment effects on characteristics of the target plot manager, adding additional outcomes which are not reported in Table 1 in the main text. The dependent variables correspond to the *baseline* characteristics of whomever is managing the Target Plot in the first endline season (2019 Short Rains). Column (1) is an indicator variable for whether the household head has received any agricultural training. Column (2) is a categorical variable for the level of agricultural experience they have compared to the average farmer in their village, with 1 being *much less experience* and 5 being *much more experience*. Column (3) is the total acres of land owned by the household. Columns (4) and (5) measure the total input and output per acre of land, with (4) the total input per acre is measured for the long rains season in 2019, and with (5) the total output per acres is measured for the short rains season in 2018. Note that the measures corresponded to different seasons due to the surveys being conducted at different stages. Column (6) pertains to food security constructed as an indicator variable for whether the household had any maize stocks from their own production in the last 6 months. Column (7) is a measure of wealth constructed as an indicator variable equal to one if the household owns cows, bulls, or oxen. Column (8) is an indicator variable for whether the household rented out land or buildings to others. Column (9) measures the total savings of the household, while (10) is an indicator variable for whether the household has lent money. Column (11) is a dummy variable for whether the household would have 5k Ksh in savings available if an emergency expense arose. In the *ITT* sub-panel, we run an ANCOVA regression of the outcome on treatment dummies, controlling for baseline values of the outcome (noting that these will be equal to the outcome itself when the Target Plot is not rented out) and strata dummies (see Equation (6) in the paper). In the *LATE* sub-panel, we run an ANCOVA regression with the same controls, but we instrument the dummies for whether the Target Plot was rented out with the Rental Subsidy treatment, while controlling for the Cash Drop treatment (see Equation (6) in the paper). *p<0.1, **p<0.05, ***p<0.01.

E Target plot outcomes

E.1 Target plot outcomes: Robustness

Table E.1: Robustness: Target Plot Cultivation and Crop Choice

	Cultivated				Maize				Commercial			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
ITT												
Rental Subsidy	0.06***	0.07***	0.07***	0.05**	-0.01	0.00	0.00	-0.01	0.07***	0.07***	0.07***	0.07***
	[0.02]	[0.02]	[0.02]	[0.02]	[0.03]	[0.03]	[0.03]	[0.03]	[0.02]	[0.02]	[0.02]	[0.02]
Cash Drop	0.06***	0.07***	0.07***	0.06***	0.05*	0.05*	0.05*	0.05*	0.02	0.02	0.03	0.02
	[0.02]	[0.02]	[0.02]	[0.02]	[0.03]	[0.03]	[0.03]	[0.03]	[0.02]	[0.02]	[0.02]	[0.02]
p-value Rent = Cash Paid	*0.89*	*0.96*	*0.98*	*0.55*	*0.05*	*0.10*	*0.10*	*0.04*	*0.02*	*0.05*	*0.06*	*0.04*
TOT												
Rental Subsidy Paid	0.08***	0.09***	0.09***	0.06**	-0.01	0.00	0.00	-0.02	0.10***	0.09***	0.10***	0.09***
	[0.03]	[0.03]	[0.03]	[0.03]	[0.04]	[0.04]	[0.04]	[0.04]	[0.03]	[0.03]	[0.03]	[0.03]
Cash Drop Paid	0.06***	0.07***	0.07***	0.06***	0.05*	0.05*	0.05*	0.04	0.02	0.02	0.03	0.02
	[0.02]	[0.02]	[0.02]	[0.02]	[0.03]	[0.03]	[0.03]	[0.03]	[0.02]	[0.02]	[0.02]	[0.02]
p-value Rent = Cash Paid	*0.47*	*0.37*	*0.36*	*0.83*	*0.07*	*0.16*	*0.16*	*0.08*	*0.00*	*0.01*	*0.02*	*0.01*
Mean Y in Control Group	0.82	0.82	0.82	0.82	0.69	0.69	0.69	0.69	0.09	0.09	0.09	0.09
Controls	Main	Only Size	None	PDS	Main	Only Size	None	PDS	Main	Only Size	None	PDS
Observations	1,957	1,957	1,957	1,957	1,956	1,956	1,956	1,956	1,956	1,956	1,956	1,956

Notes: The table reports treatment effects on the likelihood the Target Plot is cultivated (col. 1-4), cultivated with maize (col. 5-8), cultivated with commercial crops, i.e., groundnuts, sugarcane, tobacco (col. 9-12). Along with results under the core specification (col. 1, 5 and 9), the table includes results when, in addition to controlling for survey round dummies and strata dummies, only plot size is controlled for (col. 2, 6 and 10), when no other variables are controlled for (col. 3, 7 and 11), and when, following Belloni et al. (2014), we control for Target Plot variables selected via post-double-selection (PDS) (col. 4, 8 and 12). Details on the data sources are included in the notes of Table 3. In the *ITT* Panel, we run an ANCOVA regression of the outcome on treatment dummies (see Equation (4) in the paper). In the *TOT* Panel, we instrument dummies for whether the respondent took up the treatment in any of the four seasons with the treatment assignment (see Equation (5) in the paper). We cluster standard errors by the target plot. *p<0.1, **p<0.05, ***p<0.01.

Table E.2: Robustness: Value of Inputs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ITT								
Rental Subsidy	10.1***	0.24**	11.1***	0.29**	12.4***	0.32***	10.7***	0.21**
	[3.4]	[0.11]	[3.4]	[0.12]	[3.6]	[0.11]	[3.3]	[0.10]
Cash Drop	3.5	0.14	4.7	0.17	7.8**	0.23*	4.6	0.11
	[2.9]	[0.11]	[3.0]	[0.12]	[3.3]	[0.12]	[2.8]	[0.10]
p-value Rent = Cash Paid	*0.05*	*0.34*	*0.05*	*0.26*	*0.20*	*0.42*	*0.05*	*0.28*
TOT								
Rental Subsidy Paid	13.9***	0.34**	15.2***	0.41***	16.9***	0.45***	14.7***	0.30**
	[4.5]	[0.13]	[4.4]	[0.14]	[4.6]	[0.14]	[4.3]	[0.14]
Cash Drop Paid	3.6	0.14	4.7	0.17*	7.8**	0.23**	4.5	0.11
	[2.8]	[0.10]	[2.9]	[0.10]	[3.2]	[0.10]	[2.8]	[0.10]
p-value Rent = Cash Paid	*0.01*	*0.08*	*0.01*	*0.04*	*0.03*	*0.07*	*0.01*	*0.11*
Mean Y in Control Group	33.0	IHS	33.0	IHS	33.0	IHS	33.0	IHS
Controls	Main	Main	Only Size	Only Size	None	None	PDS	PDS
Observations	1,957	509	1,957	509	1,957	509	1,957	509

Notes: The table reports treatment effects on the value of inputs used on the Target Plot, as well as several robustness tests. Appendix Table E.1 details the different robustness tests included in this table. Details on the data sources are included in the notes of Table 3. This table also includes results using the inverse hyperbolic sine transformation (IHS) of the sum of the input values used on each Target Plot for each robustness test (even columns). In the *ITT* Panel, we run an ANCOVA regression of the outcome on treatment dummies (see Equation (4) in the paper). In the *TOT* Panel, we instrument dummies for whether the respondent took up the treatment in any of the four seasons with the treatment assignment (see Equation (5) in the paper). We cluster standard errors by the target plot. *p<0.1, **p<0.05, ***p<0.01.

Table E.3: Robustness: Value of Household Labor

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ITT								
Rental Subsidy	-2.1	-0.02	-1.4	0.00	-1.3	-0.00	-1.9	-0.02
	[2.5]	[0.11]	[2.5]	[0.11]	[2.5]	[0.11]	[2.4]	[0.10]
Cash Drop	3.2	0.07	3.1	0.08	3.4	0.08	3.6	0.05
	[2.6]	[0.12]	[2.7]	[0.12]	[2.7]	[0.12]	[2.6]	[0.10]
p-value Rent = Cash Paid	*0.05*	*0.44*	*0.09*	*0.52*	*0.08*	*0.52*	*0.03*	*0.49*
TOT								
Rental Subsidy Paid	-2.9	-0.03	-2.0	0.00	-1.8	-0.00	-3.0	-0.03
	[3.3]	[0.14]	[3.4]	[0.14]	[3.4]	[0.14]	[3.3]	[0.13]
Cash Drop Paid	3.2	0.07	3.1	0.08	3.5	0.08	3.0	0.05
	[2.6]	[0.11]	[2.6]	[0.11]	[2.6]	[0.11]	[2.5]	[0.10]
p-value Rent = Cash Paid	*0.05*	*0.43*	*0.10*	*0.54*	*0.09*	*0.54*	*0.05*	*0.54*
Mean Y in Control Group	46.1	IHS	46.1	IHS	46.1	IHS	46.1	IHS
Controls	Main	Main	Only Size	Only Size	None	None	PDS	PDS
Observations	1,957	509	1,957	509	1,957	509	1,957	509

Notes: The table reports treatment effects on the value of household labor used on the Target Plot, as well as several robustness tests. Appendix Table E.1 details the different robustness tests included in this table. Details on the data sources are included in the notes of Table 3. This table also includes results using the inverse hyperbolic sine transformation (IHS) of the sum of the value of household labor used on each Target Plot for each robustness test (even columns). In the *ITT* Panel, we run an ANCOVA regression of the outcome on treatment dummies (see Equation (4) in the paper). In the *TOT* Panel, we instrument dummies for whether the respondent took up the treatment in any of the four seasons with the treatment assignment (see Equation (5) in the paper). We cluster standard errors by the target plot. *p<0.1, **p<0.05, ***p<0.01.

Table E.4: Robustness: Value of Hired Labor

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ITT								
Rental Subsidy	3.0	0.08	3.3	0.17	3.7*	0.19	3.7	0.13
	[2.1]	[0.16]	[2.1]	[0.16]	[2.1]	[0.16]	[2.1]	[0.14]
Cash Drop	1.8	0.06	1.9	0.08	3.0	0.13	3.0	0.07
	[2.1]	[0.15]	[2.1]	[0.15]	[2.1]	[0.15]	[2.0]	[0.13]
p-value Rent = Cash Paid	*0.60*	*0.88*	*0.53*	*0.57*	*0.75*	*0.69*	*0.75*	*0.64*
TOT								
Rental Subsidy Paid	4.1	0.11	4.5	0.23	5.1*	0.27	4.4	0.16
	[2.7]	[0.19]	[2.8]	[0.20]	[2.8]	[0.20]	[2.8]	[0.19]
Cash Drop Paid	1.8	0.06	1.9	0.08	3.0	0.13	2.0	0.03
	[2.0]	[0.13]	[2.0]	[0.13]	[2.0]	[0.13]	[2.0]	[0.13]
p-value Rent = Cash Paid	*0.38*	*0.75*	*0.32*	*0.37*	*0.43*	*0.44*	*0.34*	*0.44*
Mean Y in Control Group	22.7	IHS	22.7	IHS	22.7	IHS	22.7	IHS
Controls	Main	Main	Only Size	Only Size	None	None	PDS	PDS
Observations	1,957	509	1,957	509	1,957	509	1,957	509

Notes: The table reports treatment effects on the value of hired labor used on the Target Plot, as well as several robustness tests. Appendix Table E.1 details the different robustness tests included in this table. Details on the data sources are included in the notes of Table 3. This table also includes results using the inverse hyperbolic sine transformation (IHS) of the sum of the value of hired labor used on each Target Plot for each robustness test (even columns). In the *ITT* Panel, we run an ANCOVA regression of the outcome on treatment dummies (see Equation (4) in the paper). In the *TOT* Panel, we instrument dummies for whether the respondent took up the treatment in any of the four seasons with the treatment assignment (see Equation (5) in the paper). We cluster standard errors by the target plot. *p<0.1, **p<0.05, ***p<0.01.

Table E.5: Robustness: Harvest Value

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ITT										
Rental Subsidy	32.4***	0.28**	34.1***	0.29**	37.6***	0.32**	33.9***	0.24*	32.7***	0.25**
	[10.4]	[0.12]	[10.3]	[0.13]	[10.8]	[0.12]	[10.0]	[0.11]	[10.6]	[0.12]
Cash Drop	12.7	0.10	14.9	0.12	23.5**	0.18	15.13*	0.06	17.0*	0.07
	[9.4]	[0.13]	[9.4]	[0.13]	[10.2]	[0.13]	[9.0]	[0.11]	[9.9]	[0.13]
p-value Rent = Cash Paid	0.06	0.18	0.07	0.18	0.22	0.27	0.07	0.11	0.16	0.16
TOT										
Rental Subsidy Paid	44.3***	0.39***	46.6***	0.41***	51.3***	0.44***	44.5***	0.33**	44.7***	0.35**
	[13.7]	[0.15]	[13.6]	[0.15]	[14.0]	[0.15]	[13.7]	[0.15]	[13.9]	[0.15]
Cash Drop Paid	12.7	0.10	14.9	0.12	23.3**	0.17	13.2	0.06	17.0*	0.07
	[9.1]	[0.11]	[9.1]	[0.12]	[9.8]	[0.12]	[9.0]	[0.11]	[9.6]	[0.11]
p-value Rent = Cash Paid	0.01	0.04	0.01	0.04	0.04	0.05	0.01	0.05	0.04	0.04
Mean Y in Control Group	96.3	IHS	96.3	IHS	96.3	IHS	96.3	IHS	96.3	IHS
Controls	Main	Main	Only Size	Only Size	None	None	PDS	PDS	Unresolve	Unresolve
Observations	1,957	509	1,957	509	1,957	509	1,957	509	1,957	509

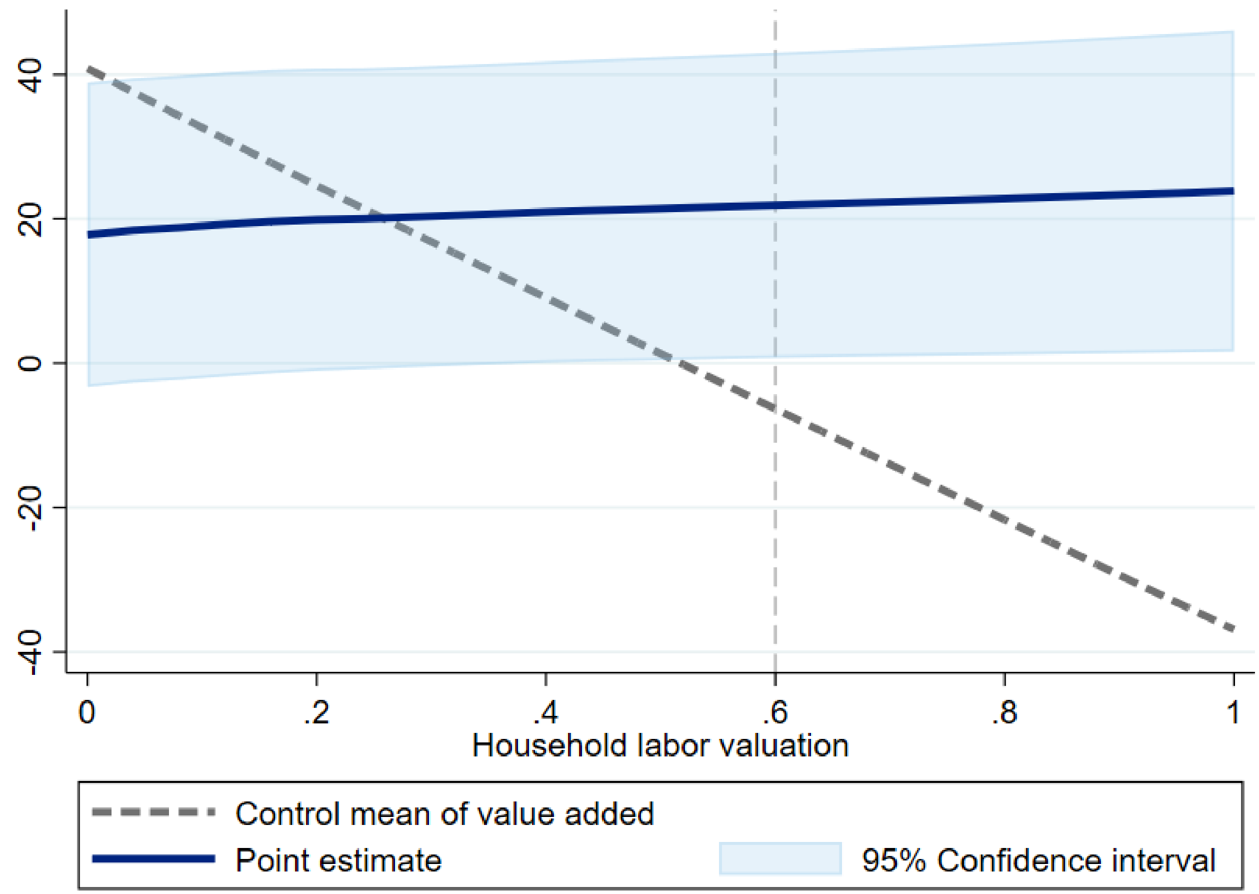
Notes: The table reports treatment effects on the value of harvest on the Target Plot, as well as several robustness tests. Appendix Table E.1 details the different robustness tests included in this table. A test controlling for unresolved harvest (see Section 3.4 in the paper), in addition to the core controlled variables, is included in this table (cols. 9 and 10). Details on the data sources are included in the notes of Table 3. Results using the inverse hyperbolic sine transformation (IHS) of the sum of the harvest values from each Target Plot for each robustness test are also included (even columns). In the *ITT* Panel, we run an ANCOVA regression of the outcome on treatment dummies (see Equation (4) in the paper). In the *TOT* Panel, we instrument dummies for whether the respondent took up the treatment in any of the four seasons with the treatment assignment (see Equation (5) in the paper). We cluster standard errors by the target plot. *p<0.1, **p<0.05, ***p<0.01.

Table E.6: Robustness: Value Added

	(1)	(2)	(3)	(4)	(5)
ITT					
Rental Subsidy	15.6**	16.2**	17.4**	17.4**	15.1*
	[8.1]	[7.8]	[7.9]	[7.7]	[7.8]
Cash Drop	-0.9	1.4	4.6	4.6	1.6
	[7.1]	[7.2]	[7.3]	[7.1]	[7.2]
p-value Rent = Cash Paid	0.05	0.08	0.13	0.12	0.11
TOT					
Rental Subsidy Paid	21.4**	22.1**	23.8**	11.2*	20.7**
	[10.7]	[10.3]	[10.5]	[10.4]	[10.4]
Cash Drop Paid	-0.9	1.3	4.5	0.3	1.5
	[6.9]	[7.0]	[7.1]	[7.0]	[7.0]
p-value Rent = Cash Paid	0.03	0.04	0.06	0.04	0.06
Mean Y in Control Group	-6.4	-6.4	-6.4	-6.4	-6.4
Controls	Main	Only Size	None	PDS	Unresolve
Observations	1,957	1,957	1,957	1,957	1,957

Notes: The table reports treatment effects on value added for the Target Plot, as well as several robustness tests. Appendix Table E.1 details the different robustness tests included in this table. A test controlling for unresolved harvest (see Section 3.4 in the paper), in addition to the core controlled variables, is also included in this table (col. 5). Details on the data sources are included in the notes of Table 3. In the *ITT* Panel, we run an ANCOVA regression of the outcome on treatment dummies (see Equation (4) in the paper). In the *TOT* Panel, we instrument dummies for whether the respondent took up the treatment in any of the four seasons with the treatment assignment (see Equation (5) in the paper). We cluster standard errors by the target plot. *p<0.1, **p<0.05, ***p<0.01.

Figure E.1: Value Added TOT Coefficients by Household Labor Value



Notes: The figure includes the rental subsidy treatment effect on value added under different valuations of household labor. Valuation refers to how household labor is valued relative to hired labor. A valuation of 0 indicates that household labor is zero, while a valuation of 1 indicates household labor is valued the same as hired labor. Data used to construct the different variables come from follow-up surveys we run at the end of season 1 to 4 with the manager of the Target Plot and are measured in USD. We use a 60% value of houeshold labor throughout the paper, the vertical line inidcates results at this valuation. We winsorize the top and bottom 1% of each variable. To generate the coefficients used in the graph, we run an ANCOVA regression controlling for baseline values of each variable, plot size, survey round dummies and strata dummies. We instrument dummies for whether the respondent took up the treatment in any of the four seasons with the treatment assignment (see Equation (5) in the paper). We cluster standard errors by the target plot.

Table E.7: Robustness: Soil Quality Index

	(1)	(2)	(3)	(4)
ITT				
Rental Subsidy	-0.02	-0.02	-0.02	-0.02
	[0.06]	[0.06]	[0.06]	[0.05]
Cash Drop	0.02	0.02	0.03	0.03
	[0.05]	[0.05]	[0.05]	[0.05]
p-value Rent = Cash Paid	*0.46*	*0.46*	*0.43*	*0.40*
TOT				
Rental Subsidy Paid	-0.02	-0.02	-0.02	-0.03
	[0.07]	[0.07]	[0.07]	[0.07]
Cash Drop Paid	0.02	0.02	0.03	0.02
	[0.05]	[0.05]	[0.05]	[0.05]
p-value Rent = Cash Paid	*0.46*	*0.46*	*0.44*	*0.46*
Mean Y in Control Group	-0.02	-0.02	-0.02	-0.02
Controls	Main	Only Size	None	PDS
Observations	967	967	967	967

Notes: The table reports treatment effects on the soil quality of the Target Plot, as well as several robustness tests. Appendix Table E.1 details the different robustness tests included in this table. Details on the data sources are included in the notes of Table 3. Labratory fixed effects are also included for the results in this table. In the *ITT* Panel, we run an ANCOVA regression of the outcome on treatment dummies (see Equation (4) in the paper). In the *TOT* Panel, we instrument dummies for whether the respondent took up the treatment in any of the four seasons with the treatment assignment (see Equation (5) in the paper). We cluster standard errors by the target plot. *p<0.1, **p<0.05, ***p<0.01.

E.2 Target plot outcomes: Attrition

Table E.8: Attrition across surveys

	S0-2019 LR	**S1-2019 SR**	**S2-2020 LR**	**S3-2020 SR**	**S4-2021 LR**	**S1-4**
	(1)	(2)	(3)	(4)	(5)	(6)
A: Manager Characteristics						
Rental Subsidy	0.01					
	[0.02]					
Cash Drop	0.02					
	[0.01]					
p-value Rent=Cash	*0.26*					
Control Mean	*0.97*					
B: Target Plot Follow-up						
Rental Subsidy		-0.02	-0.01	-0.02	-0.02	-0.02
		[0.03]	[0.02]	[0.03]	[0.03]	[0.02]
Cash Drop		0.03	0.03	0.03	0.03	0.03*
		[0.02]	[0.02]	[0.02]	[0.03]	[0.02]
p-value Rent=Cash		*0.02*	*0.11*	*0.07*	*0.07*	*0.02*
Control Mean		*0.94*	*0.95*	*0.93*	*0.91*	*0.93*
C: Soil Samples						
Rental Subsidy		-0.05**			-0.05*	-0.05**
		[0.02]			[0.03]	[0.02]
Cash Drop		-0.00			0.02	0.01
		[0.02]			[0.02]	[0.02]
p-value Rent=Cash		*0.03*			*0.01*	*0.00*
Control Mean		*0.98*			*0.94*	*0.96*
D: Owner Follow-up						
Rental Subsidy		-0.03	-0.04*	-0.06**	-0.06**	-0.05**
		[0.02]	[0.02]	[0.03]	[0.03]	[0.02]
Cash Drop		-0.00	-0.00	0.02	0.02	0.01
		[0.02]	[0.02]	[0.02]	[0.02]	[0.01]
p-value Rent=Cash		*0.15*	*0.06*	*0.00*	*0.00*	*0.00*
Control Mean		*0.98*	*0.98*	*0.97*	*0.94*	*0.97*
Observations	521	521	521	521	521	2,084

Notes: The table reports completion rates across the different data collection activities included in the study. Data in column 1 come from the baseline survey, while data for columns 2-6 come from follow-up surveys we run at the end of season 1 to 4. Soil samples are only collected in seasons 1 and 4, as such the pooled estimate in column 6 only includes 1,042 observations. We run an ANCOVA regression of a completion dummy on treatment dummies and include strata dummies for all columns. Column (6) also includes survey round dummies. We utilize robust standard errors for Columns (1)-(5) and we cluster standard errors by the target plot for column (6). *p<0.1, **p<0.05, ***p<0.01.

Table E.9: Target plot outcomes with Lee Bounds: plot use and crop choice results

	Cultivated	Maize	Commercial
	(1)	(2)	(3)
ITT			
Rental Subsidy	0.06*** [0.02] 0.05** [0.02] 0.06*** [0.02]	-0.01 [0.03] -0.02 [0.03] -0.01 [0.03]	0.07*** [0.02] 0.07*** [0.02] 0.09*** [0.02]
Cash Drop	0.06*** [0.02] 0.09*** [0.02] 0.06*** [0.02]	0.05* [0.03] 0.08*** [0.03] 0.04 [0.03]	0.02 [0.02] 0.03 [0.02] -0.00 [0.02]
p-value Rent = Cash	*0.91* *0.05* *0.98*	*0.05* *0.00* *0.14*	*0.03* *0.06* *0.00*
TOT			
Rental Subsidy Paid	0.08*** [0.03] 0.06** [0.03] 0.08*** [0.03]	-0.02 [0.04] -0.02 [0.04] -0.01 [0.04]	0.10*** [0.03] 0.09*** [0.03] 0.12*** [0.03]
Cash Drop Paid	0.06*** [0.02] 0.09*** [0.02] 0.06*** [0.02]	0.05* [0.03] 0.08*** [0.03] 0.04 [0.03]	0.02 [0.02] 0.03 [0.02] -0.00 [0.02]
p-value Rent = Cash	*0.46* *0.27* *0.38*	*0.08* *0.01* *0.17*	*0.01* *0.02* *0.00*
Mean Y in Control Group	0.82 0.83 0.82	0.69 0.71 0.69	0.09 0.09 0.07
Observations	1,957 1,914 1,914	1,956 1,913 1,913	1,957 1,914 1,914

Notes: The table reports the bounded treatment effects following Lee (2009), with bounds created for each variable by trimming the top and bottom of the control and cash drop group, as these groups had the lowest attrition. For each cell in the table, results are ordered as following: unbounded, lower bound and upper bound. Details on the data sources and construction of the variables are included in the notes of Table 2. In the *ITT* Panel, we run an ANCOVA regression of the outcome on treatment dummies, controlling for baseline values of the outcome, plot size, survey round dummies, and strata dummies (see Equation (4) in the paper). In the *TOT* Panel, we run an ANCOVA regression with the same controls, but we instrument dummies for whether the respondent took up the treatment in any of the four seasons with the treatment assignment (see Equation (5) in the paper). We cluster standard errors by the target plot. *p<0.1, **p<0.05, ***p<0.01.

Table E.10: Target plot outcomes with Lee Bounds: inputs and output results

	Value of Inputs		Value of Household Labor		Value of Hired Labor		Harvest Value		Value Added	Soil Index
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ITT										
	10.1*** [3.4]	0.24** [0.11]	-2.1 [2.5]	-0.02 [0.11]	3.0 [2.1]	0.08 [0.16]	32.4*** [10.4]	0.28** [0.12]	15.6* [8.1]	-0.02 [0.06]
Rental Subsidy	9.2*** [3.4]	0.20** [0.11]	-2.8 [2.5]	-0.08 [0.11]	2.8 [2.1]	0.03 [0.16]	31.0*** [10.5]	0.21* [0.12]	11.8 [7.7]	-0.03 [0.06]
	10.9*** [2.8]	0.27** [0.11]	-0.6 [2.3]	0.00 [0.11]	4.4** [1.8]	0.10 [0.16]	34.4*** [8.2]	0.30** [0.13]	17.8*** [6.5]	0.01 [0.06]
	3.5 [2.9]	0.14 [0.11]	3.2 [2.6]	0.07 [0.12]	1.8 [2.1]	0.06 [0.15]	12.7 [9.4]	0.10 [0.13]	-0.9 [7.1]	0.02 [0.05]
Cash Drop	4.2 [2.9]	0.24** [0.10]	4.7* [2.7]	0.19* [0.10]	2.9 [2.1]	0.16 [0.14]	15.7 [9.6]	0.24** [0.11]	7.7 [6.8]	0.05 [0.06]
	-0.0 [2.1]	0.11 [0.11]	-0.3 [2.3]	0.04 [0.12]	-0.9 [1.6]	-0.01 [0.15]	-0.9 [5.9]	0.06 [0.13]	-11.8** [4.9]	-0.00 [0.05]
	0.05	*0.34*	*0.05*	*0.45*	*0.60*	*0.89*	*0.06*	*0.17*	*0.05*	*0.46*
p-value Rent = Cash	*0.13*	*0.70*	*0.00*	*0.01*	*0.97*	*0.38*	*0.15*	*0.80*	*0.61*	*0.17*
	0.00	*0.12*	*0.93*	*0.73*	*0.00*	*0.46*	*0.00*	*0.07*	*0.00*	*0.74*
TOT										
	13.9*** [4.5]	0.34** [0.13]	-2.9 [3.3]	-0.03 [0.14]	4.1 [2.7]	0.11 [0.19]	44.3*** [13.7]	0.39*** [0.15]	21.4** [10.7]	-0.02 [0.07]
Rental Subsidy Paid	13.5*** [4.5]	0.26** [0.12]	-3.6 [3.3]	-0.10 [0.13]	3.4 [2.7]	-0.02 [0.19]	42.3*** [13.6]	0.31** [0.14]	16.2 [10.3]	-0.04 [0.07]
	15.1*** [3.7]	0.38*** [0.13]	-0.8 [3.1]	0.00 [0.14]	6.0*** [2.3]	0.14 [0.19]	47.2*** [10.7]	0.41*** [0.15]	24.5*** [8.6]	0.02 [0.07]
	3.6 [2.8]	0.14 [0.10]	3.2 [2.6]	0.07 [0.11]	1.8 [2.0]	0.06 [0.13]	12.7 [9.1]	0.10 [0.11]	-0.9 [6.9]	0.02 [0.05]
Cash Drop Paid	4.1 [2.9]	0.23*** [0.08]	4.9* [2.6]	0.21** [0.09]	2.5 [2.0]	0.12 [0.12]	15.8* [9.3]	0.25*** [0.09]	7.7 [6.6]	0.05 [0.05]
	0.0 [2.1]	0.11 [0.10]	-0.3 [2.2]	0.04 [0.11]	-0.9 [1.5]	-0.02 [0.13]	-1.0 [5.7]	0.06 [0.11]	-11.8* [4.8]	-0.00 [0.05]
	0.01	*0.08*	*0.05*	*0.43*	*0.38*	*0.77*	*0.01*	*0.04*	*0.03*	*0.46*
p-value Rent = Cash	*0.02*	*0.79*	*0.01*	*0.01*	*0.72*	*0.40*	*0.04*	*0.66*	*0.39*	*0.18*
	0.00	*0.01*	*0.88*	*0.75*	*0.00*	*0.36*	*0.00*	*0.01*	*0.00*	*0.72*
	33.0		46.1		22.7		96.3		-6.4	-0.02
Mean Y in Control Group	33.6	IHS	46.9	IHS	23.1	IHS	98.0	IHS	-1.2	0.00
	29.4		43.5		20.0		83.7		-16.5	-0.07
	1,957	509	1,957	509	1,957	509	1,957	509	1,957	967
Observations	1,914	498	1,914	498	1,914	498	1,914	498	1,914	946
	1,914	498	1,914	498	1,914	498	1,914	498	1,914	946

Notes: The table reports the bounded treatment effects following Lee (2009), with bounds created for each variable by trimming the top and bottom of the control and cash drop group, as these groups had the lowest attrition. For each cell in the table, results are ordered as following: unbounded, lower bound and upper bound. Details on the data sources and construction of the variables are included in the notes of Table 3. In the *ITT* Panel, we run an ANCOVA regression of the outcome on treatment dummies, controlling for baseline values of the outcome, plot size, survey round dummies, and strata dummies (see Equation (4) in the paper). In col. (10), we also control for laboratory fixed effect. In the *TOT* Panel, we run an ANCOVA regression with the same controls, but we instrument dummies for whether the respondent took up the treatment in any of the four seasons with the treatment assignment (see Equation (5) in the paper). We cluster standard errors by the target plot. *p<0.1, **p<0.05, ***p<0.01.

E.3 Target plot outcomes: Additional results

E.3.1 Individual inputs

Table E.11: Target plot outcomes: inputs

	Inputs		Seeds			Compost		Inorganic			Pesticide		Ox-Plough	Tractor
	Value	IHS	Use	Value	IHS	Use	Value	Use	Value	IHS	Use	Value	Use	Use
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
ITT														
Rental Subsidy	10.11***	0.24**	0.05**	7.63***	0.34***	-0.04**	-0.43	0.07**	2.07	0.12	0.02*	0.20	0.03	0.00
	[3.43]	[0.11]	[0.02]	[2.27]	[0.11]	[0.02]	[0.35]	[0.03]	[1.48]	[0.13]	[0.01]	[0.19]	[0.03]	[0.01]
Cash Drop	3.53	0.14	0.06**	3.59*	0.27**	0.00	0.29	0.02	0.29	0.02	0.01	-0.01	0.05*	-0.01
	[2.89]	[0.11]	[0.02]	[1.91]	[0.11]	[0.02]	[0.37]	[0.03]	[1.40]	[0.12]	[0.01]	[0.17]	[0.02]	[0.01]
p-value Rent = Cash Paid	*0.05*	*0.33*	*0.68*	*0.07*	*0.52*	*0.02*	*0.06*	*0.06*	*0.21*	*0.40*	*0.23*	*0.24*	*0.61*	*0.61*
TOT														
Rental Subsidy Paid	13.93***	0.34**	0.06**	10.45***	0.47***	-0.05**	-0.59	0.10***	2.84	0.17	0.03*	0.27	0.04	0.00
	[4.48]	[0.13]	[0.03]	[2.97]	[0.13]	[0.02]	[0.47]	[0.04]	[1.94]	[0.15]	[0.02]	[0.25]	[0.03]	[0.02]
Cash Drop Paid	3.57	0.14	0.06**	3.59*	0.27***	0.00	0.29	0.02	0.29	0.02	0.01	-0.01	0.05*	-0.01
	[2.80]	[0.10]	[0.02]	[1.84]	[0.10]	[0.02]	[0.36]	[0.03]	[1.36]	[0.11]	[0.01]	[0.16]	[0.02]	[0.01]
p-value Rent = Cash Paid	*0.01*	*0.08*	*0.79*	*0.01*	*0.08*	*0.01*	*0.05*	*0.01*	*0.13*	*0.26*	*0.12*	*0.19*	*0.96*	*0.65*
Mean Y in Control Group	33.02	IHS	0.81	13.07	IHS	0.14	2.18	0.63	16.06	IHS	0.06	0.59	0.45	0.05
Observations	1,957	509	1,957	1,957	509	1,957	1,957	1,957	1,957	509	1,957	1,957	1,957	1,957

Notes: The table reports treatment effects on the inputs used on the Target Plot. The inputs variable (used in cols. 1 and 2), is a composite of seeds, compost, inorganic fertilizer and pesticide. The value of each input, the transformation of the value and the dummy for use on the Target Plot are included in the table. IHS outcomes for compost and pesticides are not included as many plots did not use either input. Use of inputs is not included as results largely mirror cultivation rates, shown in Table 2. Details on the data sources are included in the notes of Table 3. In the *ITT* Panel, we run an ANCOVA regression of the outcome on treatment dummies, controlling for baseline values of the outcome, plot size, survey round dummies, and strata dummies (see Equation (4) in the paper). In the *TOT* Panel, we run an ANCOVA regression with the same controls, but we instrument dummies for whether the respondent took up the treatment in any of the four seasons with the treatment assignment (see Equation (5) in the paper). We cluster standard errors by the target plot. *p<0.1, **p<0.05, ***p<0.01.

E.3.2 Results by stratum

Table E.12: Target plot outcomes by strata: plot use and crop choice

	Cultivated	Maize	Commercial
	(1)	(2)	(3)
Panel A: Strata C			
ITT			
Rental Subsidy	0.01	-0.08**	0.07**
	[0.02]	[0.03]	[0.03]
Cash Drop	0.00	-0.03	0.01
	[0.02]	[0.04]	[0.03]
p-value Rent = Cash Paid	*0.77*	*0.25*	*0.05*
TOT			
Rental Subsidy Paid	0.01	-0.11**	0.10**
	[0.03]	[0.05]	[0.04]
Cash Drop Paid	0.00	-0.04	0.01
	[0.02]	[0.04]	[0.03]
p-value Rent = Cash Paid	*0.72*	*0.11*	*0.02*
Mean Y in Control Group	0.92	0.80	0.10
Observations	1,289	1,288	1,288
Panel B: Strata NC			
ITT			
Rental Subsidy	0.14***	0.08	0.07*
	[0.05]	[0.05]	[0.03]
Cash Drop	0.16***	0.18***	0.04
	[0.05]	[0.05]	[0.03]
p-value Rent = Cash Paid	*0.59*	*0.08*	*0.31*
TOT			
Any Rental Subsidy Paid	0.19***	0.12*	0.09**
	[0.06]	[0.06]	[0.04]
Any Cash Drop Paid	0.16***	0.18***	0.03
	[0.05]	[0.05]	[0.03]
p-value Rent = Cash Paid	*0.60*	*0.35*	*0.12*
Mean Y in Control Group	0.62	0.50	0.07
Observations	668	668	668

Notes: The table reports treatment effects on agricultural outcomes in the Target Plot for plots that were planned to be cultivated (Strata C) and plots that were not planned to be cultivated (Strata NC) in the first studied season (see Section 3.3 in the Paper for more details on the stratification). Details on the data sources and construction of the variables are included in the notes of Table 2. In the *ITT* Panel, we run an ANCOVA regression of the outcome on treatment dummies, controlling for baseline values of the outcome, plot size, survey round dummies, and strata dummies (see Equation (4) in the paper). In the *TOT* Panel, we run an ANCOVA regression with the same controls, but we instrument dummies for whether the respondent took up the treatment in any of the four seasons with the treatment assignment (see Equation (5) in the paper). We cluster standard errors by the target plot. *p<0.1, **p<0.05, ***p<0.01.

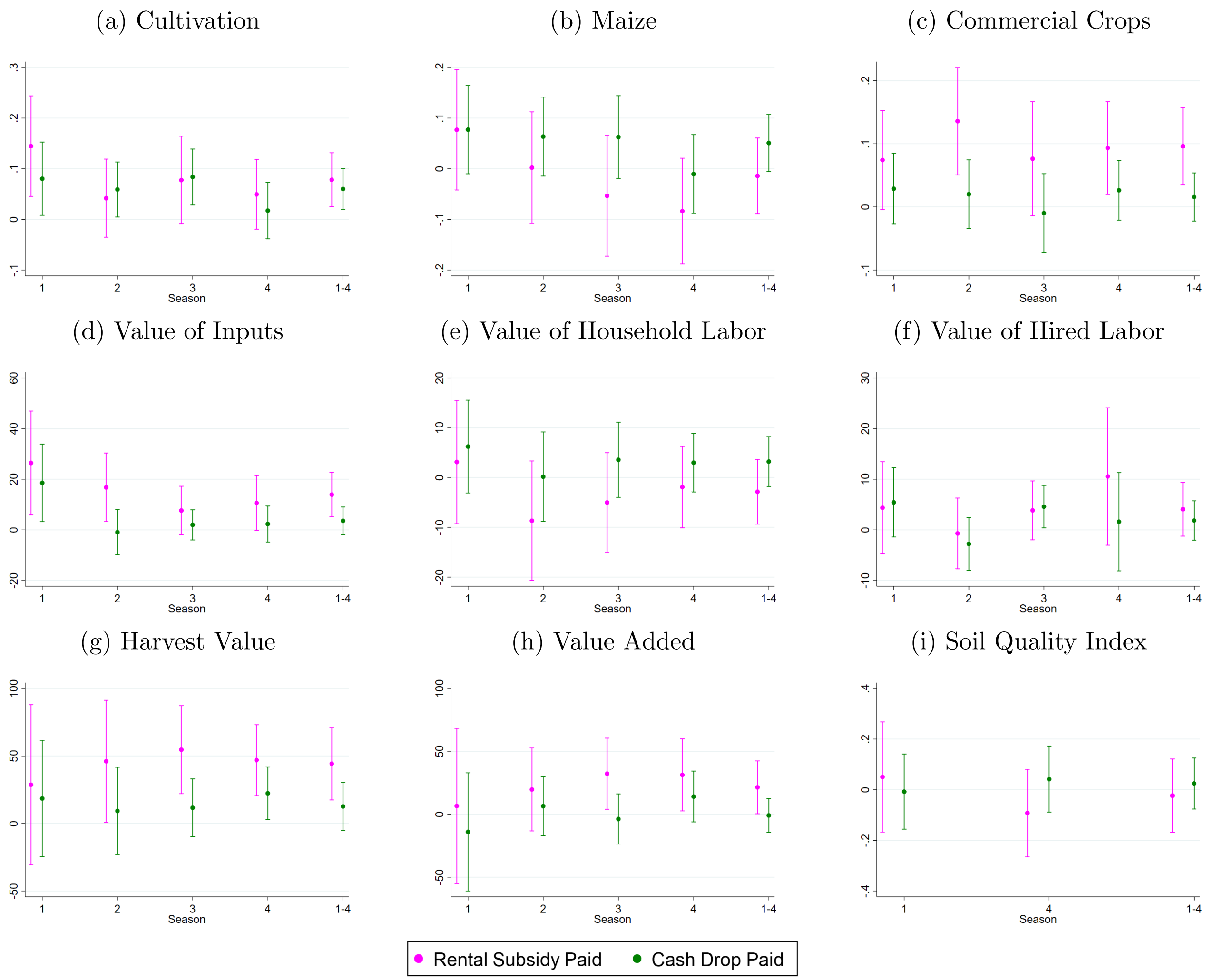
Table E.13: Target plot outcomes by strata: inputs and output

	Value of Inputs		Value of Household Labor		Value of Hired Labor		Harvest Value		Value Added	Soil Index
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: Strata C										
ITT										
Rental Subsidy	10.7**	0.16	-7.2**	-0.14	2.8	-0.02	30.9**	0.17	15.9	0.02
	[4.4]	[0.12]	[3.0]	[0.11]	[2.7]	[0.19]	[12.6]	[0.12]	[9.8]	[0.07]
Cash Drop	4.8	0.11	-3.6	-0.13	1.0	-0.05	17.6	0.01	9.7	0.06
	[3.3]	[0.12]	[3.0]	[0.13]	[2.6]	[0.17]	[11.2]	[0.13]	[9.1]	[0.07]
p-value Rent = Cash Paid	*0.16*	*0.66*	*0.26*	*0.96*	*0.51*	*0.86*	*0.30*	*0.22*	*0.54*	*0.60*
TOT										
Rental Subsidy Paid	14.9***	0.22	-9.9**	-0.19	3.9	-0.03	42.4***	0.25*	22.0*	0.03
	[5.7]	[0.15]	[4.1]	[0.14]	[3.5]	[0.24]	[16.4]	[0.15]	[13.1]	[0.09]
Cash Drop Paid	5.0	0.11	-3.7	-0.13	1.0	-0.05	18.0	0.01	9.9	0.06
	[3.2]	[0.11]	[2.9]	[0.11]	[2.5]	[0.15]	[11.0]	[0.12]	[9.0]	[0.06]
p-value Rent = Cash Paid	*0.06*	*0.37*	*0.11*	*0.65*	*0.39*	*0.90*	*0.11*	*0.10*	*0.33*	*0.71*
Mean Y in Control Group	34.5	IHS	53.1	IHS	23.7	IHS	103.0	IHS	-9.4	-0.01
Observations	1,289	335	1,289	335	1,289	335	1,289	335	1,289	640
Panel B: Strata NC										
ITT										
Rental Subsidy	9.6*	0.38	6.7	0.18	3.5	0.18	43.1**	0.49	21.4	-0.10
	[5.3]	[0.25]	[4.6]	[0.28]	[3.3]	[0.31]	[19.3]	[0.30]	[14.6]	[0.11]
Cash Drop	1.8	0.18	15.5***	0.44	4.2	0.25	11.1	0.29	-16.7	-0.04
	[5.3]	[0.24]	[4.8]	[0.28]	[3.5]	[0.28]	[16.8]	[0.29]	[11.2]	[0.09]
p-value Rent = Cash	*0.13*	*0.40*	*0.09*	*0.36*	*0.84*	*0.81*	*0.10*	*0.51*	*0.01*	*0.57*
TOT										
Rental Subsidy Paid	13.3*	0.51*	9.5	0.25	4.9	0.24	59.1**	0.65**	31.0*	-0.13
	[7.0]	[0.28]	[6.3]	[0.32]	[4.4]	[0.35]	[25.3]	[0.33]	[20.0]	[0.13]
Cash Drop Paid	1.7	0.18	15.5***	0.44*	4.2	0.25	10.4	0.28	-17.1	-0.04
	[5.0]	[0.19]	[4.6]	[0.23]	[3.3]	[0.23]	[15.9]	[0.24]	[10.6]	[0.08]
p-value Rent = Cash	*0.06*	*0.16*	*0.33*	*0.50*	*0.86*	*0.98*	*0.04*	*0.22*	*0.01*	*0.43*
Mean Y in Control Group	30.1	IHS	32.8	IHS	20.8	IHS	83.7	IHS	-0.6	-0.05
Observations	668	174	668	174	668	174	668	174	668	327

Notes: The table reports treatment effects on agricultural outcomes in the Target Plot for plots that were planned to be cultivated (Strata C) and plots that were not planned to be cultivated (Strata NC) in the first studied season (see Section 3.3 in the Paper for more details on the stratification). Details on the data sources and construction of the variables are included in the notes of Table 3. In the *ITT* Panel, we run an ANCOVA regression of the outcome on treatment dummies, controlling for baseline values of the outcome, plot size, survey round dummies, and strata dummies (see Equation (4) in the paper). In col. (10), we also control for laboratory fixed effect. In the *TOT* Panel, we run an ANCOVA regression with the same controls, but we instrument dummies for whether the respondent took up the treatment in any of the four seasons with the treatment assignment (see Equation (5) in the paper). We cluster standard errors by the target plot. *p<0.1, **p<0.05, ***p<0.01.

E.3.3 Results by season

Figure E.2: TOT Coefficient Plots: plot use, crop choice, inputs and output



Notes: These figures present the estimated TOT effects on the Target Plot. In each graph, the marker identifies each TOT coefficient with bars showing the 95% confidence interval around each coefficient. For details on how each estimate is generated, see Table 2 for the cultvation and crop choice results and Table 3 for the inputs and output results.

E.3.4 TFP

Table E.14: TFP results & robustness tests

	Core	Strata C	Alternative Calibrations		
	(1)	(2)	(3)	(4)	(5)
ITT					
Rental Subsidy	4.69**	5.02*	7.59*	4.62**	4.19**
	[2.23]	[2.58]	[4.08]	[2.11]	[1.73]
Cash Drop	0.89	1.40	0.59	1.09	1.49
	[1.99]	[2.42]	[3.67]	[1.89]	[1.53]
p-value Rent = Cash Paid	*0.10*	*0.18*	*0.10*	*0.11*	*0.14*
TOT					
Rental Subsidy Paid	6.08**	6.59**	9.83*	5.98**	5.43**
	[2.79]	[3.28]	[5.09]	[2.64]	[2.16]
Cash Drop Paid	0.91	1.44	0.62	1.11	1.51
	[1.93]	[2.37]	[3.56]	[1.83]	[1.48]
p-value Rent = Cash Paid	*0.05*	*0.10*	*0.06*	*0.05*	*0.06*
Mean Y in Control Group	16.89	16.92	34.52	16.47	12.80
Land Share	.53	.53	.61	.391	.18
Labor Share	.43	.43	.26	.419	.46
Observations	1,621	1,142	1,621	1,621	1,621

Notes: The table reports treatment effects on the TFP of the Target Plot. The construction of the TFP variable is detailed in Section 7.3 of the Paper. The table includes our core specification of TFP (col. 1), a specification restricted to Strata C (col. 2), and a range of alternatively calibrated TFP based on different factor shares (col. 3-5). Observations are restricted to farmers reporting a positive harvest value and labor quantity. TFP is calibrated against factor shares estimated in Gollin and Udry (2021) for Uganda (col. 1 and 2) and Tanzania (col. 3). Restuccia and Santaeulalia-Llopis (2017) include factor shares for Malawi and Valentinyi and Herrendorf (2008) for the U.S., which are used in column 4 and column 5 respectively. In the *ITT* Panel, we run an ANCOVA regression of the outcome on treatment dummies, controlling for baseline values of the outcome, plot size, survey round dummies, and strata dummies (see Equation (4) in the paper). In the *TOT* Panel, we run an ANCOVA regression with the same controls, but we instrument dummies for whether the respondent took up the treatment in any of the four seasons with the treatment assignment (see Equation (5) in the paper). We cluster standard errors by the target plot. *p<0.1, **p<0.05, ***p<0.01.

E.3.5 Soil sample analysis

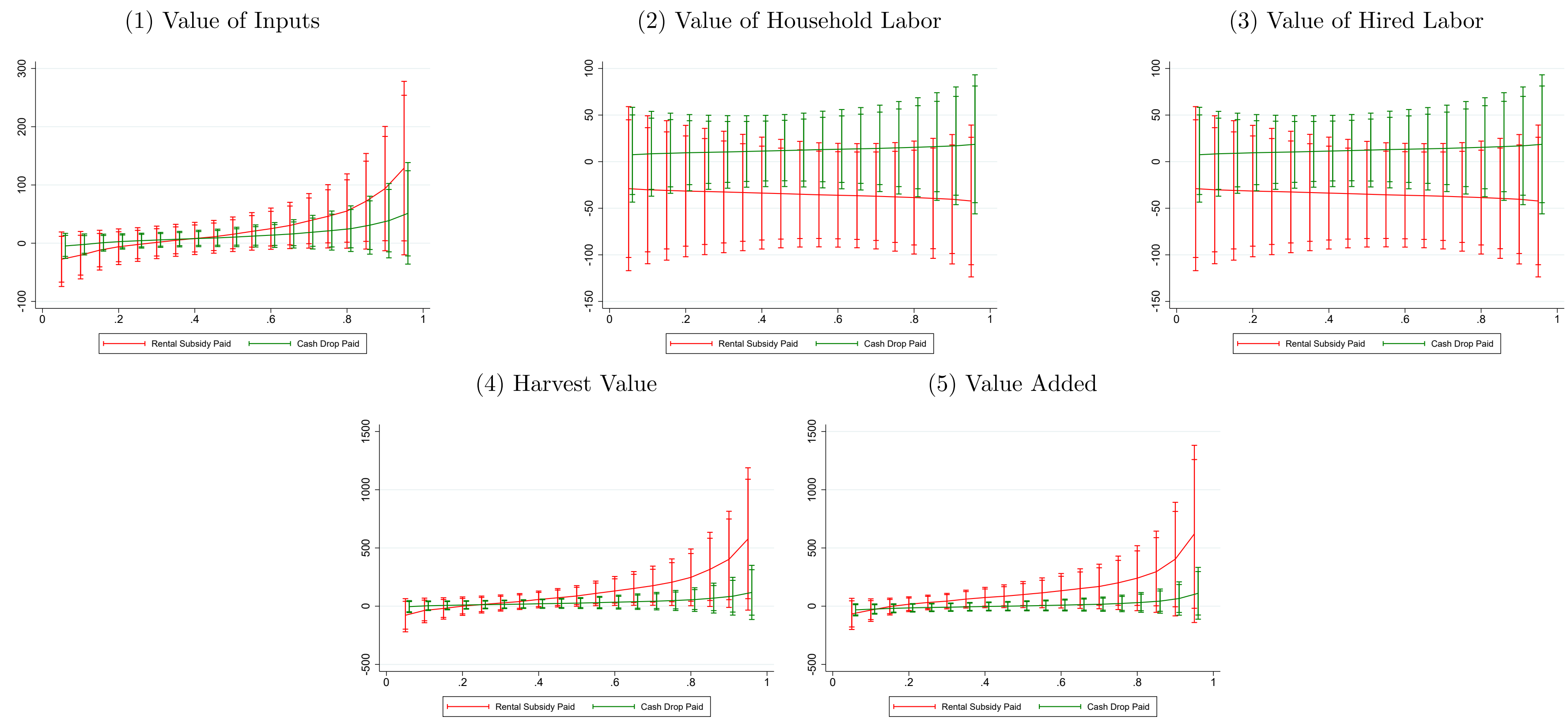
Table E.15: Additional soil quality results

	Index	Nitrogen	Potassium	Phosphorus	Organic Carbon	pH
	(1)	(2)	(3)	(4)	(5)	(6)
ITT						
Rental Subsidy	-0.03	-0.02	-0.14	-0.21	0.06	-0.04
	[0.06]	[0.05]	[0.21]	[1.26]	[0.64]	[0.04]
Cash Drop	0.01	-0.07*	0.20	1.15	-0.18	0.08*
	[0.05]	[0.04]	[0.22]	[1.31]	[0.59]	[0.04]
p-value Rent = Cash Paid	*0.39*	*0.19*	*0.11*	*0.29*	*0.69*	*0.00*
TOT						
Rental Subsidy Paid	-0.05	-0.03	-0.19	-0.29	0.09	-0.05
	[0.07]	[0.06]	[0.27]	[1.60]	[0.82]	[0.04]
Cash Drop Paid	0.02	-0.07*	0.20	1.16	-0.18	0.08**
	[0.05]	[0.04]	[0.20]	[1.23]	[0.56]	[0.04]
p-value Rent = Cash Paid	*0.35*	*0.33*	*0.10*	*0.32*	*0.71*	*0.00*
Endline Round	1&4	1&4	1&4	1&4	1&4	1&4
Mean Y in Control Group	-0.02	1.39	5.87	21.65	22.50	5.58
Observations	986	986	986	986	986	986

Notes: The table reports treatment effects on agricultural outcomes in the Target Plot. The soil index in column (1) comes from two rounds of soil testing that we conducted at the end of season 1 and 4. The index combines the standardized versions of the 5 additional variables included in the table (nitrogen, potassium, phosphorus, organic carbon and pH value). The index is standardized against the control group. In columns (2)-(6) we winsorize the top 1%. In column (1) we winsorize the top and bottom 1%. In the *ITT* Panel, we run an ANCOVA regression of the outcome on treatment dummies. We control for plot size, laboratory fixed effects, survey round dummies, and strata dummies (see Equation (4) in the paper). In the *TOT* Panel, we run an ANCOVA regression with the same controls, but we instrument dummies for whether the respondent took up the treatment in any of the four seasons with the treatment assignment (see Equation (5) in the paper). We cluster standard errors by the target plot. *p<0.1, **p<0.05, ***p<0.01.

E.3.6 Quantile regressions

Figure E.3: Quantile regression results



Notes: The figure includes the estimated treatment effect results generated from quantile regressions of agricultural outcomes on the Target Plot. Each variable is the total from all four seasons, with only one Target Plot observation used in estimation of the results. Quantiles are spaced .05 p.p. apart. Additional details on the construction of the variables are included in the notes of Table 3. We run an ANCOVA regression controlling for baseline values of the outcome and we instrument dummies for whether the respondent took up the treatment in any of the four seasons with the treatment assignment (see Equation (5) in the paper).