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ABSTRACT

Do land market frictions cause misallocation in agriculture? In a field experiment in Western Kenya, we randomly subsidize owners to rent out land. Transferring cultivation rights to renters increases output and value added on the plots, consistent with imperfect land markets and misallocation, and induced rentals persist after the subsidy ends. Additional analysis provides insights on the magnitude and nature of land frictions—which include search, risks, and learning—and on the sources of gains from trade—which include differences between owners and renters in crop choices, productivity, and financial market constraints, but not in labor constraints.

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1 Introduction

Agriculture is the main income source for most households in Sub-Saharan Africa, yet markets for its key input, land, function poorly. Rental markets operate under many frictions, while rural sales markets remain sparse, despite a recent deepening of land markets in many areas of the continent (Deininger et al., 2017). These barriers to the trade of land have far-reaching consequences for the economic lives of rural households and are often considered a major obstacle to increasing agricultural productivity and to economic development more broadly.

A recent strand of literature, started by Chen et al. (2023), documents wide dispersion in productivity across farmers and argues that improvements in land markets would generate significant output gains, by reallocating land toward more productive farmers. However, measurement error, unobserved land heterogeneity, and other sources of endogeneity pose challenges to such quantifications of misallocation and the corresponding benefits of market-enhancing interventions (see, e.g., Gollin and Udry, 2021). The potential for gains from land reallocation is also intrinsically linked to a large literature on agricultural household models, which uses observational data to test whether endowments and other household characteristics affect farm investments and outcomes (see, e.g., Benjamin, 1992; LaFave and Thomas, 2016).

This paper brings experimental evidence to these debates. We present results from a randomized controlled trial in Western Kenya, offering landowners subsidies to rent out one of their plots, thus inducing marginal land rentals. Our design enables us to identify who selects into rental markets at the margin, and to understand the effects of the experimentally induced land reallocation on investment, output, and productivity on the rented plots: what renters do differently to owners. By fostering a market-driven change in who cultivates the land—the thought experiment implicit in existing work—our experimental design investigates the existence of land misallocation in our study setting. Analyzing rich survey data collected over four agricultural seasons, we consider several mechanisms for misallocation suggested by agricultural household models, including differences across households in technology, productivity, and access to labor and financial markets.

In the experimental setting, land rental markets do operate but imperfectly, as is often the case in Sub-Saharan Africa (Christiaensen, 2017). At baseline, farmers report multiple sources of frictions, including search, land disputes, concerns about soil exploitation, and transaction costs. The rental subsidy paid to landowners —worth approximately 30% of the average rental price in the village and payable for up to three crop seasons (one and a half years) —aims to compensate owners for part of these frictions, and hence to increase the gains from, and the volume of, trade. While induced rentals could increase productive efficiency, it is not a given —the subsidy may induce experimentation, or trades with small frictions but also small productivity gains, or, if too large, may even induce trades with negative gains, as we illustrate in a simple conceptual framework.

In our first main result, we characterize owners and plots that are on the margin of rental market participation. We began the project implementation by listing 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 asked owners about their interest in a subsidy to rent out one additional plot, among those they were not planning to rent out. 16.4% of eligible owners expressed interest in the subsidy, suggesting that, for most owners, the perceived costs of trade were large relative to any perceived gains. Interested farmers mentioned cash needs and a lack of inputs for cultivation as the primary reasons for their interest, and they owned more land and left a higher share of their plots unused, relative to farmers who were not interested. Throughout the paper, we refer to the plot that interested owners chose to be eligible as the *Target Plot*. In terms of selection, they were similar to interested owners' other plots along many observables, but less likely to have been cultivated recently.

After conducting a baseline survey with 521 interested owners, we randomized who was assigned to receive the rental subsidy. In addition to a control group and a 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 led to a large and persistent increase in the likelihood that the Target Plot was rented out. While 23% of owners in the control group rented out the Target Plot, 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. This effect did not displace renting out of owners' other (non-Target) plots, which occurred rarely, and for which we estimate precise zero effects. Moreover, the effect on Target Plot rentals persisted in the fourth and fifth seasons of the study, when rentals were no longer subsidized, with 58% of owners in the rental subsidy group continuing to rent out, 96% of them to the same renter.

To identify treatment effects on agricultural production on Target Plots, we use four follow-up surveys with plot managers, undertaken at the end of each of the four crop seasons following the baseline. Both the rental subsidy and the unconditional cash transfer increased the likelihood that the Target Plot was cultivated, with similar treatment-on-treated effects (+6-8 p.p. from a control mean of 82%). These increases were concentrated in (the randomization stratum of) Target Plots that owners were not intending to cultivate in the first experimental season (36% of the plots).

The rental subsidy had large and significant effects on the value of non-labor inputs on the Target Plot (+$9.2 from a control mean of $31.6), but had no significant effect on labor inputs. In turn, it led to a higher harvest value (+$39.4 from a control mean of $94.1) and value added (+$20.8 from a control mean of $3.2), and these effects were larger than, and significantly different from, those of the unconditional cash transfer to the owner, which were mostly small. We find similar treatment effects, albeit less precisely estimated, when restricting to Target Plots whose owners intended to cultivate them in the first experimental season. Since there was no effect on cultivation rates for these plots, this suggests that treatment effects on the Target Plot were driven in part by intensive-margin adjustments, not only extensive-margin cultivation responses. Soil degradation is a potential cost of more intensive cultivation, and hence a potential source of land market frictions. Two rounds of soil testing show that, by the end of the experimental period, the rental subsidy had a small and non-significant effect on a soil quality index. Taken together, these results point to sizable gains on the Target Plots from the induced rentals, consistent with land market frictions preventing efficient land allocation.

We characterize land frictions in several ways. First, under additional assumptions, we can quantify them: back-of-the-envelope exercises suggest that the (per-acre) value of the rental frictions for rentals induced by the experiment is $40.7-49.4 —larger than the rental price ($33.7) —and that owners bear a large share ($74-95\%$) of these frictions. Second, additional evidence sheds light on potential sources of land market frictions. Search takes time and does not always lead to a match: on average, owners take three weeks to find a renter and 87% of those owners who did not take up the subsidy reported they searched but could not find a renter. Across treatment groups, most rentals occurred within a limited set of relatives and acquaintances: the subsidy did not overcome the costs and risks of searching for renters in a broader pool. The renters in these relatively close circles may be more productive than the owners, but they are unlikely to be the ones with the highest productivity, a point on which we further elaborate below. The subsidy also appears to have fostered experimentation and learning around renting out. For example, owners who rented out the Target Plot updated downwards their beliefs about the associated risks (e.g., land disputes, soil depletion). Interestingly, owners report reduced concerns even if they were to rent to a different renter, suggesting that their learning from experimentation may go beyond the match with a specific renter. Such search and learning frictions both have a fixed cost component and thus could explain the persistence of the rentals induced by the subsidy beyond the experimental seasons.

Guided by the insights of agricultural household models, we explore four mechanisms that may contribute to the gains from rentals on the Target Plots. While our design did not experimentally untangle them, we provide insights by comparing the attributes of owners and renters, and by analyzing treatment effects on additional outcomes. First, differences in production technology, in the form of crop portfolios: households cultivating plots in the rental subsidy group (i.e., mostly, renters) are twice as likely to cultivate cash crops compared to households cultivating plots in the control or cash drop groups (i.e., mostly, owners).[1] Second, productivity: renters are younger and more educated than owners. Household heads of renting households are also more likely to be men. These features are plausibly correlated with productivity, and indeed estimated TFP is higher in the rental subsidy group, though there are several important caveats with this estimation. Third, labor market imperfections: while renters cultivate fewer plots and hence have higher labor-to-land endowment ratios than owners, they use less household labor than owners when cultivating the Target Plot (and the same amount of hired labor). These results are inconsistent with gains from trade from a lower (shadow) price of household labor for renters, though it is certainly possible that both owners and renters are labor constrained. Fourth, financial market imperfections: the cultivation response to the unconditional cash drop suggests that owners were capital constrained. Renters have more experience with financial market participation at baseline, they are able to borrow to rent and cultivate the Target Plot, and they may be able to make larger upfront investments. For instance, they are more likely to use improved seeds, inorganic fertilizer, and pesticides, despite having paid the rent upfront.

Next, we compare our experimental results to approaches that quantify misallocation from land frictions by estimating productivity dispersion across farms and then predicting gains from reallocating land optimally (Chen et al., 2023; Adamopoulos et al., 2022b). The experimentally induced rentals increase revenue by substantially less than the predicted gains from full reallocation (2.9% vs. 128%). While part of this difference is mechanical, as we only subsidized rentals of one plot per owner, another key driver of the difference is that the marginal rentals induced by the subsidy are not those with the largest predicted gains, underlining the importance of the joint distribution of gains and frictions. For the marginal rentals, however, the experimental treatment effects are consistent with the predicted gains (based on baseline productivity of owners and renters), providing support for existing non-experimental studies of misallocation.

In a final set of results, we study the effects of the rental subsidies on the owners of the Target Plots. While renting out the Target Plot could have affected agricultural production on their

[1] Another source of technological change may be land consolidation (Foster and Rosenzweig, 2022; Bryan et al., 2023). However, in our experiment, if anything, renters were more likely to come from different villages and did not manage other plots contiguous to the Target Plot. Therefore, while increasing returns to scale may well be important in our setting, our experiment did not trigger them.

other (non-Target) plots, we do not find meaningful spillovers. The rental subsidy also did not increase non-agricultural economic activity of owners (if anything, we find a small reduction in the number of days of non-agricultural work relative to both the control and cash drop groups, though the result is noisy). In addition, the rental subsidy had no detectable effect on food security, a non-land wealth index, and household finances.

This paper brings experimental evidence to the debate about the potential gains from agricultural land reallocation in developing countries, and the barriers to achieving them. It strengthens the existing empirical evidence, which is based on observational studies (see, among many others, Deininger et al., 2008; Jin and Jayne, 2013), quantitative analyses of misallocation (e.g., Adamopoulos et al., 2022b) or natural experiments based on institutional reforms of land rights (Chari et al., 2021 in China; Chen et al., 2022 in Ethiopia) or land administration (e.g., Beg, 2022).[2] Our experimental approach, inducing land rentals, illustrates the feasibility of RCTs on the important but delicate topic of land leasing. Besides achieving identification under weaker assumptions, one advantage of randomized interventions is that they can foster changes in land managers while holding fixed any other differences which would arise through improved property rights and land administration.[3] Moreover, primary data collection tailored to the experiment can target households and land involved in marginal transactions and illustrate the nuances of the responses to the rentals.

The remainder of the paper is organized as follows. Section 2 describes the study setting. Section 3 presents the conceptual framework and the experimental design. Section 4 presents treatment effects of the rental subsidy on rentals and discusses key features of rental market frictions. Section 5 presents treatment effects on Target Plot outcomes, illustrates sources of gains from trade, and compares experimental estimates with misallocation exercises based on observational data. Section 6 reports treatment effects on Target Plot owners. Section 7 concludes.

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

Agriculture. Agriculture employs over 40% of the national workforce in Kenya. The sector is dominated by small-scale rainfed farming, with smallholders producing approximately 75% of the

[2]Recent papers on rental markets of other factors include Bassi et al. (2022), which shows that rental markets allow small firms in Uganda to increase their effective scale and mechanize production, and Caunedo and Kala (2021), which presents an experiment that subsidizes access to agricultural equipment rental markets in India.

[3]Improved property rights may increase investment and productivity for many reasons beyond fostering gains from trade, including lowering the risk of expropriation, facilitating credit access via the collateral channel and reducing the need for unproductive "guard labor" (see, e.g., Besley, 1995; Besley and Ghatak, 2010; Goldstein et al., 2018; Manysheva, 2022).

country's total food production. In our listing data, covering 7,405 households in Western Kenya (see Section 3.2 for more details), the median plot size 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 March to July/August, and a short rain season from October to December. The main staple crop is maize, while commercial crops include sugarcane, tobacco, and groundnuts. 22% of farmers in our listing data leave at least one of their plots uncultivated (corresponding, on average, to 25% of these farmers' land) and 47% of these farmers do so because they cannot afford inputs.

Property Rights. Since independence in 1963, the government's legal and policy framework of land tenure has fostered private ownership, instead of communal. Today, individual property rights are prevalent in many regions of the country, including in Western Kenya, where we conduct our study. Private property rights are, however, often 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., 2010). On average, farmers in our listing data acquired 84% of the plots they own through inheritance, although some plots are purchased (16%).

Land Rental Markets. Recent work documents that land rental markets operate, albeit sparsely, in many African countries (see, e.g., Ali et al., 2015; Christiaensen, 2017; Deininger et al., 2017). This is also true in Kenya. In our listing data, 4% of households are renting out some land.[5] Rental contracts usually include an upfront cash payment and a rental period of 1 to 2 years, covering 2 to 4 agricultural seasons.[6] The average size of rented plots is 1 acre and the average rental price per acre per season is $32 (median $23). The rental price varies, both within and across villages, with a standard deviation of $31 across villages, suggesting that land markets are not subject to a binding price norm, unlike labor markets in many settings (Kaur, 2019).

While rental markets are active in our context, their functioning is constrained by several factors. At baseline, owners in our experimental sample, which had expressed interest in the rental subsidy, perceive several barriers to renting out: difficulties in 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

[4] All statistics using listing data are based on the subsample of eligible owners, see Section 3.2 for more details.

[5] In our context, as it is often the case, we may underestimate the overall engagement in land rental markets as landowners residing outside the villages may not be captured by our surveys (Deininger et al., 2017). For comparison, in Europe and in the U.S. a substantial proportion of agricultural land is rented – 80% in France, 60% in Germany, 46% in Italy (Vranlen et al., 2021) and 40% in the U.S. (USDA 2017 Census of Agriculture).

[6] A 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, without changing the identity of the plot manager). While widespread in other settings, especially in South Asia, in our setting there is no sharecropping.

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%).[7]

External Validity. Table A.4 reports basic statistics from the LSMS-ISA on household demographics, land rental markets, farm size, and property rights for six countries in Sub-Saharan Africa, together with the corresponding statistics from our setting for comparison. Rental markets are similarly active (4% rent out vs. 0% to 5%). Households own a similar number of plots on average (2.96 vs. 1.7 to 3.0), but the area cultivated is relatively small in our setting (1.8 acres vs. 1.9 to 13.6 acres) and the proportion of land left uncultivated is low but not atypical (8% vs 0% to 30%), consistent with Western Kenya being land constrained.[8]

3 Experimental design

In this section, we describe the experimental design and implementation. To implement the study, and to induce trades in a notoriously complex and sensitive market (United Nations, 2012), we had to make important decisions about critical aspects of the design, such as the identification of potential compliers (of both owners and plots), the timeline and duration of the intervention, the amount of the subsidy, and the conditions for its disbursement. We discuss some of the key trade-offs in these decisions and the rationales for our choices as we describe the study design, including the sample selection, intervention, randomization strategy, data collection, and balance. Figure 1 illustrates the timeline of the field and survey activities.

Before detailing the experimental design, we present a simple conceptual framework to characterize the rentals induced by the rental subsidy. We also draw from insights in agricultural household models to illustrate potential margins along which renters' production may differ from owners', including different technology, productivity, and input market frictions.

3.1 Conceptual framework

To characterize the trades induced by the rental subsidy, we introduce a very simple framework. Denote by Δ the gains from a given rental (i.e., the increase in profits a renter can accrue on the

[7]Experimental evidence from Uganda in Kaboski et al. (2022) suggests that relaxing liquidity constraints may also increase land market transactions.

[8]The proportion of households with a formal certificate or documentation of ownership is relatively high (75% vs. 1% to 38%). However, we only collected this data among owners who expressed interest in renting out a plot for the plot they selected to rent out, and hence the proportion among the broader population and across all plots owned by farmers may be smaller.

land), absent any rental-market frictions. The owner's participation constraint is $p > \pi$, where p is the rental price and π is the profit the owner makes on the plot, and the renter's participation constraint is $\pi + \Delta > p$. With frictionless rental markets, a price exists which satisfies both constraints, and hence a rental occurs, if $\Delta > 0$, i.e., if the gains from the rental are positive.

Now introduce land rental market frictions, denoted by τ. The owner's participation constraint becomes $p - \alpha\tau > \pi$, where α is the share of frictions borne by the owner, and the renter's becomes $\pi + \Delta > p + (1 - \alpha)\tau$. With frictions, a rental thus occurs if $\Delta > \tau$: frictions hamper trades with $\Delta \in (0, \tau]$. Introducing a rental subsidy in this setup, s, rentals then occur if $\Delta + s > \tau$. The marginal trades induced by the subsidy are thus those with $\Delta \in (\tau - s, \tau]$. They would be efficient in a world without rental-market frictions, since $\Delta > 0$, unless the value of the subsidy is too large ($s > \tau$). In Section 5.3, we conduct simple back-of-the-envelope exercises based on this framework to recover the value of land frictions, τ, and the share of frictions borne by the owner, α.

This framework of course makes many simplifying assumptions. One major assumption is that we treat the decision as static. Different sources of land frictions may have different implications regarding dynamics. For example, an owner may bear a search cost to find a renter, but then she would not bear such a fixed cost again if the rental relationship lasts for several seasons. A temporary subsidy could induce these costs to be borne and cause lasting rental relationships. Other frictions, like the risk of land disputes and of soil degradation, may include a per-period component, and owners may update their beliefs over these risks after each season of the rental. While our framework models land frictions τ in a static reduced-form way, we consider implications for dynamics and learning in our empirical analysis (Section 4.4).

The framework above also abstracts from heterogeneity in gains from trade Δ and rental market frictions τ, and the fact that owners may have a choice over multiple potential renters. Denote the owner by i and their potential renters by $j \in J_i$. With perfect land markets, the renter with the highest gains, ie. $\text{argmax}_{j \in J_i} \Delta_{ij}$, would rent the land, so long as those gains are positive. With imperfect land markets, the realized rental will be the one with the largest *net* gains, $\Delta_{ij} - \tau_{ij}$, meaning that the joint distribution of Δ_{ij} and τ_{ij} matters. For instance, if gains and frictions are positively correlated, land may flow towards renters with low frictions, τ_{ij}, even if they are not the renters with the highest potential gains, Δ_{ij}. We discuss the empirical relevance of these considerations in Section 4.4 and 5.4

3.1.1 Agricultural household models and sources of gains from trade

Agricultural household models (Singh et al., 1986; Bardhan and Udry, 1999) are often conceived, at least implicitly, to speak to the consequences of land reallocation, and thus can speak to the potential sources of gains from rentals, Δ. In this class of models, households are endowed with labor and land, they maximize utility from leisure and consumption, they produce (agricultural) output by combining inputs through a production function, and they earn income from the household farm output and from supplying labor and land to the market. Extensions to multi-period settings also introduce wealth endowments and non-labor inputs (see, e.g., Magruder, 2018).

Under these models, with perfect (labor, capital, land) input markets, separation holds and households maximize agricultural profits given market prices, regardless of their preferences or endowments. If input markets are imperfect, however, then who owns a plot, and their preferences and endowments, may matter for how productively it is used. In this case, rentals may foster a reallocation of land toward cultivators who are more productive or face lower input frictions, increasing the productivity of the land.

While a large literature has used observational data to understand market imperfections by studying how household characteristics affect cultivation, inputs and output (see, e.g., Benjamin, 1992; LaFave and Thomas, 2016), our study is the first to experimentally induce a shift in the identity of the cultivating household. We now discuss several such potential sources of differences in agricultural returns among households, and hence potential sources of gains from rentals, as highlighted in agricultural household models. Section 5.2 interprets the effects of the rental subsidy through the lens of these channels and models.

First, households may differ in their *(total factor) productivity*. That is, they may differ in how much output they produce even when combining the same inputs using the same production technology. Features like education, age, experience, and training may affect this parameter. Second, households may differ in their *production technologies*. For the sake of distinguishing between TFP and production technologies, we will think of production technologies as choices of crop portfolio, which is especially important to distinguish from TFP as different crops may vary in their returns to factors and hence the marginal rate of technical substitution between them. Differences in crop choices between owners and renters may reflect different knowledge of production technologies or, as we discuss below, they may be the result of differences in other frictions.

Turning to input constraints, third, households may face different *labor market constraints*. Frictions either when hiring workers on the farm or when supplying labor outside, may result in labor intensity varying across households, even absent other differences. For example, if renters have a higher labor-land ratio than owners (e.g., household size over farm acreage) then their labor intensity may be higher, while if they face lower wedges than owners when supplying labor outside the farm, then their labor intensity may be lower. Fourth, households may face different *financial market imperfections*. When capital constraints bind, households will underinvest in non-labor inputs on their farms. Differences in wealth or in access to finance across owners and renters may thus be another source of potential gains from rentals. In addition, under imperfect insurance markets, households' risk preferences and ability to manage risk may matter. Producers who are less risk adverse or better able to insure may for instance choose more risky or less established crops, which may feature higher levels of uncertainty about the outcomes (e.g., due to learning).

Finally, we discuss predictions on the effects of renting land out when each of the above mechanisms operates individually. If gains from trade arise from differences in TFP alone, then we expect input intensity to increase when a plot is rented out. If gains arise from differences in available technologies (crops) alone, then we would expect the use of at least one of the inputs to increase, and potentially a substitution away from the other (depending on the relative input intensity of the new crop). Turning to input market frictions, if gains arise only because renters face a lower marginal cost of labor, then we might expect labor intensity to increase (and potentially a switch to a more labor-intensive crop); symmetrically with credit market frictions. Naturally, when multiple sources of gains from trade operate concurrently, the predictions become more complex (see, e.g., Jones et al., 2022 for a formal approach).[9]

3.2 Eliciting interest: farmer listing, sample selection, and owner baseline

Listing and eliciting interest. After a small-scale pilot in 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 7,405 plot owners. Each respondent answered a short section on demographics and listed each of their owned plots. For each plot, 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 and the upcoming 2019 Short Rains.

At the end of the listing survey, 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). We provide further details on the rental subsidy in Section 3.3. For ethical considerations, only owners with at least two plots (N=5,350) were eligible for the subsidy. Each of these interested owners was then asked to identify one plot they

[9] As we discuss in Section 3.2, the rental subsidy covered only one plot. Agricultural household models generate predictions on how renting out one plot may affect production choices on other plots cultivated by the owner. We discuss these predictions in Section 6, where we present experimental results on the effects of the treatment on owners, including on owners' other (non-rented) plots.

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.*' At the end of the listing, our enumerators conducted a GPS measurement of the Target Plot.

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. For our research design, it is crucial that we 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. Section 4.1 considers selection, comparing owners interested in the subsidy to those who were not interested and Target vs non-Target Plots.

Sample selection and baseline owner survey. Shortly after the listing and while harvesting of the 2019 Long Rains (the last pre-intervention season) was ongoing, we conducted a baseline household survey with owners who expressed interest in the subsidy during the listing. The experimental design required conducting the randomization and offering the subsidies before the 2019 Short Rains crop season started. Thus, due to time constraints, we attempted to baseline only 767 of 877 interested owners and tracked and interviewed 618 of them (80.5%). After applying basic sample restriction criteria, our final study sample included 521 owners interested in the subsidy (and their Target Plots).[10] 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.[11]

3.3 Interventions: the rental subsidy and the unconditional cash transfer

The main treatment of interest is the rental subsidy. To benchmark it and control for income effects, we also introduced an unconditional cash transfer. We discuss their details below.

Rental subsidy value and duration. Owners randomly selected into the rental subsidy group received the subsidy if they rented out the Target Plot identified in the listing. The rental subsidy was expressed in per-acre terms and was worth approximately 30% of the average rental

[10] Sample restriction criteria included: outliers in plot size, enumerator reporting the wrong subsidy amount to the respondent, owners reporting they had already rented out the plot or that they did not own the plot or that they did not expect to be able to find a renter. Appendix Table A.1 compares listing data for interested owners who were surveyed (and thus entered the study) and those who weren't. The two groups have similar baseline characteristics.

[11] To leave those owners who were subsequently assigned to the conditional subsidy group enough time to find renters, we ran the baseline survey while the 2019 Long Rains harvesting was ongoing. Therefore, we do not have information on harvest amount for that season 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.

price. 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. We collected the average rental price in each village through a brief community survey run before the listing. In most villages, rental prices were between $30 and $40 per acre per season.

We offered the subsidy for up to three crop seasons. As we discuss later (Section 4.3), 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. In the listing, before owners decided whether to express interest for the subsidy, they were informed about the amount of the subsidy per acre per season and the maximum duration (three seasons). Since in multi-season contracts renters usually pay the owner upfront for the entire duration of the contract, we also paid the rental subsidy upfront for all seasons (up to three) in these cases. Payment of the rental subsidy occurred mostly via mobile money, with a handful of payments in cash.

Rental subsidy restrictions and verification. We placed no restrictions on who the plot could be rented out to, beyond it being someone outside of the household of the owner. We did not want to restrict the choice of renter for three reasons: first, so that our matches would be "organic", i.e., close to occurring naturally; second, 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 third, since pilot work suggested rental markets were thin with substantial search costs, limiting 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. Alternative experimental designs that would have provided a renter counterfactual were not feasible for logistical or budgetary reasons.[12] In addition, our individual-level randomization design cannot shed light on general equilibrium effects on rental prices induced by the intervention.

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: we required written confirmation of the rental agreement by the local chief, and we conducted an extensive verification with both the owner and the renter before disbursing the payment. Of course, while these measures plausibly reduced cheating, we cannot claim they eliminated it completely. 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

[12] 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.

(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 4.2 provides more details). The cash transfer payment occurred mostly via mobile money, with a handful of payments in cash.

Randomization. We randomized the 521 study owners into three groups: rental subsidy, unconditional cash transfer, and control. We performed the randomization in five waves, each covering approximately one fifth of the sample. Within each wave, we stratified the randomization by county, intended Target Plot use reported by the owner for the upcoming crop season (66% cultivating vs 34% fallowing or undecided), and plot size group. In 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*. Appendix Table A.2 compares Stratum C vs. Stratum NC, for owner demographic and socio-economic variables, and for Target Plot baseline characteristics. As we discuss in Section 5, breaking down results into these two strata provides insights into the nature of the responses to the rental subsidy.

3.4 Data collection

Our data collection strategy includes an owner baseline survey at the end of the 2019 Long Rains (season 0), a renter baseline survey at the beginning of the 2019 Short Rains (season 1), and follow-up data collection at the end of four crop seasons: 2019 Short Rains (season 1), 2020 Long Rains (season 2), 2020 Short Rains (season 3), and 2021 Long Rains (season 4). We described the owner baseline survey in Section 3.2. Here, we describe the other surveys.

Baseline renter survey. At the beginning of the first experimental season (2019 Short Rains), we collected information on all rentals of the Target Plots. In this season, 212 Target Plots were rented out. We then conducted a survey with each renter, which included similar questions to the baseline owner survey: 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 seasons 1-4, 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.[13] Since large shares of output are not sold, and sizable shares of inputs are not purchased, we compute median prices of each crop and input by crop-season-county and compute the values by multiplying the price by the relevant quantity.[14] Concerning labor, 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.[15] In the follow-up survey at the end of season 4, we collected information on renting out in season 5 by asking about the upcoming season. Due to COVID-19, we conducted phone interviews for the second half of follow-up round 1 and the entire follow-up round 2.

Soil samples. At the end of crop season 1 and crop season 4, 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).

3.5 Randomization balance

Appendix Table A.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 most baseline variables are balanced, a few variables are unbalanced. The control group appears to have higher likelihood of erosion and lower value of inputs to both the rental subsidy and the cash transfer groups.[16] As we discuss in Section 3.7, in the main results we use ANCOVA specifications that control for the value of baseline outcomes and all the results are also robust to post-double selection of controls (Belloni et al., 2014). Finally, the unbalance of a few baseline variables in the control group is not a concern for the comparisons between the rental subsidy and the unconditional

[13] 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 may inflate 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.

[14] In 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. We then contacted the farmer and verified the amount for all but 6% of the plots. In Appendix Table D.5, we show that results on harvest value and value added are robust to controlling for a dummy for non-verified planned harvest. 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.

[15] The value of household labor was obtained by first computing the total number of days worked for each task across household members and then summing across tasks. Days of work performed by household members who are less than 16 years old were assigned a weight of 0.6 (results are robust to alternative weights of child labor). For each task performed, the total number of days worked was valued using 60% of the endline-round-task-specific median wage reported for hired workers across all plots. A similar approach was used for hired labor.

[16] Appendix Tables A.4 and A.5 report balance for stratum C and NC. The unbalance in Target Plot input value is driven by Stratum C (66% of observations), while Stratum NC (34% of observations) has higher value of hired labor in the rental subsidy group.

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% in all surveys and above 95% for most rounds (Appendix Table D.6). 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. We present these bounds when we discuss the experimental results.

3.7 Empirical Strategy

The experimental analysis focuses on treatment effects on rental of the Target Plots, on agricultural production on the Target Plots, and on Target Plot owners' outcomes, including on their other plots. Here, we provide an overview of our empirical strategy. Appendix B presents further details, including all the estimating equations.

First, in Section 4, we use data from follow-up surveys to document the effect of treatments on the likelihood that the Target Plot is rented out:

$$y_{is}^{t} = \beta_0 + \beta_1 RentalSubsidy_i + \beta_2 CashTransfer_i + \delta x_i^0 + \eta_s + \eta^t + \epsilon_i^t, \tag{1}$$

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 baseline values of the outcome variable in the 2018 Long Rains and 2019 Short Rains.

Second, we examine how the treatments affect agricultural production, including cultivation rates, crop choice, input value, harvest value, value added, and soil quality —first for the Target Plot in Section 5 (using four follow-up surveys with the Target Plot Manager), and then in Section 6.1 for owners' other plots (using four follow-up surveys with the Target Plot Owner, reshaped by plot). We cluster standard errors by Target Plot and owners, respectively. For continuous outcomes, we focus on winsorized (1%) outcomes in levels and on the inverse hyperbolic sine (IHS) transformation of the total outcome across rounds.[17] We estimate ITT, which follows closely

[17] 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).

Equation (1), and Treatment on Treated (TOT), where we instrument whether the respondent received any rental subsidy or unconditional cash transfer during the study with the treatment assignment dummies:

$$y_{is}^{t} = \gamma_0 + \gamma_1 Rental\widehat{Subsidy}Paid_i + \gamma_2 Cash\widehat{Transfer}Paid_i + \delta x_i^0 + \eta_s + \eta^t + \epsilon_i^t. \qquad (2)$$

There are two different questions we can answer directly through these TOT coefficients. First, what is the effect of offsetting the rental frictions through the payment of the rental subsidy to the owners? This is given by γ_1 and includes *i)* the effect of the induced rentals, *ii)* an income effect of the subsidy to owners (which may be partly passed through to renters), for both marginal and inframarginal rentals. We note that, since we require the chief to confirm the rental (see Section 3.3), the estimates capture the effects of rentals verified by the chief. 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. When comparing these two coefficients, one should keep in mind that the set of compliers differs between the two treatments. However, as there is essentially perfect compliance in the unconditional cash transfer, the comparison of γ_1 to γ_2 is a lower bound of the effect of the rental subsidy on compliers in this group *controlling for the income effect*, under the plausible assumptions that the income effect on the outcome of interest (e.g., inputs): 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.[18]

Finally, in Section 6.2, we use owner surveys to study treatment effects on their non-agricultural outcomes, including food security, non-agricultural activities, assets, and household finances.

4 Do subsidies increase land rentals?

In this section, we first discuss selection into the experimental sample: which owners are interested in the subsidy, and which plots they choose as Target Plot. Second, we report take up of the treatments. Third, we present treatment effects on the likelihood of renting out the Target Plot and discuss several notable features of the rental agreements. Finally, we discuss what we learn from the results about the nature of land rental frictions.

[18] 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 estimate 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. In Appendix B.2, we discuss how we can bound this effect and we use these bounds for the back-of-the-envelope exercises in Section 5.3.

4.1 Who is on the margin of renting out?

Analysis of listing data allows us to quantify interest for the subsidy. In the listing exercise, 877 of the 5,350 eligible owners (16.4%) expressed interest in the rental subsidy. The main reasons for their interest were needing cash (78%), not having sufficient inputs to cultivate the plot (16%) and being unable to hire sufficient labor to cultivate the plot (15%).

Selection of farmers: interested vs non-interested owners. Table 1 – Panel A shows that, compared to those who did not express interest in the rental subsidy, interested owners owned more land and were more likely to both rent out their plots and to leave them fallow. The results are based on data from the listing exercise, which only collected limited information on demographics and agricultural plots. Interested owners were also more likely to be male and own a phone. There was a small difference in experience of cultivating commercial crops, with interested owners having less experience than their non-interested counterparts.

Selection of plots: Target Plots vs. non-Target Plots. Interested owners were asked to choose the plot for which the rental subsidy would apply — the Target Plot — during the listing exercise. Table 1 – Panel B compares baseline characteristics for Target versus non-Target plots. 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. From the perspective of baseline agricultural use, Target Plots are significantly less likely to be cultivated and more likely to be rented out, both in the 2019 Long Rains and in the 2018 Short Rains. These effects 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 and the average value of hired labor employed on these plots is higher compared to non-Target plots.

4.2 Take up of the treatments

Rental subsidy take up. 70.3% of Target Plot owners eligible for the rental subsidy took it up. Of them, 78% received the rental subsidy for three seasons, 20% for two seasons, and 2% for one season. The two main reasons for incomplete take-up were that owners either could not find a renter (87%) or they decided to cultivate the Target Plot themselves (11%). In Section 4.4, we provide more detail on the steps taken by owners to find renters. Appendix Table C.1 compares baseline characteristics of treatment owners who took up the subsidy vs those who did not. Takers have more education and training, they supply more labor for agricultural and non-agricultural work, own larger Target Plots, use more inputs, and have more access to savings and credit.

There was little churn in renters. 88% of the owners in the rental subsidy group who had rented in season 1 where still renting out in season 3 (the last season in which we provided subsidies), and 97% of these rentals were to the same renter of season 1. Since those renters who rented for multiple seasons typically paid the entire rent at the beginning of the first season, we also paid at the beginning of the first season the rental subsidy for multiple seasons (up to three seasons, even if 8% of the rental agreements had a longer duration).

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 stratum. 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.

4.3 Induced rentals and their characteristics

Treatment effects on Target Plot rentals. 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.2 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 3.2), our intervention still exhibits imperfect compliance. This arises for two reasons. First, some treatment owners did not take up the rental subsidy (see Section 4.2), 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.[19] 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.

Features of the rental agreements. Appendix Table C.3 Column 1 presents several noticeable features of the rental contracts, measured at the beginning of the first experimental season.

[19]There are many potential reasons why some owners in the control group rented out the Target Plot. For example, if the plan reported in the listing was preliminary or if owners began exploring rental opportunities (paying search costs) upon hearing about the possibility of rental subsidies. We cannot disentangle among such explanations but doing so does not matter for our results, nor their interpretation.

The initial contracts for the rentals covered on average 20.6 months (approximately three seasons, in line with the subsidy duration), with a total cash amount of $93.3 (approximately $31 per season). About one-third of the Target Plots were rented out to family members and 62% to neighbors or friends. A fifth of the renters resided in a different village than the Target Plot. Only 16% of the renters had rented the Target Plot before, suggesting that the rental subsidies successfully induced new rentals. Columns 2 and 3 in Appendix Table C.3 compare the rentals in the rental subsidy group (i.e., rentals that were mostly induced by the experiment) with those in other groups (and thus not induced by the experiment). Overall, the Target Plots rented out, rental prices, and the relationships between owners and renters were similar across the two groups, except that those rented out in the rental subsidy group were significantly less likely to have been previously rented out and that renters in the rental subsidy group were significantly less likely to have rented in the Target Plot before.[20] These results thus suggest that the rental subsidies successfully induced new rentals which were comparable to those naturally occurring in this context.

Persistence of Target Plot rentals after the end of the rental subsidies. The treatment effect of rental subsidies on Target Plot rentals persisted after the intervention ended (seasons 4 and 5). The treatment effect is still very large, 34-38 p.p., though smaller than in the intervention seasons. Almost all of these rentals (94%) were with the same renters who managed the plot in seasons 1 to 3. In addition, according to a brief follow-up phone survey we ran in July 2023 (season 9), 80% of the owners who were still renting out the Target Plot in season 4 (2021 Long Rains) reported they were still renting it in season 8 (2023 Long Rains) and 69% of them reported they were still renting it in season 9 (2023 Short Rains).[21]

This persistence suggests that the subsidy may have helped foster long-term relationships between owners and renters by covering fixed search costs or by fostering experimentation, an issue we delve into in Section 4.4. Most 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.

Rentals of non-Target Plots. Increased rentals of Target Plots did not crowd out renting out of other plots owned by the treatment households. Table 6 shows that the rental treatment

[20]Rental prices across groups appear to be similar. However, we cannot experimentally identify pass-through of the subsidy to the renter via a reduction of the rental price: that would require observing the rental price of an equivalent set of rented plots with and without the subsidy, but the subsidy treatment induced many more plots to be rented out.

[21]The July 2023 phone calls targeted: *i)* the 55 owners who rented the Target Plot for the first time during the experiment and who said that they would still be renting out in season 5 to the initial renter found in season 1, reaching 51 of them; *ii)* the 37 owners who did not take up the rental subsidy during our experiment because they could not find a renter, reaching 34 of them.

did not affect the likelihood of renting out non-Target Plots (see Section 6.1 for further details).

4.4 Understanding land rental frictions

In this section, we discuss five key features of land rental frictions, based on the results presented above and on additional findings.

First, for the majority of farmers, the perceived frictions are large relative to the perceived gains from rentals. At baseline, 10% were renting out without a subsidy, and 16% of farmers were interested in the rental subsidy which was worth 30% of the rental price. Relative few owners are on the margin of land market participation.

Second, search takes time and does not always lead to a match. The mean and median time spent searching for a renter was three weeks. Of the 30% of owners in the rental subsidy group who did not take up the subsidy, most (87%) did not because they could not find a renter. The July 2023 phone calls to owners provide further insights into the search process. When asked why they were not renting out the plot before the rental subsidy, 43% said they feared that identifying a suitable renter would take too long. Negotiations with the renter took place in 90% of matches, and the agreed price is substantially lower than the price initially proposed by the owner (KSh 1,115, or 22%, lower on average), though owners report that the negotiations were not "hard".[22]

Third, most of the search is limited to family and acquaintances, consistent with the descriptive statistics in Appendix Table C.3. 68% of the owners asked friends, neighbors, or relatives if they wanted to rent. 64% asked friends, neighbors, or relatives if they knew other people interested in renting. Only 21% asked to spread the word beyond this circle. Among those who found a renter, 24% did so through an intermediary, typically a friend or a relative, whom they did not pay. When asked how they decided that the renter was trustworthy to rent to, in an unprompted open-ended question, 90% mentioned already knowing the renter because they were a friend or a relative. When asked if they knew other people who would be interested in renting their plot, 90% of owners said that they did not. Restricting search in this way may explain why owners often struggle to find a match, and may result in rentals that do not have the highest potential gains from trade, an issue we return to in Section 5.4.

Fourth, the persistence of most induced rentals beyond the subsidy period suggests that frictions have a substantial fixed cost component, in addition to any per-period component. The search activities discussed above are a plausible source of fixed costs. In addition, there may

[22]Additional communication between owners and renters before finalizing the agreement concerns previous plot use (which owners report discussing with renters in 74% of the cases), crops grown (64%), and yields (34%). In addition, a small share of owners makes auxiliary agreements with renters, e.g., about crops grown (4%) and about measures to prevent soil depletion (8%), such as forbidding the use of urea-based fertilizer.

be long-term benefits from experimentation. For instance, while soil exploitation was a concern at baseline, analysis of soil quality data (see Section 5.1) shows little evidence of degradation in soil quality from the rental subsidy. Similarly, no owners who rented out the Target Plot in the rental subsidy group report experiencing land disputes with the renter by the end of our main surveys (season 4), despite it being a concern at baseline. Even in the follow-up calls in season 9, only 4% of owners reported disputes with the renter, more precisely about the terms of the rental payment. These calls also suggest owner learning: among those we could reach, while at baseline 39% were concerned about land disputes potentially arising were they to rent, by season 9 none are still concerned about disputes, if they were to rent to the same renter. Among the same owners, the share concerned about soil depletion also fell from 51% to 24%, and about improper use of fertilizer from 35% to 22%. Interestingly, owners also report lower concerns even in the hypothetical scenario that they were to rent to a different renter, suggesting that owners' learning from experimentation may go beyond the match with a specific renter.[23] As a potential benefit of renting out, owners may also learn about cultivation practices from the renters: when renters grew different crops on the Target Plot than owners previously had, 75% of owners report paying attention to the performance of the new crop on the Target Plot, all think that the renter was successful, and 62% say they would consider growing the crop in the future.

Fifth, there may of course also be learning among renters, for example about their productivity on the Target Plots. Appendix Table C.4 compares the characteristics of rentals which terminate after at most three seasons (the subsidy period) to those which persist for four or more. Revenue and value added on the Target Plot during the three experimental seasons are substantially lower for rentals which terminate, yet this is not reflected in the rental price, which is similar to rentals that persist, pointing to the role of learning about productivity.[24] Does this reflect asymmetric information about plot quality, or learning about match quality? At baseline, soil quality and Target Plot revenue achieved by owners are slightly higher for rentals that persist, but the difference is not significant and substantially smaller than differences in revenues post-renting. This suggests that renters decide whether to continue renting the Target Plot after learning their match-specific productivity, with a limited role for asymmetric information about plot quality.

[23]The shares of contacted owners who reported a concern at baseline but after renting say they would not be concerned even if renting to a different renter are 90% for land disputes, 27% for soil depletion, and 39% for fertilizer.

[24]Rental prices are, however, correlated with baseline characteristics: a one st.dev. increase in baseline revenue per acre increases rental price per acre by 0.1 st.dev (p=0.14) and a one st.dev increase in plot size reduces it by 0.25 st.dev (p<0.001). These correlations are consistent with owners reporting that they communicated with the renter about previous plot use and yields, as discussed above.

5 Treatment effects on Target Plot outcomes

In this section, we discuss the treatment effects on Target Plots and their interpretation. First, we present results on cultivation, inputs, output, and soil quality. Second, we consider mechanisms behind the results, highlighting differences between owners and renters and using insights from agricultural household models to guide the analysis. Third, we quantify land frictions and relate our findings to the existing literature on misallocation in land markets.

5.1 Treatment effects on Target Plot outcomes

Table 2 presents results on the production choices and outcomes on the Target Plot, for the entire sample (Panel A) and then separately for the stratum where owners reported they were planning to cultivate the Target Plot in the first experimental season, Stratum C (Panel B) and the stratum where owners reported they were not planning to cultivate it, Stratum NC (Panel C).

Cultivation. As discussed in Section 2, 8% of land is left uncultivated in the setting according to the listing data. Over the four experimental seasons, 18% of the Target Plots were left uncultivated on average, with a higher rate in Short Rains crop seasons than Long Rains (24% vs 12%). Column (1) shows that both the rental subsidy and the unconditional cash transfer increased the likelihood of cultivation: the TOT coefficients were 8 p.p. and 6 p.p., respectively (from a control mean of 82%). The two effects are statistically indistinguishable. Panels B and C show that the treatment effect on cultivation rates was nil in Stratum C, while it was large in Stratum NC (+16-19 p.p.).

Inputs. For non-labor inputs, the rental subsidy significantly increased the value used on the Target Plot (Columns 2 and 3). The TOT is \$9.2 (s.e.=3.6), from a control mean of \$31.6, in the level specification and 0.33 (s.e.=0.15) in the IHS specification. Panels B and C show that treatment effects are sizable in both stratum C and NC (23% and 46% of the respective control means), across which they are statistically indistinguishable. Since in Stratum C there was no treatment effect on the likelihood of cultivation, the effects in this stratum suggest that changes in input on the Target Plot are driven at least in part by intensive-margin adjustments, not just by the extensive margin responses. Treatment effects for the cash drop are smaller and noisier, though the difference from the rental subsidy coefficients is also noisily estimated (e.g., \$4.0 with a s.e.=3.2 in the level specification)

For labor inputs, treatment effects of the rental subsidy are small and insignificant (Columns 4 and 5). Analysis by stratum suggests a decline in the value of labor in Stratum C (-5.8 from a control mean of 67) and an increase in Stratum NC (+11.9 from a control mean of 45), a heterogeneity plausibly driven by the different treatment effects on cultivation rates across strata. Similar patterns are found in the treatment effects of cash drop, where the effects in Stratum NC are even larger (+18.9).

Output and productivity. The rental subsidy significantly increased harvest value by 39.4 (s.e.=12.5), from a control mean of 94.1 (Column (6)). In the IHS specification of Column (7), the treatment effect is 0.42 (s.e.=0.17). Across strata, treatment effects are similar in levels and larger in Stratum NC when using the IHS specification (0.27 vs 0.68). Treatment effects of the cash drop are smaller and significantly different from those of the rental subsidy. In turn, there is a significant treatment effect of the rental subsidy on value added (col. 8). The TOT is $20.8 (s.e.=9.7), from a control mean of $3.2. The treatment effects of rental subsidy are again similar across strata ($23.1 in Stratum C and $24.6 in Stratum NC). The treatment effect of the unconditional cash transfer is small (TOT -$0.9), insignificant, and differs significantly from the rental subsidy coefficient (the difference is 19.8, s.e.=9.6).[25]

Quantile regressions in Appendix Figure D.1 shed further light on the distributional effects on these outcomes: rental subsidy coefficients become positive around the median and are mostly increasing in percentiles: the treatment effect on harvest value is $23.4 at the median and $132.6 at the 95th percentile (for comparison, the TOT coefficient in Table 2 is $39.4); the treatment effect on value added is 23.9 at the median and $102 at the 95th percentile (for comparison, the TOT in Table 2 is $20.8). For both outcomes, the rental subsidy appears to have a negative effect in the lowest (5th-10th) percentiles. Finally, the difference between rental subsidy and cash drop is large and sizable above the median, though we are somewhat underpowered to detect it.

Encouraging markets which transfer temporary cultivation rights to renters thus results in higher harvest value and value added, suggesting misallocation of cultivation rights, as we discuss further below. The treatment effects on Target Plot outcomes differ from the results of longitudinal studies of rentals 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.[26] Our results are however consistent with recent papers showing that reforms in land rights (Chari et al., 2021; Chen et al., 2022) or in the administration of land

[25] Interestingly, the cash drop appears to have a negative, marginally significant, treatment effect on value added of the Target Plots in Stratum NC. This result is consistent with the idea that in this stratum, the cash drop encouraged owners to cultivate plots that were marginal for them (resulting in an increase in non-labor and, particularly, labor inputs), and thus on which they achieved low value added. In contrast, the rental subsidy induced cultivation by new managers, who were able to obtain positive returns on these Target Plots.

[26] 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.

records (Beg, 2022) improved agricultural efficiency, arguably because they increased the volume of rentals.

Robustness. Appendix D.2 presents several robustness exercises. Table D.4 shows ITT results. Rental subsidy coefficients on cultivation, inputs, harvest value and value added are large and significant, with the magnitude scaled by the first stage (0.7) relative to the TOT estimates in Table 2.

Table D.5 shows that the results on cultivation, inputs, labor, harvest, and value added are robust to alternative specifications where we vary the list of baseline controls, including specifications that have no controls other than strata dummies, that only include plot size as an additional control, and that select controls via post-double-selection (Belloni et al., 2014). TOT coefficients of the rental subsidies remain large and significant across specifications. Rental subsidy TOT coefficients on harvest value and value added are consistently higher than cash drop ones, further assuaging concerns about baseline imbalances discussed in Section 3.5. 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 robust to Lee Bounds (Appendix Table D.7), though the cash drop coefficient on value added (Column 8) becomes larger in the lower bound specification, making the difference between rental subsidy and cash drop noisier.

In the spirit of Rosenzweig and Udry (2020), we also examine treatment coefficients by season, in Appendix Figure D.2. While the coefficients for individual seasons are of course noisier than when pooling them, the effects on harvest value and value added appear to grow over time. We speculate this may be due to renters learning how to better cultivate the Target Plot over time, although other factors, like crop choices or seasonal idiosyncratic shocks, could also be responsible for these trends.

Appendix Figure D.3 shows that the coefficients on value added are stable when using alternative valuations of household labor, though the control mean of value added depends heavily on the valuation choice, in line with the literature (see, e.g., Anagol et al., 2017; Bold et al., 2021).

Soil quality. To fully account for the costs and benefits of renting out, we need to consider changes in soil quality: more intensive cultivation, together with an absence of ownership rights for the renter, could lead to depletion in soil quality. As discussed in Section 3.4, we collected soil results for each Target Plot at the end of seasons 1 and 4. 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 soil index has predictive power: a one s.d. increase in the soil index is associated with an increase in harvest value of 18.5% of the mean.

We present the results in Table D.2. Column (1), which pools together the two seasons, indicate no significant soil quality differences across the treatment and control groups. Additional analysis in Columns (2)-(6) reveals no significant impact on any individual nutrient. Columns (7)-(10) suggest a more negative impact of rental subsidy on soil quality at the end of season 4 and in Stratum NC (where cultivation rates increased), but the coefficients are noisy. Land degradation induced by rentals may indeed increase over a longer time horizon. Interestingly, in interviews conducted four years (eight crop seasons) after the beginning of the rentals, owners, however, reported lower concerns about land degradation on the rented plot, compared to baseline rates (see Section 4.4 for more details).

Summary. This section shows that, for the marginal owners taking up the subsidy, the rental subsidy fostered rentals of the Target Plot, and increased harvest value, value added, and TFP, suggesting misallocation in land. Importantly, since we only collect data for two years, our paper cannot identify the long-term effects of rentals, and both costs and benefits may increase over time. On the one hand, some costs may only kick in at a later stage, like soil quality deterioration or land disputes.[27] On the other hand, benefits in terms of crop choice, investment and output may continue if rental relationships persist, or if owners become more optimistic about the gains from rental markets, or if renters learn how to cultivate the Target Plot over time, points for which Section 4.4 provides some evidence.

5.2 Understanding the gains from rentals

In this section, we leverage the insights of the agricultural household models described in Section 3.1.1 to discuss possible mechanisms behind the results. In the framework, a change in the identity of the cultivator can affect agricultural returns because farmers differ in their production functions, TFP, labor market frictions, and financial market frictions. Our design did not aim to manipulate experimentally these mechanisms. Instead, we examine them by comparing baseline characteristics of owners and renters, and by presenting additional results on Target Plot outcomes. The stratification by the owner's intention of whether to cultivate the Target Plot is key to understand adjustments on the intensive margin of cultivation, as the rental subsidy does not change the likelihood that the Target Plot is cultivated in Stratum C.

[27] For instance, in a study of sugarcane plots in China, Pang et al. (2021) observe degradation in soil quality for plots cultivated with sugarcane for 10 and 30 years.

5.2.1 Technology

In this Section, we consider two possible sources of differences in production function technologies across farmers: crop portfolio and returns to scale from land consolidation.

Crop portfolio. Table 3 shows that the treatment altered the Target Plot's crop portfolio. We focus on two dummies: 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). Panel A presents the full-sample results. Across the four follow-up surveys, the control mean was 0.69 for maize and 0.09 for commercial crops. The rental subsidy increased commercial crop cultivation significantly, by 0.10 (TOT), s.e.=0.03, and it had no effect on maize cultivation. The cash drop, in contrast, increased the likelihood of maize cultivation (0.05), but not of commercial crops. The difference in treatment effects on commercial crop cultivation between the two treatments is significant (0.08, s.e.=0.03).

Panels B and C present results by stratum. The patterns of substitution from maize to commercial crops are particularly transparent in Stratum C, which isolates, as discussed above, effects conditional on cultivation: in this stratum, the rental subsidy reduced cultivation of maize and increased cultivation of commercial crops, while the unconditional cash transfer had no impact. In the NC stratum, both treatments increased the likelihood of both maize and commercial crop cultivation, reflecting the increase in cultivation rates of the Target Plot.

Increased commercial crop cultivation may reflect better knowledge and relative productivity of cash crop cultivation among renters versus owners. Alternatively, if commercial crops require more non-labor inputs, it may result from renters having better access to capital or worse access to labor than owners, and hence choosing a more capital-intensive crop. Put simply, comparative advantage in cash crops may be either technological or due to differential distortions. In the analysis of other mechanisms below, we thus discuss how other factors —such as farmer demographics, labor market constraints, and financial constraints —may lead to different crop choices between owners and renters (and, in turn, to different input intensities).

Returns to scale from land consolidation. We also consider the potential role of economies of scale arising from land consolidation. In principle, rentals may foster land consolidation, by allowing renters to rent in plots that are contiguous to other plots they manage (Foster and Rosenzweig, 2022; Bryan et al., 2023). However, the experimental rental subsidy treatment did not induce land consolidation: renters were more likely to reside in different villages and only 8% of them were managing other plots contiguous to the Target Plots. Hence the improvements in agricultural outcomes are not driven by increasing returns to scale at the plot level in crop production; there may be large gains from consolidation in our setting, but they are not triggered by our intervention.

5.2.2 Productivity

TFP. Appendix Table D.1 examines treatment effects on Total Factor Productivity (TFP) on the Target Plot. 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.[28] In the TOT, the rental subsidy increased TFP by 37% of the mean (+6.5 from a control mean of 16.5), showing that renters have higher unobserved (total factor) productivity. The results are robust when restricting the sample to Stratum C (where there was no effect on the likelihood of cultivation) and when using alternative calibrations.

Manager characteristics: demographics and education. We also explore how, by changing who managed the Target Plot, the rental subsidy changed several plot-manager traits that are plausibly correlated with productivity. To study this question, we use specifications similar to Equation (2), but where the outcome variables are the *baseline* characteristics of the Target Plot's manager in the first experimental season: the treatment may affect these outcomes by changing *who* manages the Target Plot, not the characteristics of a given manager. Effectively, we identify the difference between the renters and the owners, among the rentals induced by the rental subsidy. Appendix B.2.1 presents further details on the estimation of treatment effects on manager characteristics.

Table 4 – Panel A shows that several characteristics are consistent with the idea that, in response to the rental subsidy, more productive managers took over Target Plots. Columns (1) and (2) show that, in response to the rental subsidy, the Target Plot was cultivated by younger and more educated households (a decrease of 5.4 years in the age of the household head, from a control mean of 49, and an increase of 10 p.p. in the likelihood of having completed high school, from a control mean of 0.24). Column (3) shows that the rental subsidy also increased the share of Target Plots cultivated by households with a male household head (+18 p.p. from a control mean of 0.69). Thus, in this setting, rental markets 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

[28] We highlight several important caveats in our study of TFP: i) The assumption of a common production function is particularly problematic in our setting, given that, as we discuss later, 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.

Plot may benefit them. While renting households are younger and more educated, they report that they have similar agricultural experience than the average farmer in the village and are *less* likely to have received agricultural training (-10 p.p. from a control mean of 0.27).

5.2.3 Labor markets

Under imperfect labor markets, owners and renters may make different labor investment decisions depending on the constraints they face in the labor markets (either in hiring labor or in supplying their labor to the market) and on their endowment of land relative to household labor. Additional analysis of the effects of rental subsidy on characteristics of the Target Plot manager and on endline outcomes allows us to provide further insights on the interaction between land markets and labor markets.

Manager characteristics: land and labor. Table 4 – Panel B shows that among Target Plot rentals induced by the rental subsidy, the renters had similar household size as owners at baseline, but they owned 1.3 fewer plots (from a control mean of 3.2) and 1.16 fewer acres of land (from a control mean of 2.16). Renters were also more likely to have rented-in a plot at baseline (+21 p.p. from a control mean of 0.07), although most were new renters. Target Plots in the rental subsidy group were thus managed by households with substantially higher labor-to-land ratios, on average, than those in the other treatment groups.[29]

Household labor. Since renters had fewer other plots to manage and similar household size, one might expect the rental subsidy to induce more household labor on the Target Plot.[30] While this is one of the most natural sources of gains from trade given documented failures of separation, Table 5 (cols 3-4) shows small and non-significant treatment effects of the rental subsidy on household labor in the full sample. There is a *negative* treatment effect in Stratum C (Panel B), showing that, conditional on cultivating the Target Plot, renters use less household labor on it. Panel C shows a positive treatment effect of rental subsidies in Stratum NC, plausibly driven by the increase in cultivation rates. While owners could certainly be labor constrained, these results are inconsistent with the gains from trade coming (exclusively) from decreasing the (shadow) price of labor, in which case we would have observed an increase in labor in rented plots. Instead, the results suggest that renters may face a higher shadow wage of working on the Target Plot. One

[29] Renters also have lower non-land wealth than owners (Table 4 – Panel B). Thus, the rental subsidy induced a shift of land toward land-poorer households and thus reduced inequality in land access, consistent with one strand of the observational literature on land markets (see, e.g., Jin and Jayne, 2013; Chamberlin and Ricker-Gilbert, 2016; Ali et al., 2015; Deininger et al., 2017). However, the observation that renters are younger, more educated, and more likely to be male reveals a nuanced picture of the distributional effects of the subsidies.

[30] This prediction is also related the widely documented inverse relationship between farm size and yields (for a recent review see Gollin, 2019), a result often explained by higher labor intensity on smaller farms.

possible explanation is that, according to Table 4 – Panel B, renters are more likely than owners to live in a different village from the Target Plot (+14 p.p., from a control mean of 0.05).

Columns 5-7 in Table 5 provide further details on the household labor results. We decompose the total number of households days worked on the Target Plot in to three components: i) the number of tasks completed on the plot; ii) the average number of household members working on a task (conditional on completing the task); iii) the average number of days spent on a task per household member (conditional on completing the task). In the full sample (Panel A), plots in the rental subsidy group have a reduction in (ii), the number of household members working on a task. (-0.26 from a control mean of 2.97) and in (iii), the number of days spent on a task (-0.18 from a control mean of 2.65), though these coefficients are not significant at conventional levels. In Stratum C, we observe a significant reduction in the number of completed tasks (- 0.52 from a control mean of 5.97).

Hired labor. Finally, columns 8-9 of Table 5 show that the rental subsidy had small and insignificant treatment effects on hired labor, suggesting that renters face similar labor market conditions when hiring agricultural laborers for the Target Plot. In stratum C, while rental subsidies have a significant negative treatment effect on household labor, they do not affect hired labor. This suggests that the ratio between the (shadow) wage of household labor and the wage for hired labor is higher for renters than for owners. Other differences between renters and owners, induced for example by different TFPs or by cultivation of crops with different labor intensity, would plausibly shift household labor and hired labor in the same direction.

5.2.4 Financial markets

The final channel in the discussion of agricultural household models in Section 3.1.1 is frictions in capital markets: renters may have different access to finance than owners. The positive effect of the unconditional cash transfer on owners' cultivation rates and input use (Table 2, col. 1) is consistent with them facing capital constraints. These effects are especially large in Stratum NC, where 47% of owners reported a lack of inputs as the reason they were not planning to cultivate the Target Plot.

Manager characteristics: financial access. Renters may be more familiar with financial markets and better able to make upfront investments on the Target Plot. Table 4 – Panel C. Column 1, shows that households managing the Target Plot in the rental subsidy group were 16 p.p. more likely to have borrowed in the last 12 months than in the control group (control mean 0.62). This does not include loans to explicitly rent and cultivate the Target Plot: around 20% of the renters obtained such loans throughout the four experimental seasons. There was no significant difference between owners and renters in savings to deal with an emergency expenditure (col. 2).

Inputs. Appendix Table D.3 shows that Target Plots in the rental subsidy group had greater expenditure on seeds, and were more likely to be cultivated with improved seeds, inorganic fertilizer, and pesticides, consistent with the idea that renters may be able to make larger upfront investments on the Target Plot. The positive point estimates on these outcomes in Stratum C (Panel B), while noisier, suggest that the rental subsidies induced an increase in these investments even conditional on cultivation. It is notable that renters spent more than owners on non-labor inputs on Target Plots *despite* having made a large upfront rental payment to owners at the beginning of the first experimental season, often covering multiple seasons.

Risk. Finally, the rental subsidies led to wider dispersion of crop outcomes, as we have shown in the discussion of quantile treatment effects in Appendix D.1.2. This suggests that renters are thus undertaking riskier choices. This may be because they are younger and less risk averse younger or because they are better protected from risk though credit markets or insurance arrangements, however, we do not have data to test these hypotheses.

5.2.5 Summary

Analysis of additional endline agricultural outcomes, and comparison of owners vs. renters at baseline, suggests that the rental subsidies induced gains from trade on the Target Plot through several channels, including increases in productivity, changes in cultivation technologies through crop choices, and differential frictions between owners and renters in financial markets. The evidence suggests interactions among these mechanisms and the results are not consistent with any one of them operating alone (see Section 3.1.1 for a discussion of the predictions in these cases). Differential constraints in labor markets, in contrast, do not appear to drive the gains.

5.3 Quantifying land rental frictions and their incidence, for marginal rentals

Induced rentals increased value added on the Target Plot, yet did not occur without the rental subsidy, suggesting costly land rental frictions. We next apply a revealed preference approach, combining the experimental results and the simple framework from Section 3.1, to quantify these land market frictions (τ) for the marginal rentals induced by the experiment. We perform three back-of-the-envelope calculations, each of which concerns the 16.4% of listed owners who expressed interest in the rental subsidy (as we discussed in Section 4), not the entire population of farmers.

First, did the subsidy induce trades which would have positive gains in a frictionless world? In principle, the experiment could have induced inefficient trades (if $s > \tau$), but the fact that the treatment on treated on harvest value and value added are positive in Table 2 implies that the subsidy induced rentals that should occur absent frictions (i.e., for which $\Delta > 0$). The TOT is also larger than the value of the subsidy ($11.5 per acre per season, paid for three seasons), but this is not sufficient to argue that the subsidy induced welfare gains, since the parties may incur (unobserved) friction costs when transacting.

Indeed, in our second back-of-the-envelope exercise, we bound the value of the average land frictions among marginal rentals via revealed preference. Using estimates of the local average treatment effects of marginal rentals on per-acre value added, we obtain $\tau \in (40.7, 49.4]$, or 120%-146% of the average rental price ($33.7 per acre).[31] Third, we compare value added among marginal renters ($38.7 per acre) to the average rent they pay per season ($33.7 per acre). Plugging these numbers into the owner's and renter's participation constraints suggests that owners bear the majority of any friction costs (i.e., we can bound $\alpha \in [0.74, 0.95]$).[32]

These back-of-the-envelope exercises are speculative at best given the simplicity of the framework. For example, the model is static and thus cannot capture the distinction between fixed and per-period rental transactions. It also features risk-neutral agents, while risk preferences may be an important driver of land market participation both for owners and for renters. In addition, the exercises are limited to four crop seasons. Drawing firmer conclusions would require measuring outcomes for even more subsequent seasons, given that the relationships from the rental agreements persist beyond the four seasons for which we collected data. The positive effects on value added may increase, e.g., if renters learn how to cultivate the Target Plot over time or alternatively the additional activity on Target Plots may begin to impair soil quality.

5.4 Comparing treatment effects to predicted gains from full reallocation

A popular method to quantify the efficiency cost of misallocation from land frictions is to first estimate the dispersion in productivity across farms, and then to predict the gains from fully reallocating land across farms, until its marginal product is equalized (Adamopoulos et al., 2022b). This is a fundamentally different exercise from our experiment, but it is informative

[31] While the discussion earlier in this section suggests a large fixed (vs per-season) component of the friction, we present per-season values of τ for ease of exposition. We use the (lower-bound) estimate of the local average treatment effect of marginal rentals on value added, controlling for the income effect of the subsidy: $40.7 per acre per season, over four seasons (see discussion in Section 3.7 and Appendix B). To make the subsidy value comparable to the value-added results, we compute a measure of subsidy paid per season over four seasons ($11.5*3/4=$8.6). The back-of-the-envelope exercise gives similar results when using treatment coefficients at the 50th percentile, rather than the LATE.

[32] The insights from this exercise depend heavily on the valuation of household labor. We use the benchmark valuation of the household labor at 60% of hired labor (Agness et al., 2022). While the estimated treatment effect is quite stable to alternative valuations, average value added varies substantially (see Appendix Figure D.3). For instance, when valuing household labor at zero, value added among renters is $84 per acre, instead of $38.7.

to compare such a model-based prediction of the gains from full reallocation to our estimated treatment effects of the gains from marginal reallocation. We perform this comparison in two steps. First, we compare the predicted treatment effects of full reallocation to the predicted treatment effects of our induced rentals, using baseline data, to learn whether our induced rentals were those predicted to have the largest gains. Second, for our induced rentals, we compare the predicted effects using baseline data to the treatment effects from the experiment, to evaluate the accuracy of the predictions.

Through several decompositions, the analysis provides further insights into the importance of the cultivation margin in generating gains from trade, as well as the role of differences in productivity between owners and renters. We explain the analysis of this section in detail in Appendix E.

5.4.1 Are marginal rentals those with the largest gains? Comparing induced rentals to full reallocation

Based on baseline measures of land productivity, we compare the predicted effects of full reallocation among our experimental sample to the predicted effects of the actual trades induced by the experiment.[33] We begin by fitting a production function with diminishing returns to land to our baseline data, to estimate productivity for owners and renters in our sample. Appendix Figure E.1 shows wide baseline productivity dispersion among both owners and renters, with the distribution for renters shifted to the right compared to that for owners, suggesting gains from both full reallocation and from the experimental rentals.

To quantify these predicted gains, we use our baseline productivity estimates to simulate the treatment effects of land reallocations. Induced rentals are predicted to increase total revenue by 2.9% —arising from approximately 9% of total land changing management —with the majority (86%) of the gains coming from differences in productivity between owners and renters, rather than diminishing returns to land.[34] Full reallocation, in contrast, is predicted to increase revenue by 128%, in line with large predicted gains in other settings (e.g., Chen et al. 2023).

Given data limitations, the predicted gains from full reallocation are likely biased upwards by measurement error. However, they demonstrate the gulf between the two exercises, driven both by constraints on which rentals our experiment can induce (one rental per owner) and by the

[33] Our experimental sample is the largest set of farmers for which we have baseline agricultural data. This includes farmers who expressed an interest in the subsidy, and the renters that they rent out to. It would also be interesting to compare gains from induced rentals to gains from full reallocation between the universe of farmers in the experimental areas, however, we do not have detailed agricultural data for these other farmers.

[34] We note that diminishing returns are not a fundamental and may arise from several of the mechanisms that we discussed in Section 5. Most commonly, diminishing results are assumed to reflect labor market constraints, arising for instance from agency problems, but they can also reflect capital constraints, for example.

induced rentals not being those with the largest predicted gains. This latter point is important to highlight: if induced rentals were those with the largest predicted gains, a simple back-of-the-envelope calculation predicts gains from full reallocation of *at most* 2.9%/0.09 = 32%, much smaller than the actual prediction of 128%. Presumably, the rentals with largest potential gains also faced very high frictions, pointing to the importance of considering the joint distribution of gains and frictions when interpreting the potential gains from misallocation exercises.

We investigate this difference further by restricting the possible trades in the full reallocation exercise. First, we find that gains from 'full' reallocation remain high (107%) even when we restrict reallocation to only occur within county —a more realistic set of potential trades —showing that the large gains are not driven by a large difference in productivity across counties nor by a handful of very productive farmers. Second, we separate the effect of reallocation conditional on cultivating from the impact of reallocation on cultivation. Predicted gains of reallocation are 49 p.p. higher when explicitly accounting for an increase in cultivation, compared with only allowing reallocation within plots that are cultivated at baseline. However, gains conditional on cultivating are still substantially larger than those of our induced trades, even when scaling by the proportion of land reallocated, showing that the difference between the two exercises is not only driven by cultivation.

5.4.2 Are predicted treatment effects of induced rentals accurate?

For the rentals induced by our experiment, we compare predicted effects on average Target Plot revenue to our experimental treatment effects. The predicted effects, based on baseline productivity, are a 17 to 28% increase in Target Plot revenue, depending on how we translate the farm-level prediction into a prediction for the Target Plot. These predictions are very much in line with the experimental effect, a 34% increase, an encouraging finding for existing studies of land misallocation based on such predicted effects.

To summarize, our induced rentals increase productivity, but by substantially less than the predicted effect of full reallocation. This gap does not arise from inaccurate predictions of the gains from induced rentals, which are consistent with experimental gains. Instead, it appears to arise from which rentals are on the margin (and hence induced): unsurprisingly, as we allowed rentals of only one plot per owner, less land is reallocated than under full reallocation; but equally importantly, marginal rentals are not those with the largest predicted gains, underlining the importance of the joint distribution of gains and frictions.

6 Treatment effects on Target Plot owners

In this section, we study treatment effects on owner outcomes. We use data from follow-up surveys which we undertook with owners regardless of whether they rented out the Target Plot. We focus on two main sets of outcomes: agricultural outcomes on owners' non-Target plots, and non-agricultural outcomes, including labor supply outside the household farm, household assets, food security, and household finance.

To interpret the results, and their implications for the sources of gains from rentals, Δ, we note that agricultural household models discussed in Section 3.1.1 also generate predictions on how renting out one plot may affect production choices on other plots or on other activities off the household farm (see also Jones et al., 2022, which formally explores how access to irrigation on one plot would affect other plots). We highlight three key predictions. First, if input markets (labor and capital) work perfectly, then renting out one plot will not affect input use on other plots. Second, if labor constraints bind, then renting out one plot that would have otherwise been cultivated should decrease the shadow price of labor, and hence increase labor use on other plots or on non-farm businesses (and in turn have a second-order effect on non-labor inputs). Third, rental payments induce a positive income effect for the owners. This effect may enable them to increase input adoption on other plots (e.g., if they were credit constrained) or it may reduce owners' labor supply to other plots or other (non-agricultural) activities, if owners increase leisure time. Therefore, even in the presence of binding input constraints, the income effect may imply households do not allocate extra labor to other plots (and may even decrease it).[35]

6.1 Treatment effects on owners' other plots

Table 6 – Panel A presents treatment effects on owners' other (non-Target) plots. Our data collection strategy enables us to study within-farm spillovers on most, but not all, such plots: we measure agricultural outcomes of non-Target Plots if the owner manages them, but not if she rents them out (because we do not interview renters of non-Target Plots). Therefore, we first report treatment effects on the likelihood that a given non-Target Plot is rented out, and then report treatment effects on other plot outcomes, conditional on the plot not being rented out that season.

[35] To disentangle the effect of freeing up inputs from the Target Plot to other plots and the income effect from receiving rental payments, one would need to predict which Target Plot would have been cultivated if not rented and which one would not have been. In principle, the comparison of Stratum C and Stratum NC may allow some progress, but, in practice, even in Stratum NC, 62% of Target Plots are cultivated in the control group. Thus, we cannot isolate the income effect by looking at this stratum and breaking down the analysis by stratum is not helpful here. Note that this is different from the analysis of Target Plot outcomes in the previous section: there, by focusing on Stratum C, we could isolate the intensive margin responses, i.e., keeping the likelihood of cultivation constant across treatment groups.

Rentals of non-Target Plots. Column 1 shows that neither of the treatments affect the likelihood that owners rent out non-Target Plots: 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 4.3, the Target Plots rentals induced by the rental subsidy do not displace rentals of other plots; total land cultivated by the owner decreases one-for-one with induced Target Plot rentals. Second, rental rates of non-Target Plots being 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.

Agricultural outcomes on non-Target Plots. Columns 2-9 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 part 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, neither the rental subsidy nor the cash drop had sizable effects on cultivation, crop choices, investments, and output in non-Target Plots.

While we do not observe significant reallocations of labor from the Target Plot to other plots in the entire sample, it is still possible owners face labor constraints. For example, due to constraints in supplying labor to the outside market, owners' household labor on their other plots may have had low marginal product. As labor was released from the Target Plot, owners may have then preferred to consume extra leisure, rather than allocate marginal (unproductive) labor on the non-Target plots.

6.2 Treatment effects on owners' non-agricultural outcomes

Labor supply outside the household farm. In Table 6 – Panel B, we consider effects on both agricultural and non-agricultural labor supply. Both treatments have little effect on agricultural labor supply outside of the household farm, as shown in Column 1. Point estimates are less than one person-day over the agricultural season, and standard errors are small, ruling out an economically meaningful effect. However, the rental subsidy has a meaningful effect on non-agricultural labor supply, shown in Column 2, with the TOT point estimate of 10.3 fewer person-days, on a control mean of 38.8 person-days. The TOT point estimate of the cash drop is also negative but smaller and insignificant, at 4.8 fewer person days. This result suggests that the income effect dominates any labor supply effect, such that overall labor supply falls, with no evidence of any effect on structural transformation out of agriculture. Consistent with this, Column 3 shows no meaningful effect on working outside of the village, with a similar null result for migration reported in the appendix.[36]

Therefore, land market participation did not seem to induce structural transformation by untying people from their land (Gottlieb and Grobovšek, 2019; Fernando, 2022): rental subsidies led to no change in working outside of the village or migration, and, if anything, a *decrease* in non-agricultural labor. This contrasts results from papers on land markets and structural transformation in China (see, e.g., Jin and Deininger, 2009, for panel data estimation and Adamopoulos et al., 2022a, for quantitative evaluation) and suggests that, in our setting, marginal owners who rent out land may have more limited opportunities in the non-agricultural sector. In addition, our intervention only subsidized the rental of one plot, for farmers who owned at least two; larger-scale interventions may of course have more transformative effects on owners' livelihoods.

Household assets. Columns 4 and 5 report treatment effects on two sets of assets. First, whether the household owns any livestock (oxen, cow, or bull). Second, the principal component of a standard list of household assets (excluding animals) and amenities, such as radios, televisions, motorbikes, metal roofs, and improved walls. There is no significant effect of the rental subsidy nor the cash drop on either asset measure.

Food security. The rental subsidy induced farmers to rent out one of their plots, reducing their total cultivated land and the amount used to cultivate staple crops. Did this affect their food stocks and food security? 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. During seasons 2-4, the rental subsidy led to a reduction in maize stocks from own production in the last 6 months, consistent with a reduction in production. In Season 1, in contrast, it led to households holding more maize stocks from their own production. Receiving income (rent plus subsidy) early in the season may have reduced the need to sell maize straight away, enabling households to benefit from seasonal price fluctuations (Burke et al., 2018). Alternatively, households may have anticipated having less maize in subsequent harvests when renting out, and thus stored more maize in Season 1 for this future need. We find no effect on whether households experienced hunger episodes in the last six months, as reported in Column 8. The control mean is relatively low, 0.16, and the coefficient on rental subsidy is small, 0.03 (s.e.=0.03), perhaps unsurprisingly given owners' relatively large landholdings and the subsidy being limited to one plot.

[36] The income effect on labor supply has generally been found to be low (see, e.g., Banerjee et al., 2017). Our results suggest that it may be larger among landowners in our sample.

Household Finance. Despite the rental subsidy changing the timing of agricultural income, we do not see meaningful effects of the rental subsidy in the full sample neither on whether the household would have 5k Ksh ($40) to cover an emergency (Column 9), nor on whether it has borrowed in the last 6 months (Column 10).

7 Conclusion

Across much of sub-Saharan Africa, agriculture is the main source of livelihood for the majority of the poor, yet markets for its key input, land, feature many imperfections. Limited land market participation is argued to have important implications for agricultural efficiency and is also central to many other economic aspects of rural life in developing countries. A recent literature argues there are large potential gains from land reallocation toward better farmers, but faces challenges due to measurement error, unobserved land heterogeneity, and other sources of endogeneity.

In this paper, we present experimental evidence on the effects of incentivizing land rentals, based on a randomized controlled trial in Western Kenya. We first show how subsidies induced land market participation at the margin. Approximately 16% of landowners expressed an interest in renting out an extra plot if receiving a subsidy worth around 30% of the average rental rate. The subset of these owners that was randomized into the rental subsidy experienced a large increase in the likelihood of renting out a plot, which persisted after the end of the incentive. Compared to the control group, plots in the rental subsidy group in turn had higher commercial crop cultivation and non-labor inputs. They achieved higher yields and ultimately higher value added. These effects were larger than those of an unconditional cash transfer to plot owners. Rental subsidies have little effects on outcomes of owners who rent out. These results illustrate the importance of land misallocation in cultivation rights in our setting and show that increasing the volume of rentals can increase aggregate land returns.

Where do these gains from land reallocation come from? Guided by the insights of agricultural household models, we explore four potential mechanisms, using baseline data on characteristics of owners and renters as well as rich endline data from multiple seasons. We provide evidence for differences between owners and renters in technology (arising from crop choice), productivity, and financial constraints. Surprisingly, despite owners owning more land than renters, gains from trade do not appear to arise from differences in access to labor, though it is certainly possible that both groups are labor-constrained.

What prevents such efficiency-inducing reallocation from occurring, absent subsidies? Our analysis demonstrates several sources of land market frictions. Owners take several weeks to identify a renter, and often fail to do so. The rental subsidies fostered experimentation and learning, both for landowners and for renters, inducing more optimistic beliefs over the returns from land market participation. Since search and learning have fixed cost components, they could explain the persistence of the rentals beyond the experimental seasons. Finally, rentals mostly occur among relatives and acquaintances, both in naturally occurring rentals and in those induced by the rental subsidy, suggesting high costs and risks from searching and renting in a broader pool. While induced rentals did increase returns to land, they seemingly did not reallocate land toward farmers with the highest productivity. This demonstrates the importance of considering the joint distribution of gains and frictions when considering the practical implications of misallocation exercises: the feasibility of those reallocations predicted to result in large gains is key.

We conclude by highlighting three areas for future work. First, our goal was to induce marginal rentals and study their effects; a subsidy was the natural tool to achieve it. There may of course be more cost-effective ways to improve the functioning of land markets. Further work may aim to study the impact of addressing 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. Second, interventions at scale may have different results, for example through general equilibrium effects. Our experiment is unable to capture such effects (e.g., on rental prices), nor spillovers to renters, and so care should be taken in drawing policy conclusions from it. Future research may aim to measure these effects; doing so would require a substantially different design and larger budget, if addressed experimentally. Third, our experiment induces rentals that are limited in size (< 1 hectare on average) and duration (1-3 years, at least initially). While such rentals, which are in line with other rentals occurring in the study area, are shown to have sizable effects on agricultural production, the experimental exploration of large-scale and long-term leases remains an important area for future research.

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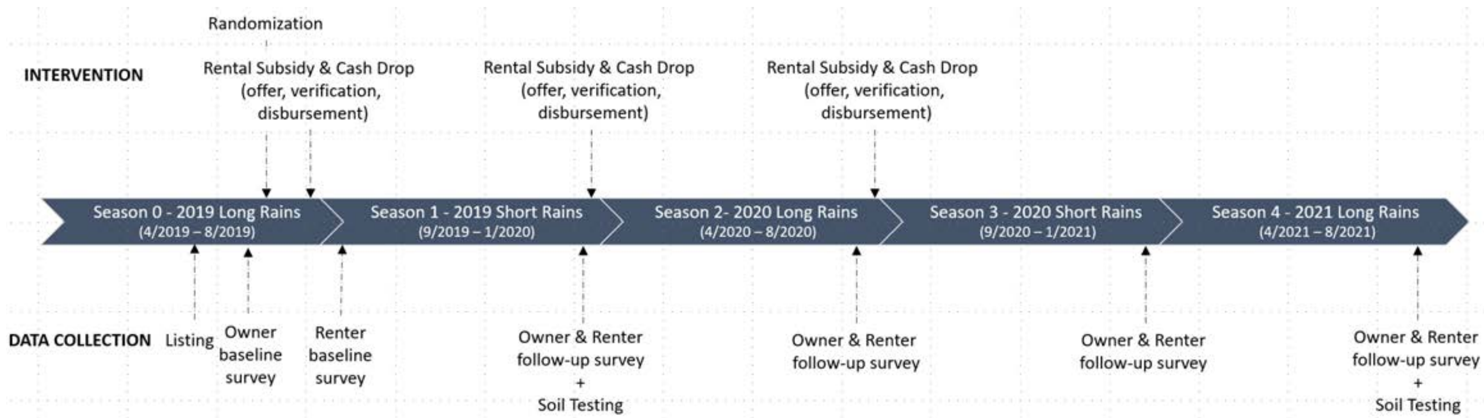
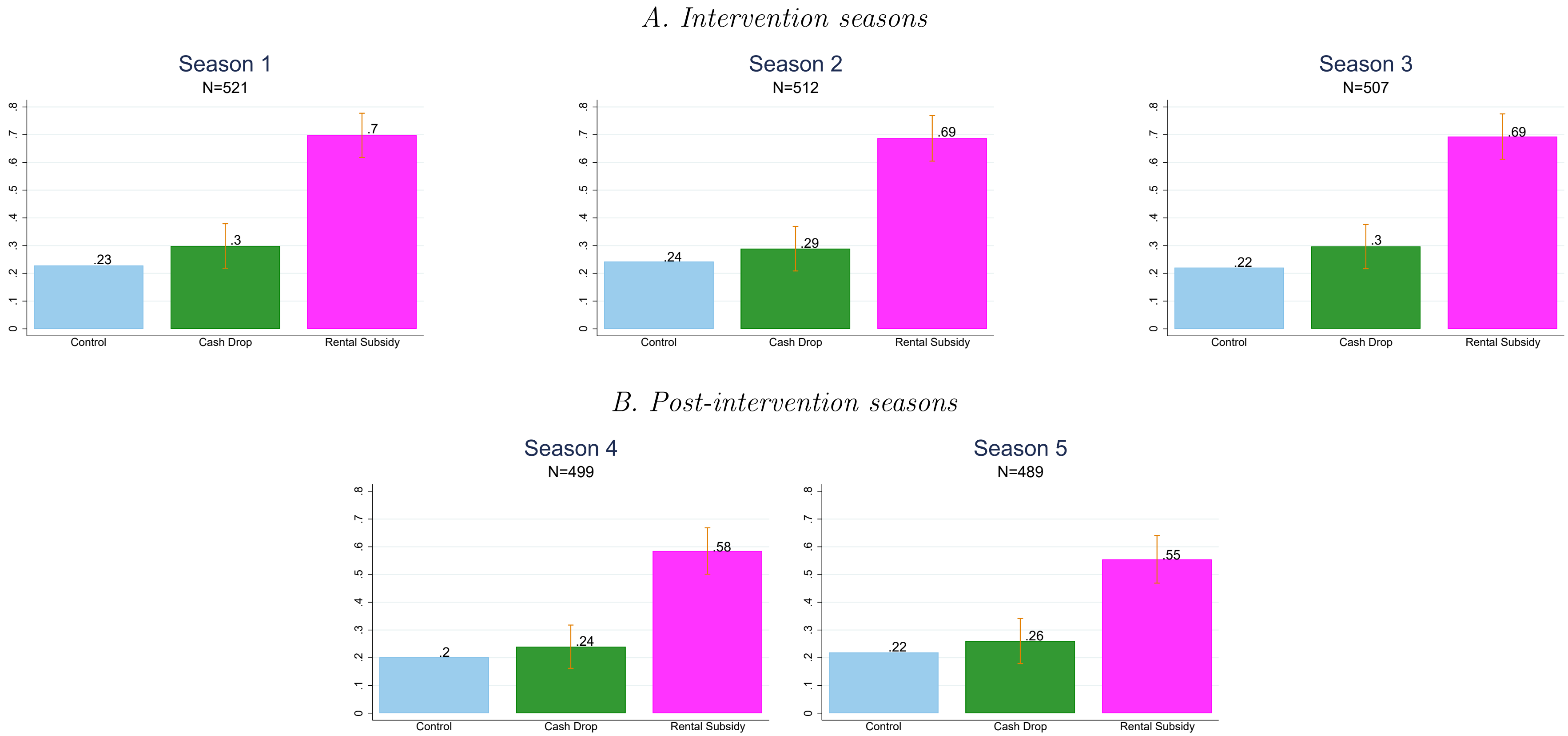
Figures

Figure 1: Timeline of intervention and data collection



Notes: This figure details the key intervention and data collection activities of the study. Activities were conducted within two annual agricultural seasons: the Long Rains and the Short Rains. Season 0 refers to the baseline period, while Seasons 1-4 are the seasons in which we collected follow-up data. We offered the treatments in Seasons 1-3. The dotted arrows show the sequence and timing of activities.

Figure 2: Target Plot Rentals



Notes: The figure reports the proportion of Target Plots rented out by treatment group by agricultural season. The rental subsidy was offered for up to three seasons (seasons 1 to 3). The data comes from the follow-up surveys we ran at the end of seasons 1 to 4 with the manager of the Target Plot. In the last survey round (season 4), we also asked about rentals for the upcoming season 5. In a handful of cases, we gathered information on the rental status of the Target Plot even if we could not complete the full follow-up survey. The number of observations varies by round due to attrition (see Appendix Table D.6) or because information on the rental status in the upcoming season was not available at the time of the survey (for season 5). The bars report 95 percent confidence intervals from a regression of an indicator equal to one if the Target Plot is rented out on dummies for the treatment groups.

Tables

Table 1: Selection of Farmers

(A) Selection of Farmers	Interested in rental subsidy [I]	Not Interested [NI]	[I-NI]	N
Male	0.68	0.62	0.06	5,350
	(0.47)	(0.49)	[0.01]	
Age	50.77	49.44	1.33	5,343
	(14.98)	(15.81)	[0.55]	
Has a phone	0.91	0.83	0.07	5,350
	(0.29)	(0.37)	[0.01]	
No. plots owned	3.50	2.86	0.64	5,350
	(1.33)	(1.05)	[0.04]	
Total acres owned (wins. 1%)	2.62	1.69	0.93	5,350
	(2.10)	(1.55)	[0.07]	
Renting out at least one plot (2019 LR)	0.12	0.03	0.09	5,350
	(0.32)	(0.17)	[0.01]	
No. plots rented out (2019 LR)	0.14	0.03	0.10	5,350
	(0.41)	(0.21)	[0.01]	
At least one plot left uncultivated (2019 LR)	0.37	0.20	0.17	5,350
	(0.48)	(0.40)	[0.01]	
Proportion of land owned left uncultivated (2019 LR)	0.14	0.07	0.07	5,350
	(0.21)	(0.16)	[0.00]	
Proportion of land cultivated w/ cash crops (2019 SR)	0.16	0.21	-0.05	5,350
	(0.25)	(0.31)	[0.01]	

(B) Selection of Plots	Target Plot [TP]	Non-Target Plots [NTP]	[TP-NTP]	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]	
Irrigated	0.06	0.05	0.01	1,898
	[0.23]	[0.22]	[0.01]	
Plot cultivated in 2019 Long Rains	0.60	0.79	-0.19	1,898
	[0.49]	[0.41]	[0.02]	
Plot rented out in 2019 Long Rains	0.12	0.06	0.06	1,898
	[0.32]	[0.24]	[0.01]	
Plot 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 in 2019 Long Rains	32.53	-11.88	45.03	1,897
	[64.12]	[1975.41]	[66.99]	
Value of household labor in 2019 Long Rains	29.27	27.30	1.97	1,042
	[42.64]	[39.90]	[2.42]	
Value of hired labor in 2019 Long Rains	13.0	9.0	4.0	1,041
	[26.6]	[18.5]	[1.2]	
Plot cultivated in 2018 Short Rains	0.54	0.69	-0.15	1,898
	[0.50]	[0.46]	[0.02]	
Plot rented out in 2018 Short Rains	0.10	0.06	0.04	1,898
	[0.29]	[0.24]	[0.01]	
Harvest value in 2018 Short Rains	61.3	75.0	-17.4	1,898
	[144.0]	[228.9]	[9.7]	

Notes: **Panel A** compares the plot owners interested in the rental subsidy against the plot owners who were not interested. The data comes from the listing survey. We report statistics for the owners who owned at least two plots and could thus become eligible for the subsidy if interested (5,350 out of 7,405). *Male* is a binary indicator equal to one if the owner was male. We winsorize *Acres Owned* at the top 1%. *Share of plots cultivated with cash* *crops* is the share of plots on which the owner is cultivating groundnuts, tobacco, or sugarcane. The *[I-NI]* columns are generated by a regression of each outcome on an interested dummy with robust standard errors.

Panel B compares plot characteristics for Target Plots against non-Target plots for the 521 study owners. The data comes from the owner baseline survey: in the study sample, there are 521 Target Plots and 1,377 non-Target plots. *Plot Size* is the reported plot size 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. Values (of agricultural inputs, household labor, hired labor and harvest) are expressed in USD (1 USD = 100 KSh) and winsorized at the top 1%. Since we needed to conduct the baseline survey while the 2019 Long Rains harvesting was ongoing, we do not have information on harvest amount for that season for most of the sample. *Value of agricultural inputs* is the value of any seeds, compost, chemical fertilizer, and pesticides used on the Target Plot. At baseline, we only collect labor variables for one non-Target Plot, hence the lower number of observations. *Value of hired labor* is the number of hired-work days valued at the median reported wage. *Value of household labor* is the number of household-member-work days, valued at 60% of the median reported wage. The difference *[TP-NTP]* is the coefficient from a regression of each outcome on a binary indicator equal to one if the plot is the Target Plot, including owner fixed effects.

Table 2: Target Plot Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Cultivated	Input Value		Labor Value		Output Value		Value Added
(A) Full Sample								
Rental Subsidy Paid	0.08	9.20	0.33	0.45	0.14	39.38	0.42	20.82
	[0.03]	[3.57]	[0.15]	[3.66]	[0.15]	[12.52]	[0.17]	[9.65]
Cash Drop Paid	0.06	5.25	0.17	4.68	0.13	15.37	0.13	1.04
	[0.02]	[2.54]	[0.12]	[3.01]	[0.12]	[8.82]	[0.14]	[6.88]
Rent - Cash	*0.02*	*3.96*	*0.16*	*-4.24*	*0.01*	*24.01*	*0.29*	*19.79*
	[0.02]	*[3.21]*	*[0.13]*	*[3.43]*	*[0.13]*	*[11.81]*	*[0.16]*	*[9.60]*
Mean Y in Control Group	0.82	31.57	IHS	59.40	IHS	94.06	IHS	3.23
Observations	1957	1957	509	1957	509	1957	509	1957
(B) Stratum C								
Rental Subsidy Paid	0.01	8.28	0.18	-5.78	-0.06	39.69	0.27	23.09
	[0.03]	[4.49]	[0.16]	[4.47]	[0.13]	[15.73]	[0.16]	[12.00]
Cash Drop Paid	0.00	4.31	0.09	-2.36	-0.08	18.30	0.01	9.30
	[0.02]	[2.90]	[0.12]	[3.33]	[0.11]	[10.84]	[0.13]	[9.18]
Rent - Cash	*0.01*	*3.97*	*0.09*	*-3.42*	*0.03*	*21.39*	*0.26*	*13.79*
	[0.02]	*[4.08]*	*[0.13]*	*[4.17]*	*[0.12]*	*[14.87]*	*[0.15]*	*[11.88]*
Mean Y in Control Group	0.92	33.88	IHS	66.99	IHS	101.18	IHS	-0.11
Observations	1289	1289	335	1289	335	1289	335	1289
(C) Stratum NC								
Rental Subsidy Paid	0.19	13.54	0.60	11.56	0.46	44.11	0.68	24.66
	[0.06]	[5.63]	[0.35]	[7.22]	[0.41]	[19.70]	[0.39]	[15.81]
Cash Drop Paid	0.16	7.82	0.33	18.95	0.54	14.39	0.36	-14.42
	[0.05]	[4.62]	[0.25]	[5.66]	[0.29]	[14.68]	[0.30]	[9.58]
Rent - Cash	*0.03*	*5.72*	*0.27*	*-7.39*	*-0.08*	*29.72*	*0.32*	*39.08*
	[0.06]	*[5.12]*	*[0.30]*	*[6.96]*	*[0.36]*	*[18.53]*	*[0.36]*	*[16.29]*
Mean Y in Control Group	0.62	27.13	IHS	45.23	IHS	80.18	IHS	9.51
Observations	668	668	174	668	174	668	174	668

Notes: The table reports treatment effects on agricultural outcomes of the Target Plot. The dependent variables in cols. (1)-(8) come from follow-up surveys we ran at the end of seasons 1 to 4 with the manager of the Target Plot. Column (1) reports the treatment effects on an indicator equal to one if the Target Plot is cultivated. The remaining columns (2)-(8) are measured in USD and are equal to zero if the Target Plot is not cultivated. Inputs in columns (2)-(3) include seeds, fertilizer, and chemicals. We obtain their total value by multiplying the quantity of each input used on the Target Plot by its county-round median price and then summing up across inputs. Labor value (cols. 4-5) includes both the values of hired and household labor. We obtain the value of household labor by multiplying the quantity of household labor used for each agricultural task by the county-round median wage for hired labor in that task, then adjusting by a factor of 0.6. The output value (cols. 6-7) is obtained in a similar way, summing across crops. In columns (1), (2), (4), (6) and (8) we pool observations from the four rounds of follow-up surveys. In columns (2)-(7) we winsorize the top 1%, in column (8) we winsorize the top and bottom 1%. In columns (3), (5) and (7), the dependent variable is the inverse hyperbolic sine transformation (IHS) of the sum by Target Plot across the four rounds of the values of the variable. **Panel A** reports results for the full sample. **Panel B** and **Panel C** report results for Stratum C and NC respectively. For each panel we run an ANCOVA regression, instrumenting for whether the plot owner took up the treatment in any of the four seasons with the treatment assignment dummies. We control for baseline values of the outcome, plot size, survey-round dummies, and strata dummies (see Equation (2) in the paper). For cultivation, baseline values are from the 2019 Long Rains and the 2018 Short Rains. For inputs and labor, baseline values are from the 2019 Long Rains; for output values, baseline values are from the 2018 Short Rains; for value added, we control for inputs and labor from the 2019 Long Rains and harvest value from the 2018 Short Rains. *Rent - Cash* reports the difference between the *Rental Subsidy Paid* and *Cash Drop Paid* coefficients and its standard error. We cluster standard errors by Target Plot.

Table 3: Target Plot: Crop Choices

	(1) Cultivated	(2) Maize	(3) Commercial
(A) Full Sample			
Rental Subsidy Paid	0.08	-0.02	0.10
	[0.03]	[0.04]	[0.03]
Cash Drop Paid	0.06	0.05	0.02
	[0.02]	[0.03]	[0.02]
Rent - Cash	*0.02*	*-0.07*	*0.08*
	[0.02]	*[0.04]*	*[0.03]*
Mean Y in Control Group	0.82	0.69	0.09
Observations	1957	1957	1957
(B) Stratum C			
Rental Subsidy Paid	0.01	-0.11	0.10
	[0.03]	[0.05]	[0.04]
Cash Drop Paid	0.00	-0.03	0.01
	[0.02]	[0.04]	[0.03]
Rent - Cash	*0.01*	*-0.07*	*0.09*
	[0.02]	*[0.04]*	*[0.04]*
Mean Y in Control Group	0.92	0.80	0.10
Observations	1289	1289	1289
(C) Stratum NC			
Rental Subsidy Paid	0.19	0.12	0.09
	[0.06]	[0.06]	[0.04]
Cash Drop Paid	0.16	0.18	0.02
	[0.05]	[0.05]	[0.03]
Rent - Cash	*0.03*	*-0.06*	*0.07*
	[0.06]	*[0.06]*	*[0.04]*
Mean Y in Control Group	0.62	0.50	0.07
Observations	668	668	668

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). The data comes from follow-up surveys we run at the end of seasons 1 to 4 with the manager of the Target Plot. We pool observations from the four rounds of surveys. **Panel A** reports results for the full sample. **Panel B** and **Panel C** report results for Stratum C and NC respectively. For each panel we run an ANCOVA regression, instrumenting for whether the plot owner took up the treatment in any of the four seasons with the treatment assignment dummies. We control for baseline values of the outcome in the 2019 Long Rains and 2018 Short Rains, plot size, survey-round dummies, and strata dummies (see Equation (2) in the paper). *Rent - Cash* reports the difference between the *Rental Subsidy Paid* and *Cash Drop Paid* coefficients and its standard error. We cluster standard errors by the Target Plot.

Table 4: Manager characteristics

(A) Demographics and Education	(1) Age	(2) High School	(3) Male	(4) Agri Training	(5) Agri Experience
Rental Subsidy Paid	-5.46	0.10	0.18	-0.10	0.04
	[1.49]	[0.05]	[0.05]	[0.05]	[0.10]
Cash Drop Paid	-1.29	0.04	0.08	0.05	0.10
	[0.89]	[0.03]	[0.03]	[0.03]	[0.06]
Rent - Cash	*-4.17*	*0.06*	*0.09*	*-0.15*	*-0.07*
	[1.42]	*[0.04]*	*[0.05]*	*[0.05]*	*[0.10]*
Mean Y in Control Group	48.98	0.24	0.69	0.27	2.83
Observations	509	509	509	509	509

(B) Land and Household	N. Plots Owned	Acres Owned	Rent in Plot(s)	Household Size	Different Village
Rental Subsidy Paid	-1.29	-1.16	0.21	0.12	0.13
	[0.17]	[0.18]	[0.05]	[0.30]	[0.04]
Cash Drop Paid	-0.12	0.02	0.04	-0.27	0.03
	[0.12]	[0.13]	[0.03]	[0.16]	[0.02]
Rent - Cash	*-1.17*	*-1.18*	*0.17*	*0.39*	*0.11*
	[0.15]	*[0.16]*	*[0.04]*	*[0.27]*	*[0.04]*
Mean Y in Control Group	3.21	2.16	0.07	5.75	0.05
Observations	509	509	509	509	509

(C) Finance	Borrowed	Emergency Savings
Rental Subsidy Paid	0.16	0.04
	[0.05]	[0.03]
Cash Drop Paid	0.02	-0.00
	[0.03]	[0.02]
Rent - Cash	*0.14*	*0.04*
	[0.04]	*[0.03]*
Mean Y in Control Group	0.62	0.85
Observations	509	509

Notes: The table reports treatment effects on the characteristics of the Target Plot manager. The dependent variables correspond to the *baseline* characteristics of the Target Plot manager in the first endline season (2019 Short Rains): the owner if the plot is not rented out (owner baseline survey data) and the renter if the plot is rented out (renter baseline survey data). **Panel A** reports demographic and education characteristics for the plot manager: their age (col. 1), whether they are high school educated (col. 2), their gender (indicator function for male) (col. 3), whether the household head received specific agricultural training in the past 3 years (col. 4) and their assessment of their experience relative to the average farmer in their village on a 5-point scale. **Panel B** reports agricultural and household characteristics: the number of plots owned (col. 1), the sum of self-reported plot sizes across all Non-target plots winsorized at the top 1% (col. 2), an indicator variable equal to one if the manager rents in any plots (col. 3), the number of household members (col. 4) and an indicator for whether the Target Plot was in a different village to their house (col. 4). **Panel C** reports savings and finance: an indicator equal to one if they have borrowed in the last 12 months (col. 1) and if they had enough savings to cover an emergency expenditure of 5,000 Ksh ($50) (col. 2). For each panel we run an ANCOVA regression, instrumenting for whether the plot owner took up the treatment in any of the four seasons with the treatment assignment dummies (see Equation (B.4) in the Appendix). We control for baseline values of the outcome (noting that these will be equal to the outcome itself when the Target Plot is not rented out), plot size and strata dummies. *Rent - Cash* reports the difference between the *Rental Subsidy Paid* and *Cash Drop Paid* coefficients and its standard error. We use robust standard errors.

Table 5: Target Plot: Labor

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total Labor		Household Labor					Hired Labor	
	Value of Household and Hired Labor		Value of Household Labor		Number of Tasks	Average Members	Average Days per Member	Value of Hired Labor	
(A) Full Sample									
Rental Subsidy Paid	0.44	0.14	-2.68	0.03	-0.01	-0.26	-0.18	3.09	0.09
	[3.66]	[0.15]	[2.98]	[0.16]	[0.22]	[0.15]	[0.12]	[2.19]	[0.24]
Cash Drop Paid	4.68	0.13	2.69	0.10	0.28	-0.09	-0.11	1.95	0.07
	[3.01]	[0.12]	[2.31]	[0.13]	[0.16]	[0.12]	[0.09]	[1.62]	[0.16]
Rent - Cash	*-4.25*	*0.00*	*-5.37*	*-0.08*	*-0.29*	*-0.17*	*-0.07*	*1.14*	*0.03*
	[3.43]	*[0.13]*	*[2.82]*	*[0.15]*	*[0.21]*	*[0.15]*	*[0.11]*	*[2.06]*	*[0.21]*
Mean Y in Control Group	59.40	IHS	40.33	IHS	5.27	2.97	2.65	18.58	IHS
Observations	1957	509	1957	509	1957	1680	1680	1957	509
(B) Stratum C									
Rental Subsidy Paid	-5.78	-0.06	-8.53	-0.18	-0.52	-0.28	-0.21	2.87	-0.12
	[4.47]	[0.13]	[3.62]	[0.16]	[0.24]	[0.19]	[0.14]	[2.85]	[0.30]
Cash Drop Paid	-2.36	-0.08	-3.48	-0.14	-0.19	-0.17	-0.18	0.89	-0.12
	[3.33]	[0.11]	[2.67]	[0.12]	[0.17]	[0.14]	[0.11]	[2.00]	[0.19]
Rent - Cash	*-3.42*	*0.03*	*-5.05*	*-0.05*	*-0.33*	*-0.12*	*-0.03*	*1.98*	*0.00*
	[4.17]	*[0.12]*	*[3.42]*	*[0.15]*	*[0.23]*	*[0.18]*	*[0.13]*	*[2.66]*	*[0.26]*
Mean Y in Control Group	66.99	IHS	46.49	IHS	5.97	3.09	2.61	19.74	IHS
Observations	1289	335	1289	335	1289	1186	1186	1289	335
(C) Stratum NC									
Rental Subsidy Paid	11.56	0.46	7.72	0.39	0.82	-0.28	-0.10	3.49	0.33
	[7.22]	[0.41]	[5.80]	[0.40]	[0.46]	[0.29]	[0.30]	[3.39]	[0.45]
Cash Drop Paid	18.95	0.54	13.92	0.53	1.07	0.05	0.04	4.86	0.38
	[5.66]	[0.29]	[4.19]	[0.29]	[0.32]	[0.24]	[0.20]	[2.70]	[0.29]
Rent - Cash	*-7.39*	*-0.08*	*-6.20*	*-0.14*	*-0.25*	*-0.33*	*-0.15*	*-1.37*	*-0.05*
	[6.96]	*[0.36]*	*[5.58]*	*[0.35]*	*[0.40]*	*[0.25]*	*[0.24]*	*[3.31]*	*[0.39]*
Mean Y in Control Group	45.23	IHS	28.50	IHS	3.96	2.63	2.78	16.27	IHS
Observations	668	174	668	174	668	494	494	668	174

Notes: The table reports treatment effects on labor outcomes for the Target Plot. The dependent variables come from follow-up surveys we ran at the end of seasons 1 to 4 with the manager of the Target Plot. The value of household labor in columns (3) and (4) is obtained by multiplying the quantity of household labor used for each agricultural task by the county-round median wage for hired labor in that task, then adjusting by a factor of 0.6. Number of tasks completed (col. 5) is a sum of eight indicators that are equal to one if a production task was completed. These tasks comprise: Land preparation/ploughing, planting, fertilizing, weeding, harvesting, farm-house transportation, house-market transportation, and drying and shelling. Average members (col. 6) and Average days (col. 7) are, respectively, the average number of household members working across each of the eight tasks and the average number of days each household member spent on each task, conditional on the task being completed (hence the lower number of observations). In columns (1), (3), (5), (6), (7), and (8) we pool observations from the four rounds of follow-up surveys. In columns (2), (4) and (9), the dependent variable is the inverse hyperbolic sine transformation (IHS) of the sum by Target Plot across the four rounds of the values of the variable. In all columns, we winsorize the top 1%. Variables in columns (1)-(4) and (8)-(9) are measured in USD. **Panel A** reports results for the full sample. **Panel B** and **Panel C** report results for Stratum C and NC respectively. For each panel we run an ANCOVA regression, instrumenting for whether the plot owner took up the treatment in any of the four seasons with the treatment assignment dummies. We control for baseline values of the outcome from the 2019 Long Rains, plot size, survey-round dummies, and strata dummies (see Equation (2) in the paper). *Rent - Cash* reports the difference between the *Rental Subsidy Paid* and *Cash Drop Paid* coefficients and its standard error. We cluster standard errors by Target Plot.

Table 6: Owner outcomes: non-Target Plots

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(A) Non-Target Plots	Rented Out	Cultivated	Maize	Commercial	Value of Inputs	Value of Household Labor	Value of Hired Labor	Output Value	Value Added	
Rental Subsidy Paid	0.01	0.01	0.01	-0.01	2.00	-0.34	1.39	4.93	0.08	
	[0.01]	[0.02]	[0.03]	[0.01]	[2.35]	[2.32]	[1.17]	[12.14]	[11.03]	
Cash Drop Paid	0.00	-0.00	-0.00	0.01	3.58	0.16	1.11	-3.37	-9.31	
	[0.01]	[0.02]	[0.02]	[0.01]	[1.91]	[1.82]	[0.82]	[9.18]	[8.20]	
Rent - Cash	*0.01*	*0.01*	*0.02*	*-0.02*	*-1.58*	*-0.50*	*0.28*	*8.30*	*9.39*	
	[0.01]	*[0.02]*	*[0.02]*	*[0.01]*	*[2.28]*	*[2.06]*	*[1.10]*	*[12.06]*	*[10.76]*	
Mean Y in Control Group	0.05	0.75	0.47	0.09	24.22	31.81	9.51	109.10	38.96	
Observations	5232	4958	4958	4958	4958	4955	4955	4955	4955	

	Labor Supply			Assets		Food Security			Finance	
(B) Non-Agricultural Outcomes	Other Farms	Non - Agricultural	Worked Outside Village	Owns Livestock	Wealth Index	Maize (S1)	Maize (S2 - S4)	Experienced Hunger	Emergency Liquidity	Borrowed
Rental Subsidy Paid	-0.73	-10.27	-0.02	-0.06	0.05	0.13	-0.08	0.03	-0.03	-0.03
	[2.08]	[5.08]	[0.03]	[0.04]	[0.11]	[0.06]	[0.03]	[0.03]	[0.04]	[0.04]
Cash Drop Paid	0.85	-4.84	-0.03	-0.02	0.07	0.06	-0.03	0.02	-0.01	-0.05
	[1.40]	[3.60]	[0.02]	[0.03]	[0.08]	[0.04]	[0.02]	[0.02]	[0.03]	[0.03]
Rent - Cash	*-1.58*	*-5.43*	*0.01*	*-0.04*	*-0.02*	*0.08*	*-0.05*	*0.00*	*-0.01*	*0.02*
	[1.87]	*[4.37]*	*[0.03]*	*[0.04]*	*[0.10]*	*[0.05]*	*[0.03]*	*[0.03]*	*[0.03]*	*[0.03]*
Mean Y in Control Group	9.15	38.83	0.18	0.64	-0.01	0.71	0.91	0.16	0.31	0.61
Observations	1985	1985	1985	1985	1971	503	1482	1984	1985	1985

Notes: The table reports treatment effects on the owners of the Target Plot. The dependent variables come from follow-up surveys we ran at the end of seasons 1 to 4 with the owner of the Target Plot, regardless of whether the plot was managed by the owner or rented out. We pool observations across seasons. **Panel A** reports agricultural outcomes on the non-Target Plots, using a reshaped plot-level panel. Observations are higher in Column (1) than Columns (2-9) as the rented out analysis is unconditional, while columns (2-9) only include plots that were not rented out. Details on the data sources and construction of the variables are included in the notes of Table 2. Columns (5)-(9) contain missing observations for three plot-seasons on these outcomes. In Columns (5)-(8), we winsorize the top 1%. In Column (9), we winsorize the top and bottom 1%. **Panel B** reports outcomes not relating to the household farm. Columns (1) and (2) are the number of person-days worked in the past season, summed across household members, on non-own-household agricultural work and non-agricultural work respectively. Column (3) is an indicator variable for whether any member of the household worked outside the village. Columns (4) and (5) are measures of wealth, with (4) being an indicator variable equal to one if the household owns any 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, 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 enough savings to cover an emergency expenditure of 5,000 Ksh ($40), while (10) is a dummy variable for whether they have borrowed in the last 6 months. Columns (5) and (8) include missings for when respondents did not provide an answer to the relevant survey questions. For each panel we run an ANCOVA regression, instrumenting for whether the plot owner took up the treatment in any of the four seasons with the treatment assignment dummies. We control for baseline values of the outcome, plot size, survey-round dummies, and strata dummies (see Equation (2) in the paper). *Rent - Cash* reports the difference between the *Rental Subsidy Paid* and *Cash Drop Paid* coefficients and its standard error. We cluster standard errors by Target Plot owner.

Appendix - For Online Publication

A Listing and baseline analysis

This appendix presents additional statistics using listing and baseline survey data. First, we use listing data to compare characteristics of surveyed vs non-surveyed plot owners, among those expressing interest in the rental subsidy in the listing (see Section 3.2). Second, we compare owner and Target Plot characteristics in the stratum where, in the listing, owners said they were planning to cultivate the Target Plot in the first experimental season vs those who said they would not. Third, we present balance by treatment group, focusing on characteristics of owners, Target Plots, and other plots. Finally, we compare out sample to farmer samples in the World Bank LSMS

A.1 Surveyed vs non-surveyed plot owners, among those expressing interest in the rental subsidy in the listing

Table A.1: Comparison of surveyed vs non-surveyed owners

	Surveyed [S]	Not Surveyed [NS]	[S-NS]	N
Male	0.68	0.69	-0.01	877
	(0.47)	(0.47)	[.03]	
Age	50.05	51.80	-1.75	875
	(14.87)	(15.10)	[1.0]	
Has a phone	0.90	0.91	-0.01	877
	(0.29)	(0.28)	[.01]	
No. plots owned	3.52	3.47	0.05	877
	(1.30)	(1.38)	[.09]	
Total acres owned (wins. 1%)	2.50	2.79	-0.29	877
	(1.88)	(2.36)	[.14]	
Renting out at least one plot (2019 LR)	0.10	0.13	-0.02	877
	(0.31)	(0.34)	[.02]	
No. plots rented out (2019 LR)	0.13	0.15	-0.02	877
	(0.40)	(0.42)	[.02]	
At least one plot left uncultivated (2019 LR)	0.39	0.35	0.04	877
	(0.49)	(0.48)	[.03]	
Proportion of land owned left uncultivated (2019 LR)	0.14	0.13	0.01	877
	(0.21)	(0.21)	[.01]	
Proportion of land cultivated w/ cash crops (2019 SR)	0.17	0.15	0.02	877
	(0.26)	(0.24)	[.01]	

Notes: The sample in the table includes plot owners who expressed interest for the rental subsidy in the listing (N=877). Within this sample, we compare those owners who were surveyed at baseline and eventually included in the study (N=521) to those who were not surveyed (N=356). The data comes from the listing survey. *Male* is a binary indicator equal to one if the respondent was male. *Age* is missing two observations relative to all other included variables, due to two large outlier age values. We winsorize *Acres Owned* at the top 1%. *Share of plots cultivated with cash crops* is the share of plots each owner is cultivating with groundnuts, tobacco or sugarcane. The *[S-NS]* columns are generated by a regression of each outcome on a surveyed dummy with robust standard errors.

A.2 Stratum C vs Stratum NC

Table A.2: Comparison of Stratum C vs Stratum NC

(A) Owner Characteristics	Plan to Cultivate [C]	Plan to Fallow [NC]	[C-NC]	N
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 plots: total acres owned in 2019 Long Rains	2.54	2.64	-0.10	521
	[1.93]	[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]	
(B) 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 in 2019 Long Rains	37.9	22.3	15.60	520
	[66.0]	[59.1]	[5.70]	
Value of household labor in 2019 Long Rains	36.0	16.3	19.70	521
	[44.5]	[35.5]	[3.60]	
Value of hired labor in 2019 Long Rains	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 2018 Short Rains (conditional, cultivated)	78.2	29.0	49.2	521
	[167.8]	[71.1]	[10.5]	

Notes: The table presents a comparison of owner and Target Plot characteristics for owners that, in the listing, reported they were planning to cultivate the Target Plot for the first experimental agricultural season, i.e., the Short Rains 2019, (*Stratum C*, N=342) against those who were either planning to leave it fallow or still undecided (*Stratum NC*, N=179). 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). It includes a missing value for when a respondent did not provide an answer to the relevant survey questions. *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 in 2019 long rains* is the value of any seeds, compost, chemical fertilizer, and pesticides used on the Target Plot. There is one missing observation for when a respondent did not report the quantity of fertilizer used. *Value of hired labor in 2019 long rains* is the number of hired-work days valued at the median reported wage. *Value of household labor in 2019 long rains* is the number of household-member-work days valued at 60% of the median reported wage. Since we conducted the baseline survey while the 2019 Long Rains harvesting was ongoing, we do not have information on harvest amount for that season for most of the sample. 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.

A.3 Balance

Table A.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	2.59	-0.17	-0.11	0.06	521
	[1.87]	[2.07]	[1.96]	[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]	
No. 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]	
No. 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 (1-3)	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 (1-3)	2.42	2.39	2.41	0.03	-0.02	0.01	509
	[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 in 2019 Long Rains	36.6	38.2	22.9	-1.1	14.6	17.2	520
	[71.7]	[71.2]	[45.2]	[6.8]	[6.4]	[6.2]	
Value of household labor in 2019 Long Rains	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 in 2019 Long Rains	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 2018 Short Rains	60.7	72.4	50.7	-8.5	10.5	18.6	521
	[125.2]	[176.4]	[124.1]	[16.3]	[14.0]	[16.6]	
(C) Non-Target Plots							
No. 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 plots: total acres owned in 2019 Long Rains	1.77	1.88	1.90	-0.12	-0.12	-0.01	521
	[1.69]	[1.83]	[1.76]	[0.18]	[0.17]	[0.19]	
No. plots 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 in 2019 Long Rains	114.0	88.6	92.9	26.9	19.0	-0.3	521
	[205.6]	[189.8]	[170.2]	[19.1]	[19.3]	[18.7]	
Value of household labor in 2019 Long Rains	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 in 2019 Long Rains	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 2018 Short Rains	216.4	216.6	231.4	8.1	-6.4	-24.6	521
	[493.4]	[495.2]	[539.0]	[57.6]	[56.3]	[55.3]	

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 Educated* is a binary indicator equal to one if the highest level of education completed by the household head is high school or higher. *Agricultural Training* 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 oxen. *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). It includes a missing value for when a respondent did not provide an answer to relevant survey questions. **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. *Soil quality index* is a soil quality index self-reported by the respondent and it could take values 1 = poor, 2 = fair, 3 = good. *Swampy/dry index* could take values of 1 = swampy, 2 = mix, 3 = dry. Nine observations are missing for when respondent's were not aware of the swampy/dry condition of 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 in 2019 long rains* is the value of any seeds, compost, chemical fertilizer, and pesticides used on the Target Plot. There is one missing observation for when a respondent did not report the quantity of fertilizer used. *Value of hired labor in 2019 long rains* is the number of hired-work days valued at the median reported wage. *Value of household labor in 2019 long rains* is the number of household-member-work days valued at 60% of the median reported wage. Since we conducted the baseline survey while the 2019 Long Rains harvesting was ongoing, we do not have information on harvest amount for that season for most of the sample. **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* are 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 and harvest is the sum of the respective values across all Non-target plots. Value of hired and household labor is the value for the largest Non-target plot. There is one missing for when no hired labor information was provided on the largest Non-target plot. They are expressed in USD (1 USD = 100 KSh) and winsorized at the top 1%. The values in three difference columns are generated by a regression of each outcome for whether the owner was assigned to the Rental Subsidy treatment (cols. 4-5) or the Cash Drop treatment (col. 6). Only the two treatment groups identified in the column header were included in the regression sample. Robust standard errors are included in parentheses.

Table A.4: Balance: Stratum C

	Rental Subsidy [RS]	Cash Drop [CD]	Control [C]	[RS-CD]	[RS-C]	[CD-C]	N
(A) Owners							
Age	49.70	51.19	49.39	-1.78	0.08	1.71	342
	[15.01]	[13.41]	[14.64]	[1.91]	[2.02]	[1.95]	
Male	0.68	0.75	0.68	-0.07	-0.01	0.09	342
	[0.47]	[0.43]	[0.47]	[0.06]	[0.06]	[0.06]	
Family Size	5.58	6.02	5.98	-0.39	-0.36	0.11	342
	[2.93]	[2.63]	[2.60]	[0.37]	[0.37]	[0.33]	
High School Educated	0.23	0.22	0.26	0.01	-0.04	-0.03	342
	[0.42]	[0.42]	[0.44]	[0.05]	[0.06]	[0.06]	
Agricultural Training	0.28	0.27	0.30	0.01	-0.02	-0.02	342
	[0.45]	[0.45]	[0.46]	[0.06]	[0.06]	[0.06]	
Compare agricultural experience to avg. farmer (1-5)	2.83	2.84	2.85	-0.03	-0.03	-0.03	342
	[0.90]	[0.79]	[0.88]	[0.11]	[0.11]	[0.10]	
No. plots owned in 2019 Long Rains	3.50	3.50	3.53	-0.01	-0.09	-0.04	342
	[1.31]	[1.30]	[1.27]	[0.17]	[0.17]	[0.17]	
Total plots: total acres owned in 2019 Long Rains	2.52	2.78	2.31	-0.33	0.14	0.46	342
	[1.91]	[2.21]	[1.62]	[0.23]	[0.20]	[0.22]	
Have maize stocks from own production, last 12 months	0.72	0.72	0.66	0.01	0.06	0.06	342
	[0.45]	[0.45]	[0.48]	[0.05]	[0.05]	[0.06]	
Experienced a hunger period, last 12 months	0.35	0.31	0.36	0.04	0.00	-0.04	342
	[0.48]	[0.46]	[0.48]	[0.06]	[0.06]	[0.06]	
Own oxen or cow	0.68	0.72	0.60	-0.05	0.06	0.12	342
	[0.47]	[0.45]	[0.49]	[0.06]	[0.06]	[0.07]	
No. person-days spent working on other farms, last 7 months	21.97	22.82	31.27	-0.64	-8.58	-5.10	342
	[77.20]	[56.04]	[84.98]	[8.73]	[10.89]	[8.64]	
No. person-days spent on non-ag work, last 12 months	17.73	20.34	25.58	-2.34	-9.49	-6.03	342
	[29.87]	[29.48]	[35.17]	[3.99]	[4.33]	[4.29]	
Taken a loan in last 12 months	0.65	0.59	0.64	0.07	0.01	-0.04	342
	[0.48]	[0.49]	[0.48]	[0.07]	[0.06]	[0.06]	
Total borrowed, last 12 months	43.2	115.6	66.6	-62.9	-24.1	43.0	342
	[67.1]	[281.5]	[133.4]	[25.7]	[14.0]	[29.3]	
Participate in ROSCA	0.42	0.44	0.49	-0.04	-0.07	-0.04	342
	[0.50]	[0.50]	[0.50]	[0.07]	[0.06]	[0.07]	
Have bank account	0.22	0.30	0.29	-0.07	-0.07	0.01	342
	[0.42]	[0.46]	[0.46]	[0.06]	[0.06]	[0.06]	
Total amount saved	55.0	91.3	65.8	-33.5	-10.3	26.3	342
	[147.9]	[199.1]	[146.2]	[22.4]	[18.3]	[23.4]	
5k Ksh in emergency savings	0.29	0.35	0.39	-0.06	-0.10	-0.04	342
	[0.46]	[0.48]	[0.49]	[0.06]	[0.06]	[0.06]	
Wealth index, assets- and amenities-based PCA	-0.06	0.17	-0.26	-0.28	0.17	0.46	341
	[1.59]	[1.87]	[1.67]	[0.24]	[0.22]	[0.23]	
(B) Target Plots							
Plot size	0.72	0.76	0.66	-0.04	0.05	0.09	342
	[0.47]	[0.51]	[0.40]	[0.04]	[0.03]	[0.03]	
Inherited	0.93	0.88	0.93	0.07	0.00	-0.06	342
	[0.26]	[0.33]	[0.25]	[0.04]	[0.03]	[0.04]	
Certificate of title/customary ownership	0.79	0.69	0.66	0.10	0.12	0.02	342
	[0.41]	[0.46]	[0.47]	[0.06]	[0.06]	[0.06]	
Respondent's homestead in different village than plot	0.01	0.02	0.01	-0.01	0.00	0.01	342
	[0.09]	[0.13]	[0.09]	[0.01]	[0.01]	[0.02]	
Sandy loam soil	0.58	0.57	0.54	-0.01	0.05	0.05	342
	[0.50]	[0.50]	[0.50]	[0.06]	[0.07]	[0.06]	
Sandy clay soil	0.28	0.27	0.32	0.04	-0.04	-0.07	342
	[0.45]	[0.45]	[0.47]	[0.05]	[0.06]	[0.06]	
Soil quality index (1-3)	2.52	2.61	2.59	-0.07	-0.06	0.01	342
	[0.57]	[0.52]	[0.56]	[0.07]	[0.08]	[0.07]	
Swampy/dry index (1-3)	2.44	2.44	2.41	-0.02	0.01	0.05	333
	[0.58]	[0.58]	[0.59]	[0.08]	[0.08]	[0.08]	
Erosion dummy	0.22	0.25	0.32	-0.03	-0.08	-0.08	342
	[0.42]	[0.43]	[0.47]	[0.05]	[0.05]	[0.05]	
Irrigation dummy	0.04	0.07	0.08	-0.03	-0.02	0.01	342
	[0.21]	[0.26]	[0.27]	[0.03]	[0.03]	[0.04]	
Cultivated in 2019 long rains	0.70	0.73	0.74	-0.03	-0.04	0.00	342
	[0.46]	[0.44]	[0.44]	[0.06]	[0.06]	[0.06]	
Rented out in 2019 long rains	0.18	0.11	0.12	0.08	0.06	-0.02	342
	[0.38]	[0.31]	[0.33]	[0.05]	[0.05]	[0.04]	
Cultivated with maize in 2019 long rains	0.58	0.60	0.61	-0.01	-0.02	-0.01	342

	Rental Subsidy [RS]	Cash Drop [CD]	Control [C]	[RS-CD]	[RS-C]	[CD-C]	N
	[0.50]	[0.49]	[0.49]	[0.07]	[0.06]	[0.07]	
Cultivated with commercial crops in 2019 Long Rains	0.05	0.07	0.03	-0.02	0.02	0.04	342
	[0.23]	[0.26]	[0.18]	[0.03]	[0.03]	[0.03]	
Value of agricultural inputs in 2019 Long Rains	41.4	47.5	25.0	-4.9	19.0	25.0	342
	[74.2]	[78.3]	[36.5]	[8.8]	[7.8]	[7.0]	
Value of household labor in 2019 Long Rains	34.35	33.91	39.76	0.94	-3.12	-3.57	342
	[44.40]	[38.70]	[49.71]	[5.47]	[6.27]	[5.92]	
Value of hired labor in 2019 Long Rains	14.4	14.8	11.1	-0.4	3.4	5.2	342
	[29.2]	[28.6]	[21.2]	[4.0]	[3.4]	[3.5]	
Cultivated in 2018 Short Rains	0.58	0.65	0.66	-0.07	-0.08	0.00	342
	[0.50]	[0.48]	[0.48]	[0.06]	[0.06]	[0.06]	
Rented out in 2018 Short Rains	0.12	0.09	0.10	0.04	0.01	-0.03	342
	[0.32]	[0.29]	[0.31]	[0.04]	[0.04]	[0.04]	
Harvest value in 2018 Short Rains	73.0	95.6	66.2	-16.5	9.6	25.3	342
	[145.7]	[204.7]	[146.8]	[23.2]	[20.1]	[23.9]	
(C) Non-Target Plots							
No. plots owned in 2019 Long Rains	2.50	2.50	2.53	-0.01	-0.09	-0.04	342
	[1.31]	[1.30]	[1.27]	[0.17]	[0.17]	[0.17]	
Total plots: total acres owned in 2019 Long Rains	1.80	2.02	1.65	-0.28	0.09	0.36	342
	[1.76]	[2.01]	[1.41]	[0.23]	[0.19]	[0.22]	
No. plots rented out in 2019 Long Rains	0.12	0.17	0.23	-0.06	-0.12	-0.06	342
	[0.37]	[0.48]	[0.53]	[0.06]	[0.06]	[0.06]	
Cultivated in 2019 long rains	2.09	1.91	2.06	0.20	0.01	-0.15	342
	[1.36]	[1.21]	[1.26]	[0.16]	[0.18]	[0.16]	
Cultivated with maize in 2019 long rains	1.07	1.08	1.18	-0.02	-0.16	-0.12	342
	[0.91]	[0.88]	[1.04]	[0.12]	[0.13]	[0.13]	
Cultivated with commercial crops in 2019 Long Rains	0.31	0.28	0.22	0.03	0.11	0.09	342
	[0.55]	[0.51]	[0.57]	[0.07]	[0.07]	[0.07]	
Value of agricultural inputs in 2019 Long Rains	89.4	82.5	71.1	6.5	19.7	13.1	342
	[138.4]	[177.1]	[133.3]	[21.6]	[17.4]	[19.3]	
Value of household labor in 2019 Long Rains	31.15	24.31	27.02	7.30	6.06	-2.55	342
	[47.23]	[29.63]	[41.58]	[5.36]	[5.99]	[4.88]	
Value of hired labor in 2019 Long Rains	6.2	10.8	7.9	-5.6	-1.7	3.5	341
	[13.0]	[21.2]	[17.6]	[2.5]	[2.1]	[2.5]	
Cultivated in 2018 Short Rains	1.85	1.73	1.84	0.15	0.00	-0.10	342
	[1.30]	[1.28]	[1.34]	[0.16]	[0.18]	[0.17]	
Harvest value in 2018 Short Rains	209.2	286.7	192.4	-69.6	32.5	98.4	342
	[480.5]	[599.4]	[441.4]	[75.5]	[60.0]	[65.3]	

Notes: The table presents the baseline balance for Stratum C owners' socio-demographic characteristics and non-agricultural outcomes (Panel A), Target Plots (Panel B) and Non-target plots (Panel C). Details on the data sources and construction of the variables are included in the notes of Table A.3. The values in three difference columns are generated by a regression of each outcome for whether the owner was assigned to the Rental Subsidy treatment (cols. 4-5) or the Cash Drop treatment (col. 6). Only the two treatment groups identified in the column header were included in the regression sample. Robust standard errors are included in parentheses.

Table A.5: Balance: Stratum NC

	Rental Subsidy [RS]	Cash Drop [CD]	Control [C]	[RS-CD]	[RS-C]	[CD-C]	N
(A) Owners							
Age	48.78	52.97	52.20	-3.08	-3.03	0.81	179
	[15.66]	[18.09]	[13.78]	[2.93]	[2.82]	[2.85]	
Male	0.69	0.72	0.69	-0.05	-0.01	0.03	179
	[0.46]	[0.45]	[0.46]	[0.09]	[0.08]	[0.08]	
Family Size	4.97	5.49	5.59	-0.59	-0.55	-0.03	179
	[2.62]	[2.85]	[2.63]	[0.50]	[0.51]	[0.53]	
High School Educated	0.31	0.20	0.17	0.12	0.10	0.03	179
	[0.46]	[0.40]	[0.38]	[0.08]	[0.08]	[0.08]	
Agricultural Training	0.39	0.21	0.37	0.19	0.05	-0.15	179
	[0.49]	[0.41]	[0.49]	[0.09]	[0.09]	[0.09]	
Compare agricultural experience to avg. farmer (1-5)	2.85	2.67	2.95	0.18	-0.04	-0.24	179
	[0.89]	[0.87]	[0.99]	[0.16]	[0.18]	[0.19]	
No. plots owned in 2019 Long Rains	3.49	3.61	3.88	-0.12	-0.44	-0.36	179
	[1.22]	[1.43]	[1.33]	[0.24]	[0.22]	[0.23]	
Total plots: total acres owned in 2019 Long Rains	2.40	2.38	3.14	0.14	-0.61	-0.71	179
	[1.79]	[1.74]	[2.42]	[0.29]	[0.33]	[0.37]	
Have maize stocks from own production, last 12 months	0.64	0.67	0.73	-0.02	-0.08	-0.07	179
	[0.48]	[0.47]	[0.45]	[0.08]	[0.08]	[0.08]	
Experienced a hunger period, last 12 months	0.32	0.44	0.39	-0.13	-0.10	0.04	179
	[0.47]	[0.50]	[0.49]	[0.09]	[0.08]	[0.09]	
Own oxen or cow	0.71	0.57	0.63	0.14	0.08	-0.09	179
	[0.46]	[0.50]	[0.49]	[0.10]	[0.11]	[0.09]	
No. person-days spent working on other farms, last 7 months	16.34	15.18	28.86	-3.53	-13.65	-16.22	179
	[55.49]	[56.21]	[90.64]	[9.79]	[14.78]	[11.85]	
No. person-days spent on non-ag work, last 12 months	26.97	19.98	25.88	7.64	-0.72	-8.17	179
	[32.89]	[35.51]	[35.10]	[5.34]	[6.05]	[6.75]	
Taken a loan in last 12 months	0.68	0.54	0.63	0.16	0.07	-0.09	179
	[0.47]	[0.50]	[0.49]	[0.08]	[0.08]	[0.10]	
Total borrowed, last 12 months	71.9	39.3	75.2	25.5	-21.2	-39.2	179
	[189.2]	[72.6]	[169.0]	[23.0]	[35.4]	[21.8]	
Participate in ROSCA	0.59	0.48	0.58	0.12	0.01	-0.10	179
	[0.50]	[0.50]	[0.50]	[0.08]	[0.09]	[0.10]	
Have bank account	0.31	0.20	0.25	0.13	0.07	-0.07	179
	[0.46]	[0.40]	[0.44]	[0.08]	[0.08]	[0.08]	
Total amount saved	82.2	42.1	104.0	49.6	-29.9	-63.5	179
	[168.9]	[89.1]	[220.3]	[28.3]	[38.5]	[30.4]	
5k Ksh in emergency savings	0.56	0.34	0.46	0.21	0.11	-0.12	179
	[0.50]	[0.48]	[0.50]	[0.09]	[0.09]	[0.09]	
Wealth index, assets- and amenities-based PCA	0.59	-0.28	-0.02	0.97	0.63	-0.27	179
	[2.73]	[1.61]	[1.63]	[0.44]	[0.40]	[0.29]	
(B) Target Plots							
Plot size	0.68	0.76	0.74	-0.05	-0.06	0.03	179
	[0.37]	[0.54]	[0.48]	[0.06]	[0.05]	[0.07]	
Inherited	0.88	0.97	0.92	-0.09	-0.05	0.06	179
	[0.33]	[0.18]	[0.28]	[0.05]	[0.06]	[0.05]	
Certificate of title/customary ownership	0.71	0.64	0.68	0.11	0.04	-0.05	179
	[0.46]	[0.48]	[0.47]	[0.08]	[0.08]	[0.08]	
Respondent's homestead in different village than plot	0.03	0.02	0.00	0.01	0.03	0.02	179
	[0.18]	[0.13]	[0.00]	[0.03]	[0.02]	[0.02]	
Sandy loam soil	0.44	0.46	0.56	-0.02	-0.11	-0.09	179
	[0.50]	[0.50]	[0.50]	[0.09]	[0.09]	[0.09]	
Sandy clay soil	0.25	0.25	0.15	-0.01	0.09	0.06	179
	[0.44]	[0.43]	[0.36]	[0.09]	[0.07]	[0.08]	
Soil quality index (1-3)	2.63	2.48	2.73	0.12	-0.11	-0.23	179
	[0.49]	[0.54]	[0.45]	[0.08]	[0.08]	[0.08]	
Swampy/dry index (1-3)	2.40	2.31	2.42	0.12	-0.09	-0.08	176
	[0.65]	[0.65]	[0.63]	[0.13]	[0.13]	[0.13]	
Erosion dummy	0.19	0.15	0.24	0.04	-0.05	-0.10	179
	[0.39]	[0.36]	[0.43]	[0.06]	[0.07]	[0.06]	
Irrigation dummy	0.05	0.02	0.07	0.04	-0.01	-0.06	179
	[0.22]	[0.13]	[0.25]	[0.03]	[0.05]	[0.04]	
Cultivated in 2019 long rains	0.51	0.34	0.24	0.18	0.27	0.11	179
	[0.50]	[0.48]	[0.43]	[0.08]	[0.09]	[0.09]	
Rented out in 2019 long rains	0.03	0.10	0.12	-0.07	-0.09	-0.01	179
	[0.18]	[0.30]	[0.33]	[0.04]	[0.04]	[0.05]	
Cultivated with maize in 2019 long rains	0.42	0.28	0.17	0.17	0.27	0.11	179

	Rental Subsidy [RS]	Cash Drop [CD]	Control [C]	[RS-CD]	[RS-C]	[CD-C]	N
	[0.50]	[0.45]	[0.38]	[0.08]	[0.08]	[0.08]	
Cultivated with commercial crops in 2019 Long Rains	0.02	0.00	0.05	0.01	-0.03	-0.05	179
	[0.13]	[0.00]	[0.22]	[0.02]	[0.03]	[0.03]	
Value of agricultural inputs in 2019 Long Rains	27.3	21.0	18.6	6.3	5.8	1.9	178
	[66.3]	[52.1]	[59.1]	[10.3]	[11.4]	[12.3]	
Value of household labor in 2019 Long Rains	27.79	12.14	9.24	18.20	20.43	3.13	179
	[47.84]	[22.15]	[29.60]	[6.93]	[7.06]	[5.06]	
Value of hired labor in 2019 Long Rains	19.5	6.0	11.1	13.4	10.6	-4.8	179
	[32.4]	[13.4]	[29.9]	[4.3]	[5.3]	[4.3]	
Cultivated in 2018 Short Rains	0.46	0.39	0.27	0.06	0.15	0.10	179
	[0.50]	[0.49]	[0.45]	[0.09]	[0.08]	[0.09]	
Rented out in 2018 Short Rains	0.05	0.10	0.10	-0.06	-0.06	0.01	179
	[0.22]	[0.30]	[0.30]	[0.04]	[0.05]	[0.05]	
Harvest value in 2018 Short Rains	37.2	29.6	20.2	7.1	12.4	5.9	179
	[66.0]	[93.0]	[45.5]	[14.3]	[9.8]	[12.9]	
(C) Non-Target Plots							
No. plots owned in 2019 Long Rains	2.49	2.61	2.88	-0.12	-0.44	-0.36	179
	[1.22]	[1.43]	[1.33]	[0.24]	[0.22]	[0.23]	
Total plots: total acres owned in 2019 Long Rains	1.72	1.62	2.39	0.19	-0.54	-0.73	179
	[1.58]	[1.44]	[2.23]	[0.27]	[0.31]	[0.35]	
No. plots rented out in 2019 Long Rains	0.07	0.11	0.19	-0.04	-0.12	-0.06	179
	[0.25]	[0.37]	[0.54]	[0.06]	[0.08]	[0.08]	
Cultivated in 2019 long rains	2.14	2.00	2.41	0.11	-0.32	-0.50	179
	[1.28]	[1.21]	[1.21]	[0.22]	[0.22]	[0.22]	
Cultivated with maize in 2019 long rains	1.31	1.30	1.41	-0.06	-0.07	-0.11	179
	[1.05]	[0.86]	[0.79]	[0.18]	[0.17]	[0.12]	
Cultivated with commercial crops in 2019 Long Rains	0.20	0.05	0.27	0.15	-0.09	-0.21	179
	[0.45]	[0.22]	[0.52]	[0.07]	[0.09]	[0.08]	
Value of agricultural inputs in 2019 Long Rains	161.2	99.8	135.9	66.3	17.5	-26.2	179
	[290.1]	[212.3]	[221.0]	[37.8]	[48.2]	[41.4]	
Value of household labor in 2019 Long Rains	24.59	24.95	31.35	-3.59	-4.46	-6.35	179
	[39.96]	[37.34]	[41.54]	[7.34]	[7.89]	[7.64]	
Value of hired labor in 2019 Long Rains	13.7	7.3	10.5	5.9	2.8	-2.5	179
	[22.6]	[17.1]	[20.2]	[3.9]	[3.9]	[3.7]	
Cultivated in 2018 Short Rains	1.86	1.67	1.95	0.19	-0.15	-0.40	179
	[1.38]	[1.14]	[1.27]	[0.23]	[0.22]	[0.23]	
Harvest value in 2018 Short Rains	230.3	86.8	308.0	158.3	-84.8	-261.5	179
	[521.1]	[99.7]	[690.1]	[79.3]	[122.5]	[96.7]	

Notes: The table presents the baseline balance for Stratum NC owners' socio-demographic characteristics and non-agricultural outcomes (Panel A), Target Plots (Panel B) and Non-target plots (Panel C). Details on the data sources and construction of the variables are included in the notes of Table A.3. The values in three difference columns are generated by a regression of each outcome for whether the owner was assigned to the Rental Subsidy treatment (cols. 4-5) or the Cash Drop treatment (col. 6). Only the two treatment groups identified in the column header were included in the regression sample. Robust standard errors are included in parentheses.

A.4 Comparison between our samples and LSMS data

Table A.6: Comparison of study samples

	LSMS-ISA						Kenya in Study Sample		
	Ethiopia	Malawi	Niger	Nigeria	Tanzania	Uganda	Listing	Baseline	Renters
Family size	5.24	4.96	6.78	6.82	5.55	6.64	.	5.69	5.60
Male household head	0.81	0.77	0.92	.	0.75	0.71	0.59	0.70	0.82
Household head's age	44.58	43.04	44.90	50.60	48.88	47.35	49.60	50.40	42.82
Proportion of households renting out	0.05	0.00	0.01	0.00	0.01	0.00	0.04	0.22	0.02
No. plots owned	3.02	1.74	2.74	1.75	2.22	1.88	2.96	3.56	1.60
Area owned (acres)	2.81	1.58	11.98	.	5.31	3.29	1.84	2.62	1.05
Proportion of land left uncultivated	.	0.00	0.10	0.00	0.30	0.10	0.08	0.18	0.06
Households w/ formal certificate/documentation	0.38	0.01	0.11	.	0.14	0.19	.	0.75	.
Proportion of plots w/ male manager	0.80	0.71	0.53	0.81	0.27	0.09	.	0.67	0.70
Cultivated area (acres)	2.70	1.92	13.62	.	2.20	2.98	1.78	1.94	1.01
Irrigated area (acres)	0.04	0.00	0.09	0.08	.	0.11	.	0.15	0.04

Notes: The table provides summary statistics of agricultural households from six other countries in Sub-Saharan Africa, based on data from the Living Standards Measurement Study - Integrated Surveys on Agriculture (LSMS-ISA), alongside the same statistics for our sample, to investigate external validity. For our sample, we report statistics for the sample of farmers we reached in the listing exercise (our most representative sample, but for which we have relatively little data), for our experimental owners (those who expressed interest in the subsidy at listing, and for whom we did a full baseline), and for our experimental renters (for whom we also did a full baseline). The LSMS-ISA based statistics are taken from three references which analyze LSMS-ISA data from between 2008 and 2011, depending on the country and variable: Deininger et al. (2017); Dillon and Barrett (2017) and Binswanger-Mkhize and Savastano (2017).

B Empirical strategy

The experimental analysis focuses on treatment effects on Target Plots and their owners. In this appendix, we describe in detail the First, we document the effect of the rental subsidy and unconditional cash transfer treatments on the likelihood that the Target Plot is rented out. Second, we examine how treatments affect agricultural production on the Target Plot, including cultivation choices, investments, output, and soil quality. To illustrate potential mechanisms behind these effects, we also study how the treatments, by inducing a reallocation of land from owners to renters. affect characteristics of farmers managing the Target Plot. Third, we study treatment effects on owners' outcomes, including agricultural outcomes on non-Target Plots and non-agricultural outcomes.

B.1 Target Plot: rentals

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

$$TargetPlotRentedOut_{is}^{t} = \beta_0 + \beta_1 RentalSubsidy_i + \beta_2 CashTransfer_i + \delta x_i^0 + \eta_s + \eta^t + \epsilon_i^t, \tag{B.1}$$

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.[1] 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.

B.2 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. The ITT regressions is:

$$y_{is}^{t} = \beta_0 + \beta_1 RentalSubsidy_i + \beta_2 CashTransfer_i + \delta x_i^0 + \eta_s + \eta^t + \epsilon_i^t, \tag{B.2}$$

where the notation follows Equation B.1, except that we have Target Plot outcomes for four seasons, not five. We cluster standard errors by Target Plot. For continuous outcomes, we focus on winsorized (1%) outcomes in levels and on the inverse hyperbolic sine (IHS) transformation of the total outcome across rounds.[2]

Since there is imperfect compliance in the rental subsidy treatment (see Section 4.2), 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 4 provides more details on take up by crop season and thus on the interpretation of the TOT.

The estimating equation for the TOT is thus:

$$y_{is}^{t} = \gamma_0 + \gamma_1 Rental\widehat{Subsidy}Paid_i + \gamma_2 Cash\widehat{Transfer}Paid_i + \delta x_i^0 + \eta_s + \eta^t + \epsilon_i^t. \tag{B.3}$$

As we discussed in detail in Section 3.7, the TOT coefficient γ_1 measures the effects of offsetting the rental frictions through the payment of the conditional subsidy to the owners. In addition, under plausible assumptions, the comparison of γ_1 to γ_2 is a lower bound of the effect of the rental subsidy on compliers in this group controlling for the income effect

Another 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 estimate 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 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. Second, comparing the rental subsidy group 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 the 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 we present in the paper).

B.2.1 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 (in the first experimental season) the Target Plot manager 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.

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

[2] 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)

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.[3]

We examine the impact of the treatments on the baseline characteristics of the manager of the Target Plot in the first season. We present TOT results.

$$x_{is}^{Manager} = \gamma_0 + \gamma_1 Rental\widehat{Subsidy}Paid_i + \gamma_2 Cash\widehat{Trans}ferPaid_i + \delta x_i^0 + \eta_s + \epsilon_i, \quad \text{(B.4)}$$

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), we instrument again $RentalSubsidyPaid_i$, a dummy for whether any rental subsidy was paid, with the treatment assignment $RentalSubsidy_i$, and $CashTransferPaid_i$ with the $CashTransfer$ treatment assignment, and the rest of the notation follows Equation B.1.

B.3 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.

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

$$y_{pis}^t = \beta_0 + \beta_1 Rental\widehat{Subsidy}Paid_i + \beta_2 Cash\widehat{Trans}ferPaid_i + \delta x_p^0 + \eta_s + \eta^t + \epsilon_p^t, \quad \text{(B.5)}$$

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.

Non-agricultural owner outcomes. For the analysis of non-agricultural owner outcomes, we present TOT estimates following Equation (2) respectively, where the index i now refers to Target Plot's owners instead of the Target Plot.

[3] While we conducted the owner baseline survey at the end of season 0, we could only run 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 on 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.

C Subsidy take up and Target Plot rentals

This appendix presents additional results on take up of the subsidy and rentals of the target plot (see Section 4 for the main results on these outcomes). First, we compare characteristics among owners in the rental subsidy treatment group who took up the rental subsidy (N=121) vs those who did not (N=51). Second, we present treatment effects on the likelihood that the Target Plot is rented out by season (1-5) and by stratum (C vs NC). We then compare plot characteristics and rental terms among rentals in the rental subsidy group and those in the control and cash drop groups. Finally, we look at learning and persistence, by comparing rentals that persist and those that do not.

Table C.1: Comparison of Rental Subsidy compliers and non-compliers

	Subsidy Taker [T]	Subsidy Non-Taker [NT]	[T-NT]	N
Age	48.86	50.63	-1.77	172
	[14.57]	[16.67]	[2.68]	
Male	0.67	0.73	-0.06	172
	[0.47]	[0.45]	[0.08]	
Family Size	5.56	4.92	0.64	172
	[2.75]	[3.00]	[0.49]	
High School Educated	0.30	0.16	0.14	172
	[0.46]	[0.37]	[0.07]	
Agricultural Training	0.40	0.14	0.26	172
	[0.49]	[0.35]	[0.07]	
Compare agricultural experience to avg. farmer (1-5)	2.93	2.61	0.33	172
	[0.91]	[0.80]	[0.14]	
No. plots owned in 2019 Long Rains	3.49	3.51	-0.02	172
	[1.25]	[1.36]	[0.22]	
Total plots: total acres owned in 2019 Long Rains	2.69	1.97	0.72	172
	[1.99]	[1.43]	[0.27]	
Have maize stocks from own production, last 12 months	0.74	0.57	0.18	172
	[0.44]	[0.50]	[0.08]	
Experienced a hunger period, last 12 months	0.31	0.41	-0.10	172
	[0.47]	[0.50]	[0.08]	
Own oxen or cow	0.74	0.59	0.15	172
	[0.44]	[0.50]	[0.08]	
Number person-days spent working on other farms, last 7 months	23.81	11.10	12.71	172
	[80.84]	[33.82]	[8.74]	
Number person-days spent on non-ag work, last 12 months	23.11	15.65	7.46	172
	[32.15]	[28.27]	[4.91]	
Taken a loan in last 12 months	0.70	0.55	0.15	172
	[0.46]	[0.50]	[0.08]	
Total borrowed, last 12 months	68.85	15.52	53.33	172
	[143.81]	[24.03]	[13.52]	
Participate in ROSCA	0.51	0.39	0.12	172
	[0.50]	[0.49]	[0.08]	
Have bank account	0.28	0.18	0.10	172
	[0.45]	[0.39]	[0.07]	
Total amount saved	69.41	52.33	17.08	172
	[161.20]	[141.68]	[24.61]	
5k Ksh in emergency savings	0.41	0.31	0.10	172
	[0.49]	[0.47]	[0.08]	
Wealth index, assets- and amenities-based PCA	0.39	-0.37	0.76	171
	[2.24]	[1.47]	[0.29]	
Plot size	0.78	0.54	0.24	172
	[0.47]	[0.29]	[0.06]	
Inherited	0.91	0.92	-0.01	172
	[0.29]	[0.27]	[0.05]	
Certificate of title/customary ownership	0.75	0.78	-0.03	172
	[0.43]	[0.42]	[0.07]	
Respondent's homestead in different village than plot	0.02	0.00	0.02	172
	[0.16]	[0.00]	[0.01]	
Sandy loam soil	0.56	0.47	0.09	172
	[0.50]	[0.50]	[0.08]	
Sandy clay soil	0.26	0.31	-0.06	172
	[0.44]	[0.47]	[0.08]	
Soil quality index (1=poor, 2=fair, 3=good)	2.57	2.53	0.04	172
	[0.55]	[0.54]	[0.09]	
Swampy/dry index (1=swampy, 2=mix, 3=dry)	2.43	2.41	0.02	170
	[0.62]	[0.57]	[0.10]	
Erosion dummy	0.22	0.18	0.05	172
	[0.42]	[0.39]	[0.07]	
Irrigation dummy	0.06	0.02	0.04	172
	[0.23]	[0.14]	[0.03]	

	Subsidy Taker [T]	Subsidy Non-Taker [NT]	[T-NT]	N
Cultivated in 2019 Long Rains	0.61	0.69	-0.07	172
	[0.49]	[0.47]	[0.08]	
Rented out in 2019 Long Rains	0.16	0.06	0.10	172
	[0.37]	[0.24]	[0.05]	
Cultivated with maize in 2019 long rains	0.53	0.53	-0.00	172
	[0.50]	[0.50]	[0.08]	
Cultivated with commercial crops in 2019 Long Rains	0.04	0.04	0.00	172
	[0.20]	[0.20]	[0.03]	
Value of agricultural inputs in 2019 Long Rains	40.54	27.14	13.40	172
	[76.66]	[57.74]	[10.66]	
Value of household labor in 2019 Long Rains	35.60	23.80	11.80	172
	[48.54]	[36.72]	[6.77]	
Value of hired labor in 2019 Long Rains	15.78	17.09	-1.31	172
	[29.36]	[32.83]	[5.30]	
Cultivated in 2018 Short Rains	0.54	0.53	0.01	172
	[0.50]	[0.50]	[0.08]	
Rented out in 2018 Short Rains	0.11	0.06	0.05	172
	[0.31]	[0.24]	[0.04]	
Plan cultivate in 2019 Long Rains (Listing)	0.65	0.67	-0.01	172
	[0.48]	[0.48]	[0.08]	
Harvest value in 2018 Short Rains	61.89	58.02	3.87	172
	[111.48]	[154.15]	[23.77]	

Notes: The table presents a comparison of socio-demographic characteristics and non-agricultural outcomes and Target Plot characteristics of owners who took up the rental subsidy vs those who did not take up, among those owners randomly assigned to the rental subsidy treatment group. The data comes from the owner baseline survey and the listing survey. Details on the construction of the variables are included in the notes of Table A.3. The values in the column *Difference* are generated by a regression of each outcome on a dummy for whether the farmer took up the rental subsidy for any season of the sample. Robust standard errors are included in parentheses.

Table C.2: Target Plot Rented Out

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Rental Subsidy	0.46	0.44	0.46	0.37	0.34	0.41	0.42	0.43
	[0.05]	[0.05]	[0.05]	[0.05]	[0.05]	[0.04]	[0.05]	[0.06]
Cash Drop	0.06	0.03	0.06	0.02	0.03	0.04	0.04	0.06
	[0.05]	[0.05]	[0.05]	[0.05]	[0.05]	[0.04]	[0.05]	[0.06]
Rent - Cash	*0.40*	*0.40*	*0.40*	*0.35*	*0.31*	*0.37*	*0.38*	*0.37*
	[0.05]	*[0.05]*	*[0.05]*	*[0.05]*	*[0.05]*	*[0.04]*	*[0.05]*	*[0.06]*
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	489	2528	1660	868

Notes: The table reports the treatment effects on the likelihood the Target Plot is rented out. The data comes from follow-up surveys we run at the end of seasons 1 to 4 with the manager of the Target Plot. Data for Season 5 (col. 5) comes from the survey we ran at the end of Season 4. Columns 7 and 8 report results for Stratum C and NC, respectively. *Rent - Cash* reports the difference between the *Rental Subsidy* and *Cash Drop* coefficients and its standard error. We run an ANCOVA regression of the rented out dummy on treatment dummies, controlling for baseline rental status and plot size, and including stratum dummies for all columns (See Equation 1 in the paper). Columns 6-8 also include survey-round dummies. We use robust standard errors for columns 1-5 and we cluster standard errors by the Target Plot for columns 6-8.

Table C.3: Characteristics of Target Plot rentals

	Rental Subsidy [RS]	Cash Drop & Control [CD&C]	[RS-(CD&C)]	N
(A) Target Plot characteristics				
Plot size (avg reported-GPS)	0.77	0.78	-0.01	212
	[0.48]	[0.54]	[0.07]	
Sandy loam soil	0.57	0.59	-0.01	212
	[0.50]	[0.50]	[0.07]	
Sandy clay soil	0.25	0.22	0.03	212
	[0.43]	[0.41]	[0.06]	
Soil quality index (1=poor, 2=fair, 3=good)	2.56	2.59	-0.03	212
	[0.56]	[0.54]	[0.08]	
Swampy/dry index (1=swampy, 2=mix, 3=dry)	2.42	2.52	-0.10	210
	[0.62]	[0.58]	[0.08]	
Erosion dummy	0.23	0.28	-0.06	212
	[0.42]	[0.45]	[0.06]	
Irrigation dummy	0.05	0.07	-0.02	212
	[0.22]	[0.25]	[0.03]	
Formal certificate available	0.82	0.77	0.05	212
	[0.38]	[0.42]	[0.06]	
Rented out at any point in 2019	0.22	0.33	-0.11	212
	[0.41]	[0.47]	[0.06]	
(B) Renters and rental contracts				
Rental contract duration (months)	20.69	21.29	-0.60	202
	[16.36]	[16.08]	[2.31]	
Cash amount agreed for rental contract	93.21	95.70	-2.49	202
	[86.75]	[111.42]	[14.50]	
Taken a loan to rent in	0.08	0.05	0.03	202
	[0.27]	[0.21]	[0.03]	
Renter's homestead in different village than Target Plot	0.21	0.21	0.00	203
	[0.41]	[0.41]	[0.06]	
Renter is a family member	0.35	0.27	0.08	202
	[0.48]	[0.45]	[0.07]	
Renter is a friend	0.32	0.38	-0.05	202
	[0.47]	[0.49]	[0.07]	
Renter is a neighbor	0.29	0.34	-0.05	202
	[0.46]	[0.48]	[0.07]	
Rented in before from same owner	0.19	0.27	-0.08	202
	[0.39]	[0.45]	[0.06]	
Rented the Target Plot before	0.16	0.29	-0.13	202
	[0.37]	[0.46]	[0.06]	
Renting in other plots at baseline (2019 Long Rains)	0.29	0.34	-0.05	203
	[0.46]	[0.48]	[0.07]	
Rental contract duration (months)	20.69	21.29	-0.60	202
	[16.36]	[16.08]	[2.31]	
Cash amount agreed for rental contract	93.21	95.70	-2.49	202
	[86.75]	[111.42]	[14.50]	
Taken a loan to rent in	0.08	0.05	0.03	202
	[0.27]	[0.21]	[0.03]	
Renter's homestead in different village than Target Plot	0.21	0.21	0.00	203
	[0.41]	[0.41]	[0.06]	
Renter is a family member	0.35	0.27	0.08	202
	[0.48]	[0.45]	[0.07]	
Renter is a friend	0.32	0.38	-0.05	202
	[0.47]	[0.49]	[0.07]	
Renter is a neighbor	0.29	0.34	-0.05	202
	[0.46]	[0.48]	[0.07]	
Rented in before from same owner	0.19	0.27	-0.08	202
	[0.39]	[0.45]	[0.06]	
Rented the Target Plot before	0.16	0.29	-0.13	202
	[0.37]	[0.46]	[0.06]	
Renting in other plots at baseline (2019 Long Rains)	0.29	0.34	-0.05	203
	[0.46]	[0.48]	[0.07]	

Notes: The table presents a comparison of Target Plot rentals that occurred in the *Rental Subsidy* (N=120) group against those that occurred in the *Cash Drop* and *Control* (N=92) group. Due to the small number of rentals in the Cash Drop and in the Control group and the similar rental rates in the two groups, we pool them together to gain power in the comparison. The sample is based on the subset of Target Plots which were rented out in the first experimental season, the short rains 2019. The data in Panel

A comes from the owner baseline survey and reports average Target Plots characteristics for the rented plots (N=212). *Plot Size* is the average between the Target Plot size reported by the owner and the 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 Pabel B comes from the renter baseline survey and reports average renters and contract characteristics (N=202). 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. Robust standard errors are reported in parentheses.

Table C.4: Learning and persistence: comparing rentals that persist to those that do not

	Continued Rentals [CR]	Terminated Rentals [TR]	[CR-TR]	N
Plot size	0.86	0.59	0.26	450
	[0.49]	[0.36]	[.08]	
Baseline soil quality	1.48	1.36	0.12	114
	[0.57]	[0.55]	[.11]	
Baseline revenue	66.36	49.60	3.88	114
	[114.86]	[78.88]	[19.07]	
Rental rate	42.45	46.63	-4.18	114
	[31.34]	[37.92]	[7.42]	
Target Plot cultivated (Seasons 1-3)	0.95	0.93	0.02	450
	[0.22]	[0.26]	[.02]	
Revenue (Seasons 1-3)	172.02	84.58	53.24	450
	[235.58]	[155.03]	[24.23]	
Value addded (Seasons 1-3)	25.76	-8.40	22.53	450
	[183.06]	[125.81]	[17.41]	

Notes: The table compares outcomes for Target Plots that were rented out in Season 1 and where the initial renter-owner relationship continued for all four seasons vs Target Plots that were rented out in Season 1 and where the owner rented to a different renter or stopped renting before Season 4. The data comes from the owner baseline survey and the follow-up surveys we run at the end of seasons 1 to 3 with the manager of the Target Plot. *Target Plot Size* is the average of the farmer reported size of the Target Plot and the size calculated by enumerators with GPS instruments. *Baseline soil quality* is a self-reported index of soil quality. *Rental rate* is the rental rate of the Targer Plot per season. *Baseline revenue* and *Revenue* are winsorized at the top 1% level and *Value Added* is also winsorized at the bottom 1%. Regression for these outcomes control for *Target Plot Size* The values in the column *Difference* are generated by a regression of each outcome on a dummy for whether the renter-owner relationship did not continue in the fourth season. Standard errors, included in parantheses, are robust for variables with only observation for one season. Otherwise, we cluster standard errors by the Target Plot.

D Target Plot outcomes

This appendix presents additional results on treatment effects on Target Plot outcomes (see Section 5 for the main results on these outcomes). Appendix D.1 presents results on additional outcomes, including treatment effects on TFP, soil tests and specific non-labor inputs, quantile treatment effects, breakdowns of treatment effects by crop season. Appendix D.2 presents robustness to alternative specifications and Lee Bounds.

D.1 Target plot outcomes: Additional results

D.1.1 TFP

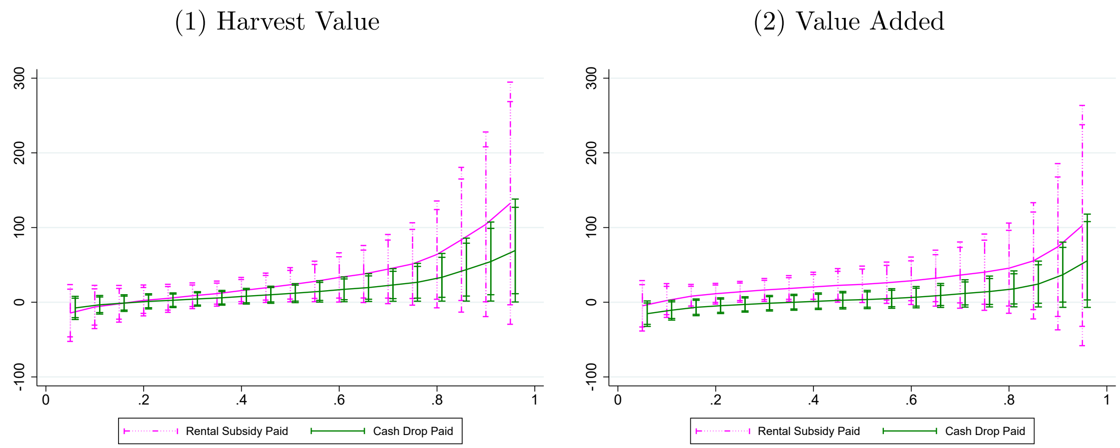
Table D.1: TFP results and robustness tests

	(1)	(2)	(3)	(4)	(5)
	Core	Stratum C	Alternate Calibrations		
Rental Subsidy Paid	6.54	7.31	10.65	6.39	5.52
	[2.70]	[3.28]	[4.91]	[2.58]	[2.06]
Cash Drop Paid	1.36	1.21	1.53	1.49	1.67
	[2.01]	[2.56]	[3.67]	[1.92]	[1.53]
Rent - Cash	*5.18*	*6.10*	*9.12*	*4.90*	*3.85*
	[2.69]	*[3.34]*	*[4.89]*	*[2.56]*	*[2.06]*
Mean Y in Control Group	16.51	16.55	33.67	16.11	12.57
Land Share	.53	.53	.61	.39	.18
Labor Share	.43	.43	.26	.42	.46
Observations	1608	1131	1608	1608	1608

Notes: The table reports treatment effects on the TFP of the Target Plot. The construction of the TFP variable is detailed in Section 5.2.2. The table includes our core specification of TFP (col. 1), a specification restricted to stratum 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 using factor shares estimated in Gollin and Udry (2021) for Uganda (col. 1 and 2) and Tanzania (col. 3). Chen et al. (2023) include factor shares for Malawi and Valentinyi and Herrendorf (2008) for the U.S., which are used in column 4 and column 5, respectively. *Rent - Cash* reports the difference between the *Rental Subsidy Paid* and *Cash Drop Paid* coefficients and its standard error. For each panel we run an ANCOVA regression, instrumenting for whether the plot owner took up the treatment in any of the four seasons with the treatment assignment dummies, controlling for baseline values of the outcome, plot size, survey-round dummies, and stratum dummies (see Equation (2) in the paper). We cluster standard errors by the Target Plot.

D.1.2 Quantile regressions

Figure D.1: Quantile regression results

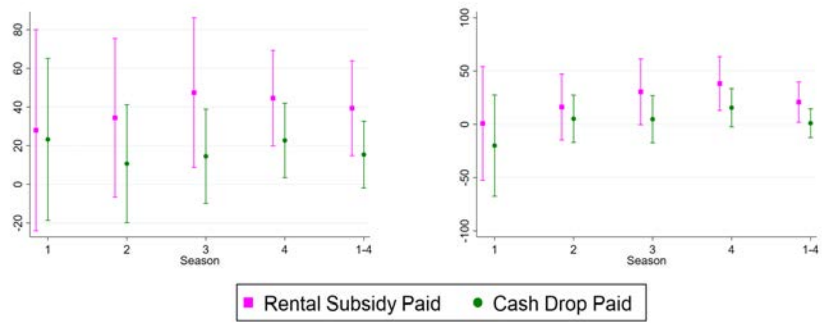


Notes: The figure reports coefficients from instrumental variable quantile regressions of agricultural outcomes on the Target Plot. Each dependent variable is the average across four seasons, with one observation per Target Plot. We run an ANCOVA regression controlling for baseline values of the outcome and we instrument dummies for whether the plot owner took up the treatment in any of the four seasons with the treatment assignment dummies. Additional details on the construction of the variables are included in the notes of Table 2.

D.1.3 Results by season

Figure D.2: Results by season

(a) Harvest Value (b) Value Added



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.

D.1.4 Soil sample analysis

Table D.2: Soil test results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Index	Nitrogen	Potassium	Phosphorus	Organic Carbon	pH	Index			
Rental Subsidy Paid	-0.04	-0.02	-0.15	-0.05	0.31	-0.05	0.02	-0.10	0.06	-0.20
	[0.09]	[0.07]	[0.29]	[1.76]	[0.91]	[0.05]	[0.13]	[0.10]	[0.12]	[0.14]
Cash Drop Paid	-0.01	-0.07	0.23	1.45	-0.10	0.09	-0.07	0.05	0.03	-0.05
	[0.06]	[0.04]	[0.21]	[1.25]	[0.57]	[0.04]	[0.08]	[0.07]	[0.08]	[0.08]
Rent - Cash	*-0.03*	*0.06*	*-0.39*	*-1.51*	*0.41*	*-0.13*	*0.08*	*-0.15*	*0.03*	*-0.14*
	[0.08]	*[0.05]*	*[0.26]*	*[1.56]*	*[0.80]*	*[0.05]*	*[0.11]*	*[0.08]*	*[0.10]*	*[0.12]*
Endline Round	1&4	1&4	1&4	1&4	1&4	1&4	1	4	1&4	1&4
Strata	All	All	All	All	All	All	All	All	C	NC
Mean Y in Control Group	-0.00	1.39	5.89	21.56	22.51	5.60	0.00	0.00	0.00	0.00
Observations	967	967	967	967	967	967	489	478	640	327

Notes: The table reports treatment effects on agricultural outcomes on the Target Plot. The soil index in column (1) comes from two rounds of soil testing that we conducted at the end of seasons 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. Columns (7) and (8) present results from season 1 and 4 individually. In columns (2)-(6) we winsorize the top 1%, while in columns (1), (7) and (8) we winsorize the top and bottom 1%. *Rent - Cash* reports the difference between the *Rental Subsidy Paid* and *Cash Drop Paid* coefficients and its standard error. We run an ANCOVA regression controlling for baseline values of the outcome and instrumenting for whether the plot owner took up the treatment in any of the four seasons with the treatment assignment dummies.

D.1.5 Non-labor inputs

Table D.3: Target Plot: Inputs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Inputs	Seeds	Improved Seeds	Compost		Inorganic Fertilizer		Pesticide	
	Value	Value	Use	Use	Value	Use	Value	Use	Value
(A) Full Sample									
Rental Subsidy Paid	9.19	5.18	0.09	-0.06	-0.86	0.08	2.97	0.03	0.28
	[3.56]	[1.73]	[0.04]	[0.03]	[0.52]	[0.04]	[1.97]	[0.02]	[0.24]
Cash Drop Paid	5.25	3.84	0.05	0.01	0.44	0.02	0.34	0.01	-0.02
	[2.54]	[1.36]	[0.03]	[0.02]	[0.42]	[0.03]	[1.37]	[0.01]	[0.15]
Rent - Cash	*3.94*	*1.34*	*0.04*	*-0.07*	*-1.30*	*0.05*	*2.63*	*0.02*	*0.29*
	[3.21]	*[1.65]*	*[0.03]*	*[0.02]*	*[0.47]*	*[0.03]*	*[1.72]*	*[0.02]*	*[0.21]*
Mean Y in Control Group	31.57	11.52	0.59	0.15	2.47	0.63	16.21	0.06	0.54
Observations	1957	1957	1957	1957	1957	1957	1957	1957	1957
(B) Stratum C									
Rental Subsidy Paid	8.28	7.10	0.06	-0.10	-1.48	0.01	1.58	0.03	0.09
	[4.49]	[2.34]	[0.05]	[0.03]	[0.63]	[0.04]	[2.49]	[0.02]	[0.36]
Cash Drop Paid	4.31	4.97	0.01	-0.02	0.05	-0.04	-0.22	0.01	-0.06
	[2.90]	[1.86]	[0.04]	[0.02]	[0.49]	[0.03]	[1.70]	[0.02]	[0.24]
Rent - Cash	*3.97*	*2.13*	*0.05*	*-0.08*	*-1.53*	*0.05*	*1.80*	*0.02*	*0.15*
	[4.08]	*[2.25]*	*[0.04]*	*[0.03]*	*[0.54]*	*[0.04]*	*[2.23]*	*[0.02]*	*[0.32]*
Mean Y in Control Group	33.88	12.43	0.66	0.19	2.93	0.71	17.46	0.06	0.69
Observations	1289	1289	1289	1289	1289	1289	1289	1289	1289
(C) Stratum NC									
Rental Subsidy Paid	13.54	4.18	0.12	0.02	0.78	0.20	5.94	0.04	0.59
	[5.63]	[2.61]	[0.07]	[0.04]	[0.98]	[0.07]	[3.02]	[0.02]	[0.29]
Cash Drop Paid	7.82	3.05	0.12	0.06	1.41	0.13	1.46	0.00	-0.05
	[4.62]	[1.93]	[0.05]	[0.03]	[0.81]	[0.05]	[2.17]	[0.02]	[0.18]
Rent - Cash	*5.72*	*1.13*	*0.00*	*-0.04*	*-0.63*	*0.07*	*4.48*	*0.04*	*0.63*
	[5.12]	*[2.42]*	*[0.06]*	*[0.04]*	*[0.92]*	*[0.06]*	*[2.72]*	*[0.02]*	*[0.27]*
Mean Y in Control Group	27.13	9.98	0.46	0.08	1.64	0.48	13.79	0.05	0.32
Observations	668	668	668	668	668	668	668	668	668

The table reports treatment effects on the inputs used on the Target Plot. The value of inputs variable (used in col. 1) is a composite of the value of seeds, compost, inorganic fertilizer and pesticide used on the Target Plot. The value of each input is included in columns (2), (5), (7) and (9). The remaining columns (3, 4, 6 and 8) are indicator variables which equal one for when a farmer applies the input to the Target plot. Details on the data sources are included in the notes of Table 2. **Panel A** reports results for the full sample. **Panel B** and **Panel C** report results for Stratum C and NC respectively. *Rent - Cash* reports the difference between the *Rental Subsidy Paid* and *Cash Drop Paid* coefficients and its standard error. We instrument for whether the respondent took up the treatment in any of the four seasons with the treatment assignment dummies.

D.2 Target plot outcomes: Robustness

D.2.1 ITT

Table D.4: Target Plot Outcomes: ITT

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Cultivated	Input Value		Labor Value		Output Value		Value Added
Rental Subsidy	0.06	6.71	0.24	0.33	0.10	28.80	0.30	15.20
	[0.02]	[2.73]	[0.13]	[2.77]	[0.13]	[9.54]	[0.14]	[7.28]
Cash Drop	0.06	5.22	0.17	4.66	0.13	15.40	0.13	1.07
	[0.02]	[2.62]	[0.13]	[3.10]	[0.14]	[9.08]	[0.16]	[7.07]
Rent - Cash	*-0.00*	*1.49*	*0.07*	*-4.33*	*-0.03*	*13.39*	*0.17*	*14.13*
	[0.02]	*[2.72]*	*[0.13]*	*[2.98]*	*[0.13]*	*[9.95]*	*[0.15]*	*[8.07]*
Mean Y in Control Group	0.82	31.57	IHS	59.40	IHS	94.06	IHS	3.23
Observations	1957	1957	509	1957	509	1957	509	1957

Notes: The table reports treatment effects on plot cultivation and agricultural outcomes for the Target Plot. To generate these results 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 (1) in the paper). *Rent - Cash* reports the difference between the *Rental Subsidy* and *Cash Drop* coefficients and its standard error. All other details are as described in Table 2.

D.2.2 Alternative specifications

Table D.5: Robustness: Alternative Specifications

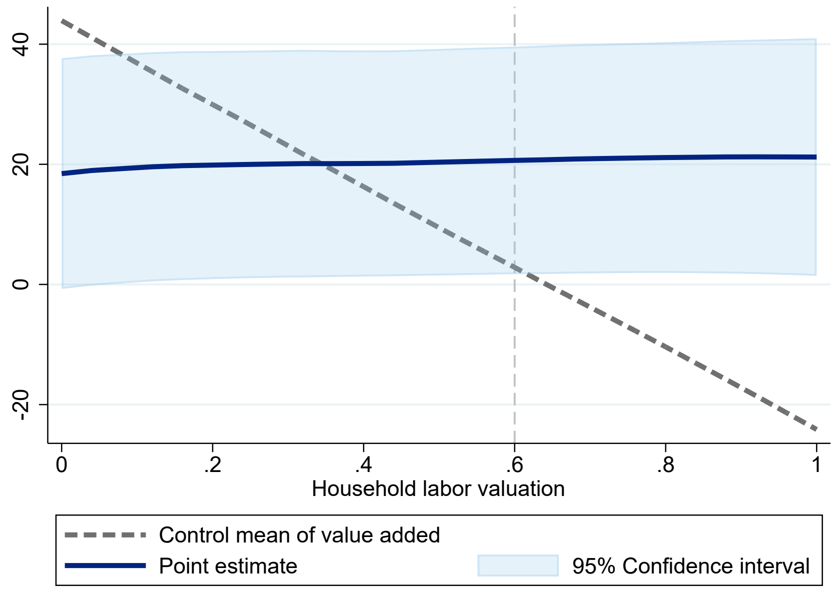
	(1)	(2)	(3)	(4)	(5)
(A) Target Plot Cultivated					
Rental Subsidy Paid	0.08	0.09	0.09	0.06	
	[0.03]	[0.03]	[0.03]	[0.03]	
Cash Drop Paid	0.06	0.07	0.07	0.06	
	[0.02]	[0.02]	[0.02]	[0.02]	
Rent - Cash	*0.02*	*0.02*	*0.02*	*0.00*	
	[0.02]	*[0.03]*	*[0.03]*	*[0.02]*	
Mean Y in Control Group	0.82	0.82	0.82	0.82	
Controls	Main	Size	None	PDS	
Observations	1957	1957	1957	1957	
(B) Labor Value					
Rental Subsidy Paid	1.43	1.43	2.24	-0.67	
	[3.76]	[3.76]	[3.75]	[3.57]	
Cash Drop Paid	4.61	4.61	6.07	3.79	
	[3.04]	[3.04]	[3.08]	[2.89]	
Rent - Cash	*-3.18*	*-3.18*	*-3.83*	*-4.46*	
	[3.47]	*[3.47]*	*[3.53]*	*[3.41]*	
Mean Y in Control Group	59.40	59.40	59.40	59.40	
Controls	Main	Size	None	PDS	
Observations	1957	1957	1957	1957	
(C) Value of Inputs					
Rental Subsidy Paid	9.20	10.02	11.55	9.53	
	[3.57]	[3.53]	[3.77]	[3.54]	
Cash Drop Paid	5.25	5.82	8.59	5.47	
	[2.54]	[2.60]	[2.83]	[2.56]	
Rent - Cash	*3.96*	*4.19*	*2.96*	*4.06*	
	[3.21]	*[3.20]*	*[3.48]*	*[3.21]*	
Mean Y in Control Group	31.57	31.57	31.57	31.57	
Controls	Main	Size	None	PDS	
Observations	1957	1957	1957	1957	
(D) Output Value					
Rental Subsidy Paid	39.38	40.45	44.87	38.20	40.16
	[12.52]	[12.49]	[12.95]	[12.37]	[12.92]
Cash Drop Paid	15.37	16.75	24.72	14.03	19.64
	[8.82]	[8.85]	[9.51]	[8.66]	[9.33]
Rent - Cash	*24.01*	*23.70*	*20.15*	*24.16*	*20.52*
	[11.81]	*[11.84]*	*[12.54]*	*[11.71]*	*[12.43]*
Mean Y in Control Group	94.06	94.06	94.06	94.06	94.06
Controls	Main	Size	None	PDS	Planned
Observations	1957	1957	1957	1957	1957
(E) Value Added					
Rental Subsidy Paid	20.82	22.76	24.76	20.97	19.82
	[9.65]	[9.58]	[9.77]	[9.62]	[9.83]
Cash Drop Paid	1.04	3.27	6.88	1.41	1.61
	[6.88]	[6.92]	[7.10]	[6.85]	[6.95]
Rent - Cash	*19.79*	*19.49*	*17.88*	*19.57*	*18.21*
	[9.60]	*[9.51]*	*[9.71]*	*[9.49]*	*[9.72]*
Mean Y in Control Group	3.23	3.23	3.23	3.23	3.23
Controls	Main	Size	None	PDS	Planned

Observations	1957	1957	1957	1957	1957

Notes: The table reports robustness tests on plot cultivation and agricultural Target Plot variables. Each test is generated by varying the control variables. Details on the construction and data sources of each of the dependent variables are included in the notes of Table 2. Column 1 includes the result as presented in Table 2. Along with results under the core specification (col. 1), the table includes results when, in addition to controlling for survey-round dummies and stratum dummies, only plot size is controlled for (col. 2), when no other variables are controlled for (col. 3), and when, following Belloni et al. (2014), we control for Target Plot variables selected via post-double-selection (PDS) (col. 4). In column (5) of Panels D and E, we control for a dummy capturing non-verified planned harvests (see discussion in Section 3.4). *Rent - Cash* reports the difference between the *Rental Subsidy Paid* and *Cash Drop Paid* coefficients and its standard error. We cluster standard errors by the Target Plot.

D.2.3 Alternative valuations of household labor

Figure D.3: 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. The data used to construct the different variables comes from follow-up surveys we run at the end of seasons 1 to 4 with the manager of the Target Plot and are measured in USD. In the main results of the paper, we use a 60% value of household labor (based on Agness et al., 2022), the vertical line indicates results at this valuation. We winsorize the top and bottom 1% of the outcome 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 stratum dummies. We instrument for whether the respondent took up the treatment in any of the four seasons with the treatment assignment dummies (see Equation (2) in the paper). We cluster standard errors by the Target Plot.

D.2.4 Attrition

Table D.6: Attrition across surveys

	(1)	(2)	(3)	(4)	(5)	(6)
	S0-2019 LR	S1-2019 SR	S2-2020 LR	S3-2020 SR	S4-2021 LR	S1-4
(A) Manager Characteristics						
Rental Subsidy	0.01					
	[0.02]					
Cash Drop	0.02					
	[0.01]					
Rent - Cash	*-0.01*					
	[0.01]					
Mean Y in Control Group	0.97					
Observations	521					
(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]
Rent - Cash		*-0.05*	*-0.04*	*-0.05*	*-0.05*	*-0.05*
		[0.02]	*[0.02]*	*[0.03]*	*[0.03]*	*[0.02]*
Mean Y in Control Group		0.94	0.95	0.93	0.91	0.93
Observations		521	521	521	521	2084
(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]
Rent - Cash		*-0.05*			*-0.07*	*-0.06*
		[0.02]			*[0.03]*	*[0.02]*
Mean Y in Control Group		0.98			0.94	0.96
Observations		521			521	1042
(D) Owner Follow-up						
Rental Subsidy		-0.03	-0.04	-0.06	-0.06	-0.04
		[0.02]	[0.02]	[0.03]	[0.03]	[0.02]
Cash Drop		0.00	0.00	0.02	0.02	0.01
		[0.01]	[0.02]	[0.02]	[0.02]	[0.01]
Rent - Cash		*-0.03*	*-0.04*	*-0.08*	*-0.08*	*-0.06*
		[0.02]	*[0.02]*	*[0.02]*	*[0.03]*	*[0.02]*
Mean Y in Control Group		0.98	0.98	0.97	0.94	0.97
Observations		521	521	521	521	2084

Notes: The table reports completion rates across the different data collection activities included in the study. *Panel A* presents results from the baseline owner survey and the baseline renter survey. Data from the baseline owner survey is used where the Target Plot wasn't rented out in the first crop season. Where the Target Plot was rented out, data from the baseline renter survey is used. *Panel B* uses data from the follow-up surveys, asked at the end of each crop season, where we asked agricultural activity questions to each Target Plot manager: the owner if the plot was not rented out and the renter if it was rented out. Results in *Panel C* come from the two rounds of soil sampling completed during the first and the fourth crop seasons. *Panel D* presents the attrition results of each of the owner follow-up surveys where we asked owners, regardless of whether they rented out the Target Plot, questions concerning their other plots, non-agricultural activities, food security, assets and household finances. As soil samples were only collected in the first and fourth crop seasons, the pooled estimate in column 6 only includes 1,042 observations. *Rent - Cash* reports the difference between *Rental Subsidy*and *Cash Drop* coefficients and its standard error. We run an ANCOVA regression of a completion dummy on treatment dummies and include stratum dummies for all columns. Column (6) also includes survey-round dummies. We use robust standard errors for Columns (1)-(5) and we cluster standard errors by the Target Plot for column (6).

Table D.7: Lee Bounds

	(1) Cultivated	(2) Maize	(3) Commercial Crops	(4) Input Value	(5) Labor Value	(6) Output Value	(7) Value Added
Rental Subsidy Paid (Lower)	0.05	-0.02	0.09	7.77	-1.07	36.62	13.60
	[0.03]	[0.04]	[0.03]	[3.54]	[3.68]	[12.64]	[9.45]
Cash Drop Paid (Lower)	0.08	0.08	0.02	5.81	5.69	17.70	5.59
	[0.02]	[0.03]	[0.02]	[2.58]	[3.01]	[9.05]	[6.71]
Rental Subsidy Paid	0.08	0.00	0.09	9.19	0.44	39.35	20.82
	[0.03]	[0.04]	[0.03]	[3.56]	[3.66]	[12.51]	[9.65]
Cash Drop Paid	0.06	0.05	0.02	5.25	4.68	15.38	1.04
	[0.02]	[0.03]	[0.02]	[2.54]	[3.01]	[8.82]	[6.88]
Rental Subsidy Paid (Upper)	0.08	0.01	0.12	12.84	3.94	55.55	33.33
	[0.03]	[0.04]	[0.03]	[3.27]	[3.53]	[11.56]	[9.12]
Cash Drop Paid (Upper)	0.06	0.05	0.00	1.85	1.99	4.81	-8.52
	[0.02]	[0.03]	[0.02]	[1.95]	[2.57]	[6.23]	[5.16]
Difference Rent - Cash (Lower)	*-0.02*	*-0.09*	*0.06*	*1.96*	*-6.75*	*18.92*	*8.01*
	[0.02]	*[0.04]*	*[0.03]*	*[3.20]*	*[3.42]*	*[11.86]*	*[9.31]*
Difference Rent - Cash	*0.02*	*-0.05*	*0.07*	*3.94*	*-4.25*	*23.97*	*19.78*
	[0.02]	*[0.04]*	*[0.03]*	*[3.21]*	*[3.43]*	*[11.82]*	*[9.60]*
Difference Rent - Cash (Upper)	*0.02*	*-0.04*	*0.12*	*10.99*	*1.94*	*50.73*	*41.85*
	[0.03]	*[0.04]*	*[0.03]*	*[2.90]*	*[3.24]*	*[10.83]*	*[9.10]*
Mean Y in Control Group (Lower)	0.88	0.73	0.12	37.54	62.98	114.75	15.91
Mean Y in Control Group	0.82	0.69	0.09	31.57	59.40	94.06	3.23
Mean Y in Control Group (Upper)	0.86	0.71	0.10	33.12	58.50	98.88	0.54
Observations (Lower)	1,916	1,916	1,916	1,916	1,916	1,916	1,916
Observations	1,957	1,957	1,957	1,957	1,957	1,957	1,957
Observations (Upper)	1,916	1,916	1,916	1,916	1,916	1,916	1,916

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 follows: unbounded, lower bound and upper bound. Details on the data sources and construction of the variables are included in the notes of Table 2. *Rent - Cash* reports the difference between the *Rental Subsidy Paid* and *Cash Drop Paid* coefficients and its standard error. 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 (2) in the paper). We cluster standard errors by the Target Plot.

E Comparing our treatment effects to the predictions of a misallocation exercise based on baseline productivity dispersion

A common misallocation exercise is to quantify the predicted effect of a *full* reallocation of land, until its marginal productivity is equalized across farmers, where the reallocations and their predicted effects are based on baseline estimates of productivity and a production function (Chen et al., 2023; Adamopoulos et al., 2022b). This is a different exercise, and potentially a very different set of land trades, from the *marginal* reallocation induced by our experiment.

In this appendix, we compare our treatment effects to the predicted effects from full reallocation, and explore where differences arise. We make the comparison in three steps. First, based on baseline measures of productivity, we compare the predicted effect on output from fully reallocating land among farmers (as per the misallocation exercise, until the marginal product of land is equalized across farmers), to the predicted effect of the actual rentals induced by the subsidy. Second, we decompose both predicted effects on several dimensions, to understand the source of predicted gains. For induced rentals, we separate out predicted gains from diminishing returns to land from predicted gains from differences in renters' vs owners' estimated productivity. For full reallocation, we separate our predicted gains from increasing cultivation from predicted gains conditional on cultivating (in line with our analysis separating the C and NC strata in Section 5), and we also quantify the effect of restricting reallocation to within county, giving a more realistic set of potential trades. Third, for the induced rentals, we compare their predicted effects on output on the Target Plot to their experimental treatment effects on the Target Plot.

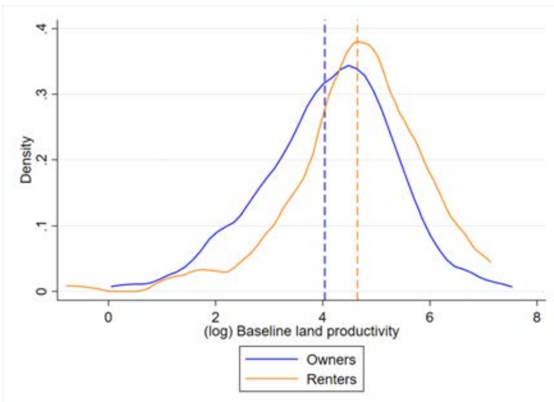
For the exercise, when necessary, we assume a Cobb-Douglas production function at the farm level, for farmer i: $Y_i = A_i L_i^{\alpha}$, where Y_i is total revenue, L_i is total land, A_i is TFP (estimated as a residual, using baseline data), and α, assumed constant across farmers, is the returns to scale.[4] Under full reallocation, land is reallocated across farmers until the marginal product of land, $\alpha Y_i/L_i$, is equalized across farmers. We calibrate $\alpha = 0.54$ based on Adamopoulos et al., 2022b; results are similar if we instead estimate α from the data ($\hat{\alpha} = 0.59$), but we do not have instruments for input use as in Gollin and Udry, 2021 and so are vulnerable to well-known biases in production function estimation when doing so.

E.1 Comparing predicted effects of induced trades vs. full reallocation

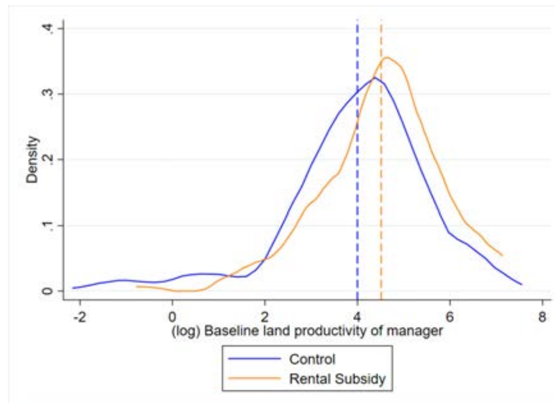
As a first step, in Figure E.1, we plot the distribution of the (log) marginal product of land across farmers, defined simply as $log(Y_i/L_i)$. Panel a) shows a comparison of the distribution of baseline land productivity among owners vs. renters whenever the Target Plot was rented out, pooling across the control and rental subsidy groups. Renters have higher productivity than owners on average — the distribution is shifted to the right — showing that rentals are on average predicted to increase output and decrease misallocation. Panel b) shows a comparison of the distribution of baseline land productivity of managers of the Target Plot in the control group vs. the rental subsidy group. In this case, the shift to the right of the distribution shows that marginal

[4] As we explained in Section 3.2, in order to leave sufficient time to subsequently induce rentals, we conducted the listing and the owner baseline while harvesting for the 2019 Long Rains was still ongoing. Thus, we are missing information on the harvest amount for a large portion of the sample for that season. In this section, we thus use harvest amount in the previous season, i.e., the 2018 Short Rains crop season. However, we do not have information on input values for that season, so we cannot include it in the production function. We also do not add labor in the production function, or normalize by it, due to similar limitations in baseline data. For these reasons, throughout this section, we use a one-input (land) production function, one of several shortcomings in this section compared with the best-executed studies of misallocation in agriculture. We highlight that our analysis in Section 5.2.2 does not suffer from this shortcoming, where we computed *endline* TFP using also labor and non-labor inputs. We also only have soil test data for Target Plots, and only at endlines seasons 1 and 4, so we do not control for soil quality in the analysis.

rentals — those induced by our rental subsidy — are also predicted to decrease misallocation. In both cases, the dotted lines show the mean marginal product of each group, which are clearly higher for renters than owners. However, from these figures alone, it is difficult to infer how much of the potential gains from full reallocation are predicted to be achieved by the rentals that occur – full reallocation involves redistributing land across farmers until these two distributions converge to a single point (and it is unclear from the figure how much land would be redistributed to achieve it), while the gap between owner and renter productivity distributions simply demonstrates the gains from an average rental.



(a) Owners vs. Renters



(b) Managers, Control group vs. Rental subsidy group

Figure E.1: Baseline dispersion in (log) land productivity

Notes: These figures show the dispersion in the farm-level marginal product of land, $log(Y_i/L_i)$, among different groups of farmers from our experimental sample, measured at baseline. Figure a) compares the distribution among all owners, in blue, to the distribution among all renters in the first intervention season (induced or not), in orange. The dashed lines show the means of the two distributions. Figure b) compares the distribution of the baseline productivity of whoever manages the Target Plot in the first intervention season. The blue line is for managers in the control group, while the orange line is for managers in the rental subsidy group. The shift to the right comes from renters being more productive than owners on average, among rentals induced by the subsidy.

E.1.1 Computing predicted gains from induced rentals

To compute the predicted gains from a given Target Plot rental, we estimate the productivity of both the owner and the renter of the Target Plot, based on baseline data, and then calculate the predicted change in their combined revenue when reallocating the Target Plot from the owner to the renter:

$$\text{Predicted gain from a rental} = (A_r((L_r + L_{TP})^\alpha - L_r^\alpha) - (A_o(L_o^\alpha - (L_o - L_{TP})^\alpha)$$

where r denotes renter, o owner, and TP target plot. We then sum these predicted gains across all rentals that occur in the rental subsidy group (in the first endline season), to compute the predicted gains from rentals in the rental subsidy group. This, however, is an overestimate of the predicted gains from the reallocation *induced* by the rental subsidy, since some of the rentals in the rental subsidy group would have occurred absent the subsidy (the 'always-takers'). We cannot identify induced rentals ('compliers') from 'always-takers' in the rental subsidy group; instead, to net out the gains from these always-takers, we compute the predicted gains from the rentals that occur in the control group. The predicted treatment effect of the induced rentals is then the difference between the predicted gains from the rentals in the rental subsidy group and the predicted gains from the rentals in the control group.

The gains are reported in Column (2) of Table E.1. For comparison, Column (1) reports the total baseline farm revenue of owner and renter households in the rental subsidy group. The induced rentals are predicted to increase total revenue by $1,950, corresponding to a 2.9% increase. We note that this increase arises from approximately 9% of the total land in the rental subsidy group changing management, since we only subsidized the rental of one plot per owner and have imperfect compliance.[5] For comparison, Column (1) reports the total baseline farm revenue of owner and renter households in the rental subsidy group. The induced rentals are predicted to increase total revenue by $1,950, corresponding to a 2.9% increase.

Decomposing predicted gains from induced rentals. We next decompose the predicted gains from inducing a change in who cultivates the Target Plot into gains coming from a change in TFP, $A_r - A_o$, and gains coming from diminishing returns to land and a change in total landholdings of the manager, L_r vs. L_o. To do so, we recalculate gains as above but assuming that the renter has the same TFP as the owner:

$$\text{Predicted gains arising from diminishing returns} = (A_o((L_r + L_{TP})^\alpha - L_r^\alpha) - (A_o(L_o^\alpha - (L_o - L_{TP})^\alpha)$$

The predicted gains from diminishing returns alone are reported in Column (3). They are $280, compared to overall predicted gains of $1,950, showing that changes in productivity accounted for the majority (86%) of the gains. We note that, the presence of diminishing returns may arise from several of the mechanisms that we discussed in Section 5. Most commonly, diminishing results are assumed to reflect labor market constraints, arising for instance from agency problems, but they can also reflect capital constraints. For the purpose of the exercise presented here, we do not need to take a stand on the source of diminishing returns.

Table E.1: Predicted treatment effects of induced reallocation on total revenue

	Predicted revenue with no reallocation (1)	Induced rentals (2)	Induced rentals without Δ productivity (3)
Total revenue	66781	1951	280

Notes: This table shows the predicted gains in total revenue from the rentals induced by the rental subsidy, based on baseline productivity estimates. The details and caveats of the exercise are explained in the above text. Column (1) shows, for the sample of all owners and renters in the rental subsidy group, the (predicted) total revenue at baseline, based on baseline productivity estimates. Column (2) shows the predicted gains in this total revenue from the rentals induced by the rental subsidy (which correspond to 9% of the total land of this group of farmers being reallocated). Column (3) shows the predicted gains if we assume that renters have the same productivity as owners, shutting down the potential for gains from productivity differences, to isolate the gains from diminishing returns to land.

E.1.2 Computing predicted gains from full reallocation

To calculate the predicted potential gains from full reallocation, we consider an output-maximizing relocation of land which equalizes the marginal product of land across farmers. We take as the set of farmers across which the reallocation can occur to be all owners and renters of the Target

[5] The average Target Plot size is 0.7 acres, while the average landholdings are 2.7 acres for owners and 1.4 acres for renters (whom we have for 70% of owners), so Target Plots account for approximately 19% of total land; and the predicted ITT gains come from the 45% of Target Plots which are marginal.

Plot in the rental subsidy group, the most inclusive set of farmers for which we have survey data.[6] Ideally, for the full reallocation exercise we would have the universe of farmers, another limitation of our full misallocation exercise relative to the frontier. If we are missing some very productive farmers —for example, because they were not interested in the small-scale rentals induced by our study, or because they travel a lot —then we are estimating a lower bound on the gains from reallocation. Solving for the optimum gives the following allocation, based on baseline estimates of TFP:

$$L_i^* = \frac{\hat{A}_i^{\frac{1}{1-\alpha}}}{\sum_j \hat{A}_j^{\frac{1}{1-\alpha}}} \sum_j L_j$$

We then compare predicted total revenue under this optimal allocation to predicted total revenue under the allocation in the control group, resulting in a predicted treatment effect which is comparable to that of the induced rentals.

The predicted gain from full reallocation is reported in Column (1) of Table E.2; total revenue of owners and renters in the rental subsidy group would increase by $85,400, a %128 increase. This is a very large increase, but not inconsistent with other estimates of gains from full reallocation (e.g. Chen et al., 2023). The predicted gain from full reallocation is thus around 40 times larger than the predicted gains from our induced rentals. However, induced rentals only reallocate 9% of land. Dividing the predicted gains from induced rentals by 0.09 gives $19,500, which is much less than the gains from full reallocation, demonstrating that the induced trades are not those with the largest potential revenue gains (as is also suggested by Figure E.1). This is perhaps not surprising, especially given the constraints on that set of rentals which our experiment can induce (only owners can rent out, and only up to one plot per owner).

One substantial caveat of our full reallocation exercise is that we base our measures of farm productivity on data from one (baseline) season, and thus cannot do the steps to remove measurement error undertaken in related papers; the resulting measurement error will bias us towards overestimating the potential gains from full reallocation.

Restricting the set of trades under 'full' reallocation. The full reallocation exercise likely contains many trades which could never happen in practice —where the trade friction, τ is extremely high —a point we consider further in the paper. Whether the gains from full reallocation mainly come from such infeasible trades, and hence whether restricting to a potentially feasible set of trades substantially reduces the potential gains from reallocation, is of central importance for considering the policy implications of the misallocation exercise. One such set of very unlikely trades in our sample is those across counties. Our sample contains four counties, spread over a substantial area of Western Kenya – it is unlikely that a farmer in one county could effectively cultivate a plot in another county. Following Chen et al. (2023), to test whether restricting to within-county reallocation substantially reduces potential gains, we rerun the above exercise, but separately for each county, and then sum the total gains. Results are reported in Column (2). We find gains to be $71,300, smaller than the $85,400 gains from full reallocation, but still substantial - restricting trades to be within counties does reduce overall gains, but our induced rentals still appear far from those with the largest gains in this restricted set.

Separating gains from cultivation from gains conditional on cultivation. The exercise above did not separate out the cultivation margin. Insofar as farmers were not cultivating some of their land, it loaded onto their productivity A. This mirrors our main experimental results on Target Plot revenue in Section 5, where we also did not explicitly separate out the cultivation

[6] We could only collect detailed baseline data for our experimental sample, not for all farmers in the listing exercise.

margin. Subsequently in that section, to make progress on mechanisms, we did attempt to separate gains from the intensive margin (conditional on cultivation) from gains from the extensive margin (inducing cultivation), by splitting the analysis by stratum C and NC. We attempt a related decomposition here, for the gains from full reallocation, in three steps. First, we re-estimate productivity A^c for each farmer based upon their *cultivated* land, L_c and output Y. Second, we re-estimate gains from fully reallocating this cultivated land L^c across farmers, according to the new distribution of productivities A^c, to test gains from only the intensive margin. Third, we re-estimate gains from fully reallocating and fully cultivating all land L, according to the new distribution of productivities A^c, to introduce the extensive margin of cultivation too. Column (3) reports results from full reallocation, but restricting to cultivating plots which were cultivated at baseline, i.e. turning off the extensive margin of cultivation. Gains are around 17% smaller, at \$70,700. If instead, we allow all plots to be cultivated, fully turning on the extensive margin of cultivation, gains are \$103,500 (Column (4)), demonstrating that inducing cultivation in this setting can increase the gains from misallocation by 46%, relative to when there is no extensive margin.

Table E.2: Predicted treatment effects of full reallocation on total revenue

	Full reallocation (1)	Only within counties (2)	Only within cultivated plots (3)	Inducing cultivation of all plots (4)
Total revenue	85439	71317	70680	103450

Notes: This table shows the predicted gains in total revenue from full land reallocation for the same sample as Table E.2 (i.e. for all owners and renters in the rental subsidy group). The details and caveats of the exercise are explained in the above text. Column (1) shows the predicted gains from full reallocation among all farmers in this sample. Column (2) presents the gains when restricting reallocation to occur within county (of which there are four in our sample). Columns (3) and (4) explicitly account for, and attempt to isolate, the cultivation margin of gains from reallocation. Here we estimate baseline (farm-level) productivity only among plots that were cultivated at baseline. In Column (3), we shut down the cultivation margin, predicting gains from full reallocation only among plots that were cultivated at baseline. In Column (4), we turn on the cultivation margin, allowing for reallocation (and hence cultivation) among all plots, irrespective of whether they were cultivated at baseline.

E.2 Comparing predicted effects to experimental effects among induced rentals

We undertake this comparison for outcomes on the Target Plot, rather than at the farm level, because as explained in Section 3.3, the experimental design does not give a renter counterfactual (e.g., for renter's farms). We thus need to arrive at predictions for Target Plot outcomes using our farm-level production function, when calculating the predicted change in output for a given rental. We do so, in order to calculate predicted the predicted change in the Target Plot revenue, in three ways: 1) assuming owners and renters achieve their average output on the Target Plot:

$$A_r(L_r + L_{TP})^\alpha \frac{L_{TP}}{L_r + L_{TP}} - A_o(L_o)^\alpha \frac{L_{TP}}{L_o}$$

2) assuming that the Target Plot is marginal, in the sense that rentals induce no spillovers to outcomes on other plots of owners and renters (as we find empirically for owners), in which case the predicted farm-level treatment effect above is identical to the predicted treatment effect on the Target Plot:

$$(A_r(L_r + L_{TP})^\alpha - A_r L_r^\alpha) - (A_o L_o^\alpha - A_o(L_r - L_{TP})^\alpha)$$

3) using a first order approximation, based on the difference in the marginal product of land:

$$(\alpha\frac{Y_r}{L_r} - \alpha\frac{Y_o}{L_o})L_{TP}$$

With these predictions for the effects of individual rentals on Target Plot revenue, we then need to compute a predicted treatment effect of the rental subsidy on (average) Target Plot revenue. We do so by comparing average predicted gains from rentals in the rental subsidy group (set to zero if there is no rental) to average predicted gains from rentals in the control subsidy group. As such we net out the effect of 'always-taker' rentals, to identify only the effect of induced rentals. These predicted treatment effects on average Target Plot revenue are reported in Table E.3, Columns (2)-(4) respectively. To benchmark them, Column (1) reports the average Target Plot revenue at baseline (short rains 2018). Predicted average treatment effects are estimated to be between \$12.2 and \$19.7, corresponding to a 17% to 28% increase. Column (5) reports the corresponding estimated average treatment effect based on our endline data— the treatment effects of the rental subsidy minus those of the cash drop to control for the income effect — which is \$24.1 corresponding to a 34% increase. The predicted treatment effects on Target Plot revenue are thus consistent with, and if anything slightly smaller than, the estimated treatment effects. This is an encouraging result for existing studies of land misallocation based on such predicted effects.

Table E.3: Treatment effects of induced rentals on average Target Plot revenue: predicted vs. experimental

	Baseline mean	Predicted effect			Experimental effect
		Production function average productivity	Production function marginal productivity	First-order approximation	
	(1)	(2)	(3)	(4)	(5)
Revenue on Target Plot	70.5	17.4	12.2	19.7	24.1

Notes: This tables compares the *predicted* revenue gains on the Target Plot from induced rentals, based on baseline estimates of productivity, to our experimentally measured treatment effects for the same rentals. The details and caveats of the exercise are explained in the above text. Column (1) shows the average revenue on the Target Plot at baseline. Columns (2) - (4) show predicted effects of the induced rentals. The three different predictions correspond to different assumptions for moving from farm-level predictions to predictions on the Target Plot, as explained above. Column (5) shows our experimental treatment effect of the rental subsidy on Target Plot revenue.