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UNLOCKING THE BENEFITS OF CREDIT THROUGH SAVING

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ABSTRACT

Access to microcredit has been shown to generate only modest average benefits for recipient households. We study whether other financial market frictions—in particular, lack of access to a safe place to save—might limit credit's benefits. Working with Kenyan farmers, we cross-randomize access to a simple savings product with a harvest-time loan. Among farmers offered a loan, the additional offer of a savings lockbox increased farm investment by 11% and household consumption by 7%. Results suggest that financial market frictions can interact in important ways and that multifaceted financial access programs might unlock dynamic household gains.

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I Introduction

A vast literature on microcredit has found mixed evidence on whether credit access allows households to finance profitable investments and improve key livelihood indicators (Banerjee et al., 2015; Meager, 2018). Even in settings where microcredit has had positive immediate effects on revenues, it often fails to translate into sustained consumption gains or business growth for the majority of households (Meager, 2016).

One possible explanation for this lack of sustained impact is difficulty in channeling increased revenues into future investments due to limited ability to save. For example, if the timing of when the returns from microcredit-enabled investments are realized does not align with the timing of when those additional revenues are needed for consumption or reinvestment, households lacking a safe way to save may struggle to translate increased revenues into desired investments. Households without access to protected saving vehicles may also face pressure to share any increase in revenue with kin, rather than re-invest.

In this study's Kenyan setting, as in many other low- and middle-income countries (LMICs), households that lack access to credit typically also face barriers to accessing other financial services, including savings products that could help them bridge this gap in timing. Therefore, it may be that – rather than being substitute financial services – credit and savings products can serve as complements.

We present novel experimental evidence on the complementarities between credit and savings. In the context of African agricultural markets, large seasonal fluctuations in the price of staple commodities provide substantial opportunities for arbitrage through storage. Despite this, smallholder farmers typically sell their crops immediately after harvest, when prices are low; many buy back grain for personal consumption in the lean season when prices are higher. We build on work by Burke et al. (2019), which finds that credit constraints contribute to farmers' inability to take advantage of this arbitrage opportunity. They find that a harvest-time loan allows farmers in Kenya to more effectively time their maize sales and earn higher revenues. However, this productive activity did not on average translate to an increase in consumption or other productive investments.

In this paper, we present the results from a contemporaneous field experiment in Kenya in which we randomly overlay access to the harvest-time loan with access to a simple savings technology,

namely, a durable, concealable metal box with a key (or "lockbox"). We find that among those who are offered a loan, being offered a savings lockbox enables farmers to move returns (and possibly part of the loan itself) intertemporally, increasing farm investment by 11% and total household consumption by 7% relative to farmers only offered the loan but not the lockbox.

The data suggest that at least two mechanisms are at play. First, the lockbox provides households with a technology to move money intertemporally to times when it is most needed. We see especially large consumption gains from lockbox usage during the lean season, when the marginal utility of consumption is presumably highest. Second, consistent with the idea that lockboxes can shield households against a "kin tax" (Dupas and Robinson, 2013b; Jakiela and Ozier, 2016) we find evidence that in addition to enabling the inter-temporal movement of consumption, lockboxes also increase total consumption. Households that are most interconnected with friends and family at baseline become less likely to provide money gifts or loans to them when they have access to a lockbox.

We present two additional pieces of evidence that bolster the central conclusion that access to savings products helps translate credit-enabled returns into long-run reinvestment and consumption gains. First, we exploit a second source of variation in the Burke et al. (2019) study, which found that returns to loans offered immediately after harvest (in October) yield much higher returns than loans offered three months later (in January). In this paper, we find that the consumption and investment benefits of being offered a lockbox are concentrated among the early loan (October) group, suggesting that access to savings is most useful when combined with access to a profitable investment (facilitated here by timely credit). A second exercise estimates the effects of a lockbox alone (among households without access to the harvest-time loan), and finds null effects on consumption and farm reinvestment, implying that the results are not the impact of having a lockbox alone. These results point to important complementarities between various financial market frictions, and suggest that multifaceted financial access programs that include access to both credit and savings technologies may be well-positioned to unlock opportunities for virtual cycles of reinvestment and dynamic household gains.

This paper is closely related to a large literature on the role of microcredit in enabling productive investments by households. In the evaluation of six randomized studies Banerjee et al. (2015) find that microcredit access increases borrowing, business creation, and investment, but does not lead

to a sustained increase in profit, income, labor supply, and consumption for the average borrower. We also speak to a separate literature on savings in LMICs that highlights the positive impacts that access to savings products – even simple ones like the lockbox studied here – can have on household economic outcomes including income, expenditure, investments and wealth (Brune et al., 2016; Chandrasekhar et al., 2018; Dupas and Robinson, 2013a,b,b; Prina, 2013; Karlan et al., 2014; Schaner, 2018). For example, Dupas and Robinson (2013b) show that a safe place to store cash helps individuals move money inter-temporally and accumulate health savings, and other studies find that commitment savings products enable higher savings (Ashraf et al., 2006).

In contrast to most of this work, we focus on the interplay between access to a savings product and to credit, and do not estimate meaningful impacts of access to a lockbox alone on household consumption and reinvestment. A handful of recent studies have explored interactions between different types of financial products. Atkinson et al. (2013) find that a commitment savings product allows individuals who are time inconsistent but want to save in the future to transition from a debt-financed to a savings-financed investment path, while Kast et al. (2018) test the impact of a peer group savings program on precautionary saving among a sample of microcredit borrowers. Burgess and Pande (2005) study the impact of access to credit and savings services via large-scale rural bank branch expansion in India and document a significant reduction in poverty. In a lab-in-field setting, Afzal et al. (2018) show that when expenditures are lumpy, individuals tend to demand both credit and savings products.[1] We contribute to this literature by highlighting the importance of simultaneous provision of two distinct financial instruments, increasing access to both credit and savings, to enable farmers to undertake productive investments, in an experimental setting.

II Setting and experimental design

II.I Arbitrage investment opportunities, reinvestment, and savings access

Agricultural markets in LMICs commonly experience large seasonal price fluctuations. In East African maize markets, prices can rise by over 25% in the months between the harvest and lean seasons. In our study area in rural western Kenya, price fluctuations during the study period of 2013-2014 and 2014-15 were 42% and 45%, respectively (Burke et al., 2019).

[1] Related studies are Kaboski and Townsend (2005); Karlan et al. (2014); Duflo et al. (2011); Suri (2011).

These price fluctuations appear to offer farmers a productive opportunity for investment in arbitrage. Rather than sell maize immediately after harvest, when prices are low, farmers can wait to sell until later in the year, when prices are substantially higher. On the other side of the market, farmers who tend to buy maize during the lean season can buy earlier, reducing outlays on the staple commodity. However, we find that most of the smallholders in our sample tend to "sell low and buy high," selling right after harvest when prices are low and buying maize back at high prices later in the year. In particular, in our baseline data we see that over 50% of maize sales occurred when maize prices were low (prior to January).

Why do farmers forgo the seemingly profitable investment of storage? Evidence from Burke et al. (2019) suggests the credit constraints are at least partially to blame. Farmers have large expenses, such as school fees, that come due shortly after harvest. Lacking alternative sources of funds, many feel compelled to sell their crop for low prices at that time to pay these bills. Burke et al. (2019) find that offering farmers a loan at harvest-time enables them to invest in maize market arbitrage, holding off selling – for some, even buying – immediately after harvest, and selling later in the season at a far higher price. This investment yields increase in revenues of 1,573 Ksh (about US$18) on an average loan size of 5,476 Ksh (US$63) and has a rate of return of 29%. However, Burke et al. (2019) show that this profitable investment fails to translate into meaningful sustained household consumption gains, nor is there significant evidence that these one-time gains reinvested in future productive capacities, such as farming inputs (see Section IV below).

In this paper, we test one explanation for why farmers have limited ability to convert one-time benefits into sustained dynamic gains, namely that they lack the ability to protect and move profits intertemporally. The inter-temporal movement of profits is critical when there is a mismatch in the timing of when an investment yields returns and when those returns are needed for consumption or reinvestment. To see this more clearly, we divide the year into four periods: (i) Harvest (roughly months September to December), (ii) Post-Harvest (months January to March), (iii) Planting (months March to June) and (iv) Lean (months July to August) seasons. The Harvest season is marked by the production of maize, which is the primary source of annual income for most farm households in our setting. They can choose to set aside maize for consumption, sell it immediately for cash, or store it for selling later. In the Post Harvest season, households have need for large and often lumpy expenditures, including to repay debt that has accumulated through the year and most

importantly, school fees, which are usually due in January (a few months after harvest). In our sample, 90% of farmers have school aged children and they report spending 37% of their harvest income on school fees. Discretionary expenses for marriage ceremonies and other local events are also often made in this period. All together, approximately 43% of total households expenditures are incurred during the Post-Harvest phase. The next period is Planting, when farmers need to invest in farm inputs, which directly affect the following year's harvest. However, given the lag between when income is received (at harvest) and when farm investments are made, farming households often find it challenging to channel funds towards this productive investment. Lastly, the Lean period prior to the next harvest is characterized by a substantial dip in consumption for both food and non-food items.

The pressure to share household resources with family and friends can further limit the reinvestment of profits, by acting like a tax on savings and wealth accumulation (Jakiela and Ozier, 2016; Chandrasekhar et al., 2018). Tight social networks that serve key economic functions are characteristic of rural communities in LMICs (Robinson, 2012), and can provide a system of support and insurance against sudden exogenous shocks. In our data, borrowing from friends is very common, with 20% of the sample having taken a loan from a friend, and over 50% reporting giving a money or maize "gift" to family or friends. However, there may also be a downside to these close social connections in rural communities: returns from profitable investments may be easily accessible by other household members who have less thrifty spending preferences, or by friends and relatives living nearby. This inability to protect individual or household earnings from the demands of relatives, often referred to as a kin tax, could influence the incentives for and success of attempts to reinvest returns into future profitable opportunities.[2]

If farmers had access to effective, protected, and discreet savings technologies, the mismatch between the timing of returns and timing of when those returns are needed would be less consequential, and demands by kin may be easier to avoid. However, in our setting, access to formal savings remains limited: two-thirds of the sample has no money saved in a formal savings account.[3] The two most prevalent forms of savings in our setting remain the most traditional, namely, cash

[2]For instance, Anderson and Baland (2002) find that the probability of a woman participating in a ROSCA has an inverse-U shaped relationship to her income share (or bargaining position) within the household, arguably due to these considerations.

[3]See Dupas and Robinson (2013a); Prina (2015); Suri and Jack (2016); Dupas et al. (2018); Karlan et al. (2014).

and bags of maize. However, saving in cash runs the risk of theft and stored maize is less liquid and more prominent to kin. Many farmers therefore lack access to safe and protected vehicles in which to save returns and transfer them from one period to the next.

Given the multiple constraints on household savings noted above, this study examines whether access to an improved savings technology can help convert short-run credit-enabled revenue increases into longer-run investment and consumption growth.

II.II Experimental design

Our sample is comprised of 1589 smallholder farmers in the Webuye and Matete counties of western Kenya (see Burke et al. (2019) for a greater description of the sample). The design overlaid two treatments: (1) an investment opportunity, in the form of a harvest-time storage loan, and (2) access to a savings product, in the form of a simple lockbox. The storage loan was offered in partnership with the organization One Acre Fund (OAF), a non-profit social enterprise that supplies financing and training to smallholder farmers. The product was cash loan provided at harvest.[4] To ensure that farmers took on a loan they were able to repay, the loan size was capped at an amount proportional to the number of maize bags the farmer had in storage at the time of loan disbursal. OAF did not take physical possession of these bags as collateral and there was no formal obligation to store the maize beyond the date of loan disbursal. The cash loans were structured similar to the in-kind loans that OAF had usually offered, with a flat interest rate of 10% and a flexible repayment structure.[5] As noted above, this loan can enable a productive investment, as it allows farmers to potentially earn high rates of return by storing and selling their maize in a timely manner.

The savings product offered to farmers was a lockbox, a simple metal box to which the farmer held the key. Lockboxes can encourage savings through three mechanisms. First, the lockbox is a safe place to store money, with cash less prone to theft compared to other at-home alternatives. Second, since participants are free to keep the box hidden, it can also help shield money from family and friends and thus reduce the magnitude of the kin tax. Third, the product can also facilitate savings through a mental accounting effect, as it provides a soft form of commitment by allocating the savings to a specific use or labeling (Thaler, 1999; Dupas and Robinson, 2013b). Unlike some

[4]Outside of OAF, access to formal credit was limited in our sample, with only 8% ever having taken out a formal bank loan. See Burke et al. (2019) for details.

[5]The only condition was that full repayment was due at the end of 10 months.

commitment accounts, a lockbox allows full flexibility in terms of withdrawal and usage (for the holder of the key), and unlike formal savings accounts can lower transaction or other costs (e.g., travel time to travel to the bank, or minimum account balances).

Farmers were first randomized into the loan product. Then, in an additional layer of randomization, farmers in each treatment group were randomized into receiving a lockbox or not. See Figure 1a for details on the experimental design. Because OAF operates in a farmer group model, the loan was introduced to randomly selected groups, which consisted of 8-12 farmers each, all of whom were assigned the same treatment. Randomization was stratified based on geographic sublocation and on whether the group average OAF loan size in the previous year was above or below the median. In Year 1, two-thirds of groups were offered a loan and one-third were not. In addition, in order to test the importance of loan timing, a random half of loan offers in Year 1 were made in October, immediately post-harvest, and the remainder were made in January, when school fees are typically due (in both cases, farmers were made aware of the timing of the forthcoming loan beforehand, in September.)

While all farmers in a particular group were assigned the same loan treatment, for research budget reasons only a random set of 6-8 farmers per group were followed up for survey data collection. Then, within these 6-8 farmers in the study sample, the savings lockboxes were randomized across farmers at the individual level, and this treatment was stratified by the group treatment assignment and gender. On average, 30% of farmers were offered the lockbox. Lockboxes were disbursed in November of Year 1.

In Year 2 of the study, the loan groups were re-randomized, with loan offers stratified based on sublocation and treatment status from Year 1. All loans for Year 2 were offered in November, as immediate-post harvest-time loans were seen to be more effective in Year 1 (Burke et al., 2019). Note that additional lockboxes were not provided in Year 2.

Taken together, in Year 1, the study included 240 farmer groups, for a total sample size of 1589 farmers. In Year 2, there was an attempt to follow all of the same groups, but several groups dissolved or merged, leaving 171 intact groups, and some farmers also re-shuffled among groups. As a result, the Year 2 sample contains 1019 farmers, with 602 farmers remaining from the Year 1 sample and 417 new randomly chosen farmers added from within these groups. Because the lockbox was only distributed at the start of Year 1, these 417 farmers new to the sample in Year 2

are not part of the lockbox experiment and are excluded from the analysis in this paper.

III Data and estimation

The study collected a baseline household survey before Year 1, three follow up rounds each year (Years 1 and 2), and a long-run follow-up (LRFU) survey one year after the completion of the last Year 2 survey round (see Figure 1b for the timeline). Three follow-up rounds were conducted in each year spanning the nine months after harvest, and were spread out across the post-harvest, planting and pre-harvest (lean) period. Surveys collected data on household information, farming practices, maize harvest and inventory, expenditures, consumption, household finances and transfers, non-farm income, time and risk preferences. The multiple follow-up rounds provide the high-frequency data necessary to document the role of credit and savings products in allowing inter-temporal movement of cash and investment, as well as measuring living standards via consumption expenditures.[6] The LRFU survey followed all 1019 farmers from the Year 2 sample and a representative subset of 481 farmers from the Year 1 sample.

Sample attrition was low, with over 90% follow-up for both years and no differential attrition across the treatment arms.[7] Appendix C presents balance in the characteristics of farmers in the Year 1 sample and the subset who continue into the Year 2 sample, for both the loan and the lockbox treatment groups, although we note some imbalances in covariates in the lockbox treatment in Year 1, which leads us to carry out a robustness check in Appendix C, as discussed below.

III.I Estimation of treatment effects

The study has four main outcome variables: net revenues from maize, total household consumption, farm investments, and school fees paid. Net revenues from maize are calculated by subtracting the amount spent purchasing maize from the revenues earned by selling maize. For farmers who received a loan, we also subtract the loan payments made each month. We refrain from calling this measure "profits from maize" as we do not measure all the costs associated with maize farming. Total (log) household consumption is aggregated from a detailed seven-day recall for food expenditure

[6] Collecting multiple follow up rounds of survey data also improved statistical power (see McKenzie (2012)).

[7] Farmers who received a loan in Year 1 were more likely to return to the study in Year two. However, since loan treatment status was re-randomized in Year 2 and stratified based on Year 1 treatment status, it should not affect the internal validity of the Year 2 results.

outside the home and 30-day recall for non-food expenditure. For farm investment, we calculate the amount spent on farm inputs in the planting season, including detailed data on the amount spent on hybrid seeds and chemical inputs such as fertilizers. We measure cash payments made towards school fees using a 30-day recall.

We begin by replicating the results in Burke et al. (2019), documenting the effect of the loan on net revenues, consumption, farm investments, and school fees. Equation 1 presents the primary econometric specification, which pools data across across survey rounds where such data is available.[8] Y_{ijrm} is the outcome variable of interest for farmer i in group j in round $r \in \{1, 2, 3\}$ in year $m \in \{1, 2\}$. $Loan_{im}$ is an indicator for whether farmer i was offered a loan in year m. The β coefficients capture the intention to treat (ITT) effects. We include round year fixed effects η_{rm} and control for the survey date d_t. We also control for stratification indicators γ_s as per Bruhn and McKenzie (2009). Standard errors are clustered at the OAF farmer group level, the level of randomization for the loans. For all outcome variables, we present robustness to inclusion of baseline covariates as well as to winsorizing the dependent variable at 5% (see Appendix D).

$$Y_{ijrm} = \alpha + \beta_1 Loan_{im} + \eta_{rm} + d_t + \gamma_s + \varepsilon_{ijrm} \tag{1}$$

We then proceed to estimate the added effect of offering a lockbox. The main lockbox specification restricts the sample to those who received a loan, and estimates the additional effect of being offered a lockbox as follows:

$$Y_{ijrm} = \alpha + \phi_1 Lockbox_{im} + \eta_{rm} + d_t + \gamma_s + \varepsilon_{ijrm} \tag{2}$$

The definition of terms is as in Equation 1, where $Lockbox_{im}$ is the indicator for individual lockbox treatment assignment. To assess whether the treatment effects estimated in Equation 2 are just the simple effect of receiving a lockbox alone, we also estimate Equation 2 restricting the sample to those farmers who did *not* receive a loan. Finally, Appendix D presents the pooled specification showing the interaction between loan and lockbox, and these are discussed below.

[8]For farm investments, there is only data for the planting season, when such investments are made. For school fees, we focus on total school fees over the year and thus do not use the round by round data.

IV Results

IV.I Take-up for loan and lockbox

Take-up of both the loan and lockbox treatments was quite high: loan take-up rates were 64% and 62% for Year 1 and 2, respectively, higher than is typical of many other credit interventions in LMICs (Karlan et al., 2010; Banerjee et al., 2015; Jack et al., 2016). Take-up for the lockbox was 97% and, conditional on take-up, 78%, 63% and 50% of farmers report using the lockbox in Year 1, 2 and the LRFU, respectively (see Appendix B and Table B.1 for further descriptive statistics). This high usage rate is a first piece of evidence of the value households attached to this savings technology.

IV.II Treatment effects

As shown in Burke et al. (2019), the loan intervention had significant positive effects on the net revenues earned from maize (Table 1, Panel A, col. 1).[9] Compared to those who did not receive a loan, farmers who were offered a harvest time loan earned Ksh 533 higher net revenues from maize. As discussed in Burke et al. (2019), this was driven by farmers increasing maize purchases when prices were low (in the post-harvest season), holding more inventories of maize, and selling maize when prices were higher (in the planting and lean seasons). However, while the loan intervention increased revenues, it did not translate to a statistically significant increase in household consumption (although point estimates are positive), nor in farm investments or school fees (cols. 2-4).[10]

We next examine whether combining credit access with a savings technology enables farmers to gain more, either in terms of consumption or long-run productive investment. While the addition of access to a lockbox does not significantly affect farm revenues (1, Panel B, col. 1), we find that it does enable farmers to safely move cash across seasons: access to a lockbox, conditional on receiving a loan, significantly increased household consumption (col. 2), leading to a 7% increase in average consumption across follow-up survey rounds. In Appendix E, we show that these consumption

[9] Appendix D provides robustness checks, estimating Equation 1 and 2 with baseline covariates and by winsorizing the dependent variable at 5%.

[10] Note that due to a minor coding error, results in Panel A Column 4 differ slightly from what is presented in Appendix Table E.4 in (Burke et al., 2019). This coding error only affected this outcome.

gains are driven by a 9% increase (significant at 5%) in consumption in the lean season, farming households' neediest period.

We also see evidence that the lockbox enabled farmers to invest gains from a one-time increase in revenues into future productive investments in their farm: farmers who receive a lockbox in addition to a loan increased on-farm investment by 11% compared to farmers who only received a loan.[11] As mentioned above, the average farmer used about half the loan amount to delay selling and/or buy maize at harvest, while the remainder was held in cash. We see that farmers who used the lockbox saved Ksh 683 in the lockbox on average in Year 1 and Ksh 360 in Year 2. Given the time lag between harvest (when income is received) and planting (when investments must be made), a lockbox seems to have helped farmers move money intertemporally and invest more in farm inputs in the planting season. Access to a lockbox, conditional on a loan, also results in a positive, albeit not significant, increase in school fee payments of 12% (col. 4).

IV.III Unpacking the timing of savings and consumption

While the above results pool data across survey rounds, we next study the impact of the lockbox on savings and consumption by round in order to unpack exactly how savings access facilitates greater welfare gains when households undertake productive investments. Figure 2 presents non-parametric estimates for the effects of the lockbox on household savings and consumption over time, conditional on being offered a loan. The left panel presents the mean household consumption for those with and without a lockbox, as well as average lockbox dis-savings for those with a lockbox. We see that farmers with access to a lockbox consume more through the entire year (a point to which we return below), and that this gap is particular pronounced during the lean season, (from June to August), as noted above. The right-hand panel, which shows the difference between treatment and control consumption over time for the lockbox treatment, along with the bootstrap-estimated 90% and 95% confidence interval, confirms that this gap in lean season consumption is significant at 95% confidence.

The timing of these consumption gains is important for welfare, as the lean season is a time of particularly high farmer need in which the marginal utility of household consumption is presumably

[11] The number of observations for farm investments is about one-third that for all other variables since this data was only collected in the planting season, as noted above.

particularly high. Along these lines, in Appendix F, we estimate the treatment effect of a lockbox on household utility (from consumption).

To understand what drives these differences in lean-season consumption, we return to the left-hand panel, on which we have overlaid the dis-savings for those with access to a lockbox. We define dis-savings as negative savings, such that a negative value implies that money was added to the lockbox, whereas, a positive value represents money being withdrawn from the lockbox. Note that the positive treatment effect on consumption coincides with the timing of dis-savings from the lockbox. While not dispositive, this does strongly suggest that farmers use the savings accumulated in the lockbox to fund lean-season consumption.

That said, the lockbox appears to work not solely through allowing farmers to move consumption across time. In contrast to a typical "consumption smoothing" mechanism, in which we would expect any increase in lean season consumption to be matched by dips in consumption in other seasons, instead we see that consumption is higher throughout the year. This suggests that a second mechanism may be at play, consistent with results from Jakiela and Ozier (2016) and Dupas and Robinson (2013b): specifically, the lockbox may enable households to shield some money from the kin tax imposed by family and friends. As noted above, in the study setting, the pressure to share money with friends and extended family is quite prevalent, and over 50% of the sample reports sharing maize or money with kin at baseline. Consistent with this, we also find that farmers who gave more money to friends and family than they received at baseline are significantly less likely to loan money to people in their social network when they have access to a lockbox (see Appendix E). Of course, the welfare implications of this reduction in kin tax are not obvious. While farmers who were offered the lockbox (in addition to the loan) are able to channel the returns from the loan into consumption and productive re-investments within their own household, it may have had adverse effects on their kin who relied on them for support and no longer received as much in the way of transfers or loans.

IV.IV Are the gains from the lockbox most pronounced among the most profitable loans?

In this section, we present additional evidence suggesting that findings we observe are the result of the interplay between access to a profitable investment and a savings technology, by documenting

that the gains from the lockbox are most pronounced when combined with the most profitable loans.

In a setting marked by seasonality, the timing of the loan matters. Recall that in Year 1, the timing of the loan was randomized, with half of groups receiving the loan in October, immediately after harvest, and the other half receiving the loan in January. Burke et al. (2019) find that the October loan lead to significantly higher maize inventories, net revenues and household consumption – perhaps because farmers who received the loan in January had already liquidated their maize to meet post-harvest expenditure needs. The October loan thus appeared to open up more productive investments (in this case, greater or longer storage) than the January loan.

Here we analyze whether the lockbox is particularly useful for the October loan group, as one would expect if what the lockbox is doing is enabling better use of the returns from productive investments. We start by replicating the Burke et al. (2019) results in Table 2, Panel A, in which columns 2, 4, 6 and 8 compare farmers who were offered the loan in October of Year 1 to the control group, while columns 1, 3, 5 and 7 present treatment effects for the January loan treatment groups versus the control group. Being offered the October loan led to a significant increase in net revenue of 588 Ksh, while the average effect of the January loan in Year 1 led to a smaller (and not statistically significant) increase in net revenues. We next examine (Panel B) whether the gains from access to the lockbox savings technology are similarly concentrated among those who received the October loan. We find evidence that this is the case for consumption, farm investment and school fees (effects for for farm investments are not significant, perhaps because this outcome is only observed in one survey round and therefore estimated effects are less precise).[12] Taken together, this provides considerable evidence that the savings technology is most impactful when household have greater returns from a productive investment in hand.

IV.V Treatment effect of lockbox alone

To assess whether the results above are driven by having a lockbox alone, we next estimate the effect of receiving a lockbox among those farmers who were not offered a loan. There is no effect of the lockbox on net revenues (Table 3, col. 1), consumption (col. 2), or farm investment (col. 3).

[12]In Appendix D we show that these results are robust to including baseline controls. Further, with the inclusion of controls, the effect of the lockbox on farm investments is statistically significantly larger for the October loan group.

For reasons that are unclear, impacts on school fees paid are surprisingly negative, but are only marginally significant (col. 4). Thus, we find that easing savings constraints alone is not sufficient to enable farmers to improve important household economic outcomes like consumption and farm investment. This is in contrast to Dupas and Robinson (2013b), who estimate large positive effects for households of being provided with a lockbox alone.[13]

Finally, in Appendix Table D.3 we also present results pooled across the loan and non-loan samples, taking advantage of the factorial design of the experiment to interact the two treatments. Consistent with the previous results, we see no significant effect of the interaction between the loan and the lockbox on revenues, suggesting that the lockbox does not increase the revenue returns to the loan (though the point estimate is positive). We do estimate large and statistically significant effects at 95% confidence of receiving both the loan and the lockbox on consumption and school fee investments, while estimated effects on farm investment are also positive though not significant. Taken together, these patterns suggest that there are meaningful complementarities between the credit and savings products, consistent with the results reported above.

V Conclusion

This study examines whether access to an improved savings technology can help convert short-run credit-enabled revenue increases into longer-run investment and consumption growth. We find that providing a savings lockbox, conditional on being offered a loan, helps farmers undertake expenditures that are incurred with a lag after harvest: farmers increase household consumption by 7%, an increase which driven by improved consumption in the lean season. Farmers are also able to increase productive investments on the farm by 11%. These gains are not observed when farmers are offered a lockbox or loan alone.

How do saving technologies allow farmers to channel returns from short-term productive investments into longer-run consumption gains and reinvestment in future production? We identify two mechanisms: first, savings products allow households to move funds intertemporally, bridging any

[13] In Appendix J, we further examine the effects of a lockbox (conditional on not having received a loan) on maize inventories and household borrowing. Consistent with the notion that households may split their savings between the lockbox and maize storage, we see from Table J.4 that households reduce maize inventories they hold by 41% (significant at 95% confidence) when offered a lockbox. We also find that being offered a lockbox lowers borrowing by 57% among farmers who did not receive a loan.

gap between when the initial investment yields returns and when consumption or reinvestment is needed. Second, savings technologies can enable households to shield returns from kin tax, leaving more funds for personal consumption and reinvestment.

The results highlight the inter-linkages between financial products, and provide one potential explanation for the often disappointing performance of existing microcredit interventions (Banerjee et al., 2015). The findings of this paper also have important policy implications, suggesting that a more integrated microfinance approach that provides households with complementary credit and savings products could be more effective at meaningfully raising household living standards in low- and middle-income countries.

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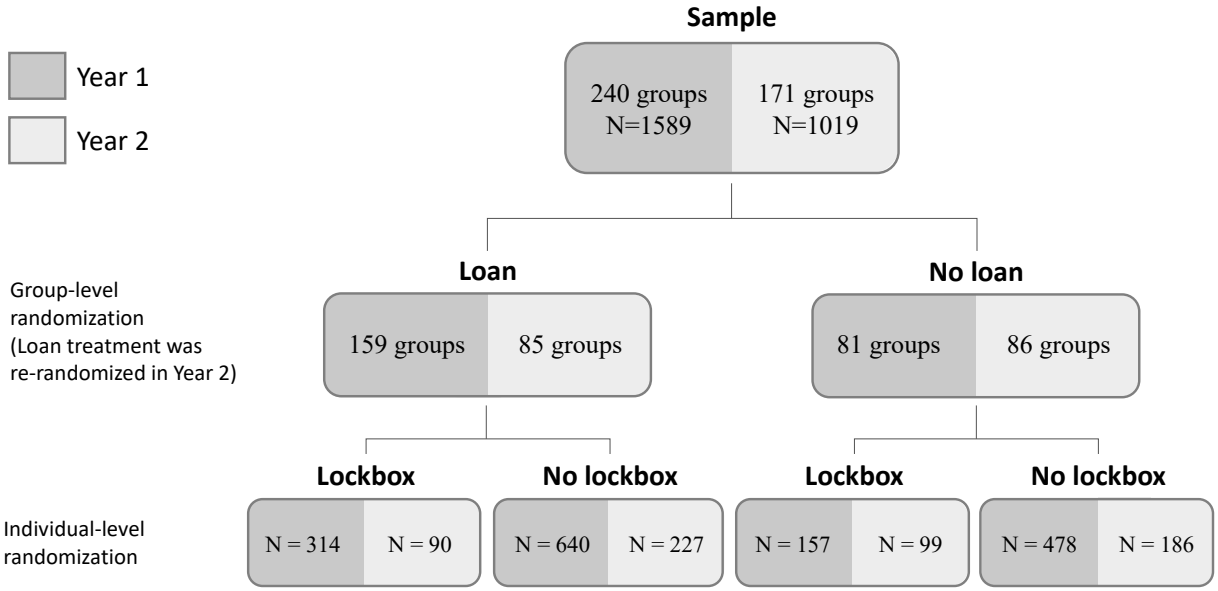
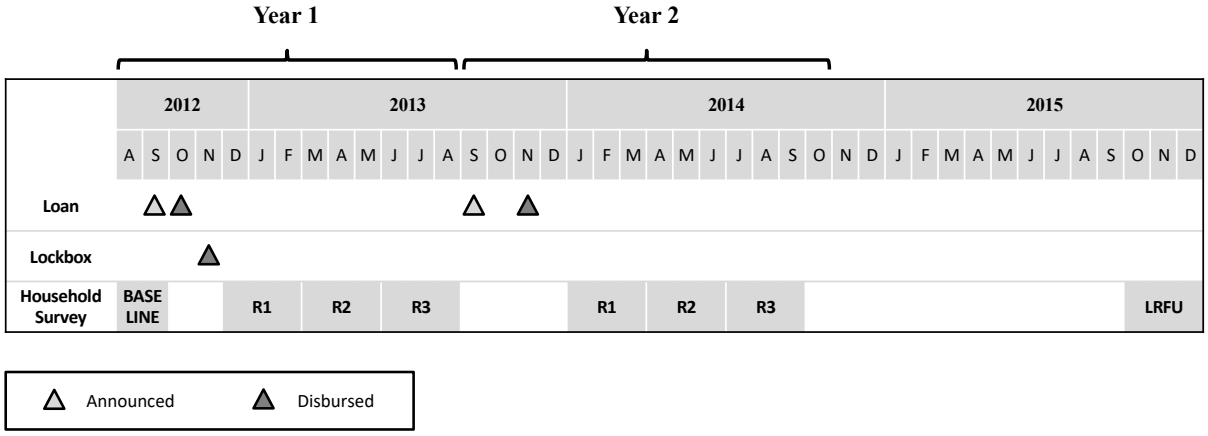
Tables and Figures

Figure 1: **Experimental design**



(a) **Study design**: There were two levels of randomization in year one- a loan and lockbox treatment. The loan treatment was randomised at the group level. The lockbox treatment was randomised at the individual level. In Year 2, the loan treatment was re-randomised. The lockbox treatment was not re-randomised in year two, but we follow a sub sample of year one individuals who participated in year two. Numbers of randomised units are given in the boxes.



(b) **Study timeline**: This figure depicts the harvest periods, timing of interventions and the survey waves.[a]

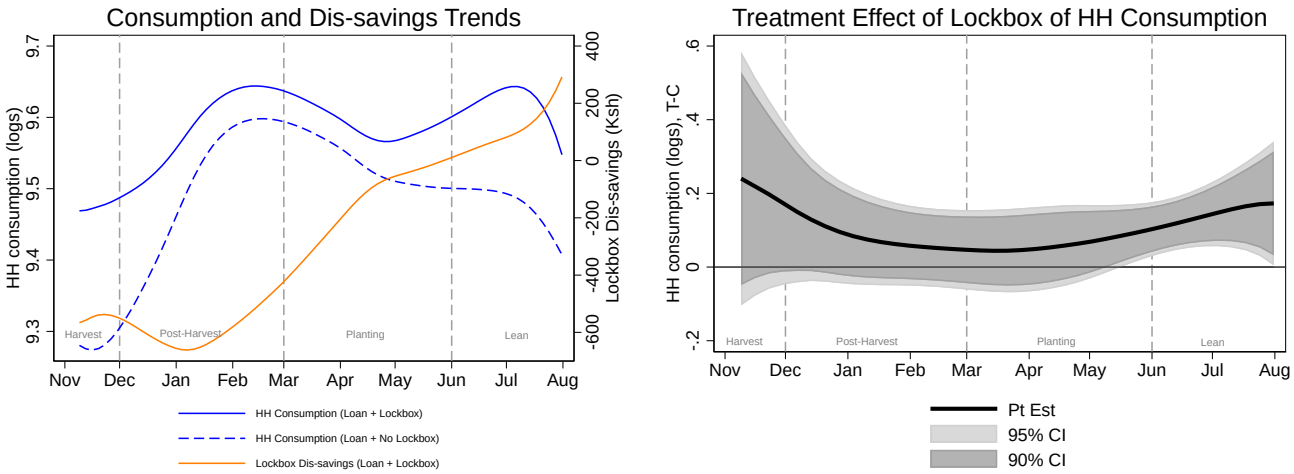
[a]R1, R2 and R3 and LRFU indicate the three survey rounds and the the long run follow-up.

Table 1: **Treatment effects** :The dependent variables are Net Revenues, Total HH consumption, Farm Investment and School Fees. Net revenues are measured by the value (in Ksh) of maize sales minus the value of maize purchases that round. The exchange rate during the study period ranged from 80 to 90Kenyan shillings per USD. Total HH consumption is the log of HH consumption (measured in logged Ksh), aggregated from a detailed 30 day recall consumption module. Farm Investment is the value (in Ksh) of hybrid seeds, DAP (fertilizer), and CAN (fertilizer) used on maize plots in the season following the loan disbursal (because the Year 2 survey only measured the quantities used, average prices from Year 1 are used to get values in Year 2). This variable was only measured in round three for each year, as that is when farmers undertake this investment. School Fees are the expenditures on school fees over the past month (in Ksh). "Lockbox" is an indicator for being in the lockbox treatment group. Panel A shows the treatment effect of the loan treatment. Panel B shows the treatment effect of the lockbox, conditional on being offered the loan treatment. The results are pooled for year one and two of the study. Regressions include round-year fixed effects, strata dummies, and controls for survey date, with errors clustered at the group level. "Mean DV" and "SD DV" are the mean and standard deviation of the dependent variable among the control group.

	(1) Net Revenues	(2) Total HH Consumption	(3) Farm Investments	(4) School Fees
Panel A: Treatment effect of Loan				
Loan	533.44	0.04	-69.84	3.85
	(195.49)	(0.02)	(155.90)	(244.86)
Observations	6730	6736	2276	6787
Mean DV	-1616.12	9.55	5332.46	3911.31
SD DV	6359.06	0.64	3596.71	8281.46
R squared	0.12	0.06	0.15	0.06
Panel B: Treatment effect of Lockbox, conditional on Loan				
Lockbox	175.60	0.07	496.03	418.45
	(237.98)	(0.03)	(223.13)	(310.71)
Observations	3436	3443	1172	3473
Mean DV	-358.80	9.52	4549.72	3400.94
SD DV	6503.00	0.64	3587.37	7455.92
R squared	0.10	0.07	0.18	0.10

Standard errors in parentheses

Figure 2: **Time trends for HH consumption and Lockbox Dis-savings**



Notes: The left panel shows how average log household consumption and lockbox savings evolve from November to August in Y1 and Y2 (pooled), as estimated with fan regressions. HH consumption (measured in logged Ksh) is aggregated from a detailed 30 day recall consumption module. Lockbox dis-savings is measured as the change in the amount saved in the box at the time of the survey. A positive dis-savings implies a decrease in the amount of savings. The exchange rate during the study period ranged from 80 to 90 Kenyan shillings per USD. The right panels show the difference in treatment minus control over time for the lockbox treatment, with a 90% and 95% confidence interval. This is estimated by bootstrapping a fan regression 1000 times, without replacement.

Table 2: **Treatment effects by loan timing** :The dependent variables are Net Revenues, Total HH consumption, Farm Investment and School Fees. Net revenues are measured by the value (in Ksh) of maize sales minus the value of maize purchases that round. The exchange rate during the study period ranged from 80 to 90Kenyan shillings per USD. Total HH consumption is the log of HH consumption (measured in logged Ksh), aggregated from a detailed 30 day recall consumption module. Farm Investment is the value (in Ksh) of hybrid seeds, DAP (fertilizer), and CAN (fertilizer) used on maize plots in the season following the loan disbursal (because the Year 2 survey only measured the quantities used, average prices from Year 1 are used to get values in Year 2). This variable was only measured in round three for each year, as that is when farmers undertake this investment. School Fees are the expenditures on school fees over the past month (in Ksh). "Lockbox" is an indicator for being in the lockbox treatment group. Panel A shows the treatment effect of the loan treatment. Panel B shows the treatment effect of the lockbox, conditional on being offered the loan treatment. Columns 1,3,5 and 7 shows the treatment effects for October and January loans of the Y1 treatment. Columns 2,4,6, and 8 show the treatment effects for the October loan. The results are pooled for year one and two of the study. Regressions include round-year fixed effects, strata dummies, and controls for survey date, with errors clustered at the group level. "Mean DV" and "SD DV" are the mean and standard deviation of the dependent variable among the control group.

	Net Revenues		Total HH Consumption		Farm Investment		School Fees	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Oct	Jan	Oct	Jan	Oct	Jan	Oct	Jan
Panel A: Treatment effect of Loan (Oct and Jan)								
Loan	587.81	-41.21	0.03	0.00	-219.55	-273.09	-310.36	-234.95
	(286.31)	(297.98)	(0.04)	(0.03)	(245.20)	(214.61)	(299.00)	(296.60)
Observations	2534	2536	2535	2534	867	869	2572	2571
Mean DV	-1616.12	-1616.12	9.55	9.55	5332.46	5332.46	3911.31	3911.31
SD DV	6359.06	6359.06	0.64	0.64	3596.71	3596.71	8281.46	8281.46
R squared	0.04	0.04	0.04	0.04	0.08	0.07	0.06	0.06
Panel B: Treatment effect of Lockbox, conditional on Loan (Oct and Jan)								
Lockbox	258.66	33.26	0.10	0.04	584.08	576.38	1132.37	-462.69
	(341.56)	(415.86)	(0.05)	(0.05)	(389.94)	(366.27)	(417.79)	(421.42)
Observations	1259	1261	1258	1257	430	432	1272	1271
Mean DV	708.05	284.57	9.45	9.47	3715.63	3823.85	2614.39	3207.12
SD DV	6227.68	6197.31	0.62	0.63	3225.57	3194.25	5947.33	7063.82
R squared	0.05	0.06	0.05	0.05	0.12	0.13	0.10	0.08

Standard errors in parentheses

Table 3: **Treatment effect of the Lockbox alone**

	(1) Net Revenues	(2) Total HH Consumption	(3) Farm Investment	(4) School Fees
Lockbox	-217.48	-0.06	105.29	-803.48
	(326.69)	(0.04)	(311.66)	(455.64)
Observations	2098	2103	713	2122
Mean DV	-1043.90	9.56	5000.87	4166.54
SD DV	6378.11	0.64	3498.52	8625.46
R squared	0.18	0.10	0.18	0.08

Notes: The dependent variables are Net Revenues, Total HH consumption, Farm Investment, School Fees, Maize inventories and Total household borrowing. Net revenues are measured by the value (in Ksh) of maize sales minus the value of maize purchases that round. The exchange rate during the study period ranged from 80 to 90Kenyan shillings per USD. Total HH consumption is the log of HH consumption (measured in logged Ksh), aggregated from a detailed 30 day recall consumption module. Non food and food consumption are also estimated using a 30 day recall. Farm Investment is the value (in Ksh) of hybrid seeds, DAP (fertilizer), and CAN (fertilizer) used on maize plots in the season following the loan disbursal (because the Year 2 survey only measured the quantities used, average prices from Year 1 are used to get values in Year 2). This variable was only measured in round three for each year, as that is when farmers undertake this investment. School Fees are the expenditures on school fees over the past month (in Ksh). "Lockbox" is an indicator for being in the lockbox treatment group. The results are pooled for year one and two.Regressions include round-year fixed effects, strata dummies, and controls for survey date, with errors clustered at the group level. "Mean DV" and "SD DV" are the mean and standard deviation of the dependent variable among the control group.

Supplementary Appendix

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A Setting

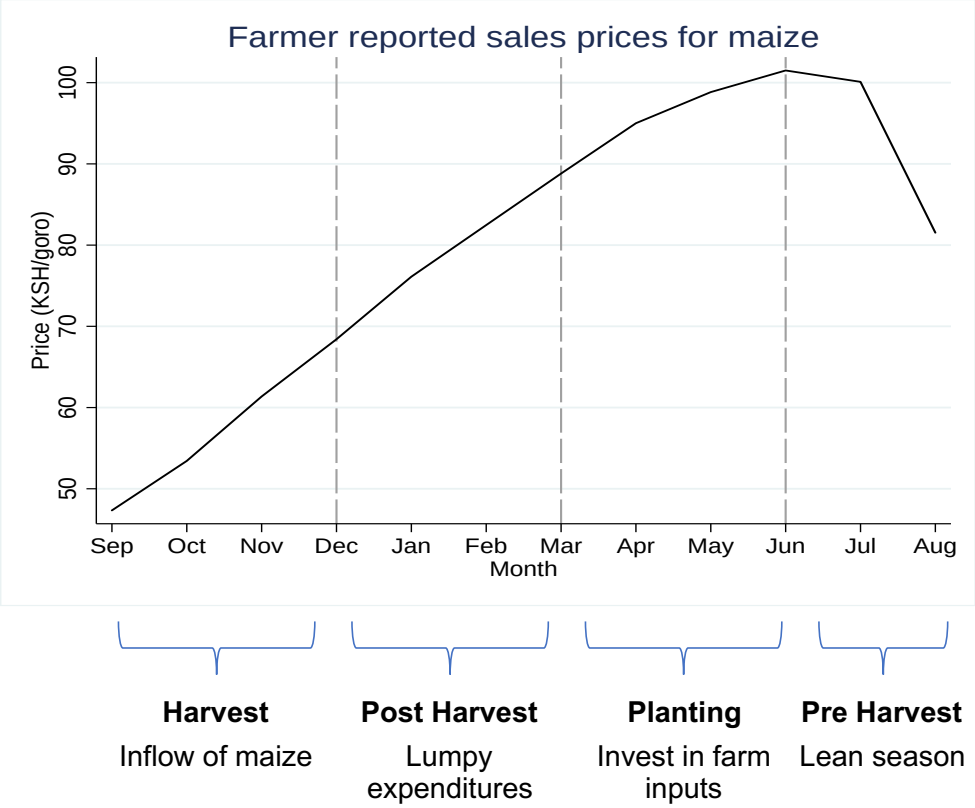


Figure A.1: **Seasonal price trends in maize markets**. Farmer-reported average monthly maize prices for the period 2007-2012, averaged over all farmers in our sample. Prices are in Kenyan shillings per goro (2.2kg). We also show the corresponding periods or seasons in our setting.

B Take-up and Use

In year one, 954 farmers were offered a loan and 617 applied and qualified for it. In year two, of the 522 farmers were offered a loan, 324 took up the loan. Take up rates of 64% and 62% for year one and two respectively, is quite high relative to similar credit interventions in low income countries. Karlan et al. (2010) find that take up rates range from 2-55% in similar settings. We think our take up rates are on the higher side because, participants in our study knew and trusted OAF from previous engagement with the NGO for other services. The unconditional loan size for the year one loan treatment was 4,817 Ksh (or $ 57). Conditional on take up the average loan size was 7,533 Ksh ((or $ 89). Similarly, for year two the unconditional loan size was 6,679 Ksh (or $ 79) and the conditional loan size was 10,548 Ksh (or $ 124). The loans were approximately 43% of harvest value, calculated based on harvest time prices. 24% of the farmers opt to take the maximum loan size possible. Default rates were below 2%.

[14] Uses Lockbox = 1 if there is a non zero amount in the box or money has been added or withdrawn from it in the last week. This metric is conditional on taking up/ still having the box.

Table B.1: **Descriptive statistics on take-up and use**

	Year 1	Year 2	Long run
Panel A : Lockbox			
Take up	0.97		
Still has lockbox		0.89	0.51
Uses lockbox [14]	0.78	0.63	0.50
If uses, current balance (in Ksh)			
Mean	683	360	339
Median	400	200	100
SD	798	375	451
Mean number of additions (in a week)	1	1	2
Mean number of withdrawals (in a week)	1	1	1
Panel B : Loan			
Take-up	0.64	0.62	
Average loan size (in Ksh)			
Unconditional	4817	6679	
Conditional on take-up	7533	10,548	

Notes: Data on balances in the lockbox are self-reported. Enumerators were asked to verify the amount by looking into the lockbox, if the participant was willing. The data on balances and withdrawals were also self reported. They were double checked using the inventory sheet, which the participants were encouraged to maintain. The exchange rate during the study period ranged from 80 to 90 Kenyan shillings per US$.

Our work relates to the literature on take-up and usage of savings products. Banerjee and Duflo (2007) find that the poor do have surplus money that they use for expenditures that are non-essential. Studies that have looked at financial diaries find that the poor often save from small and irregular incomes to undertake lumpy investments (Collins et al., 2009). However, despite a demand for savings, there is a gap between take-up and usage rates. This gap is very stark for formal savings products. Even for lenient definitions of usage, usage rates are often only half the take-up rates (Prina, 2015). However, for informal savings products, this gap is much less stark. Dupas and Robinson (2013b), find that 94% of their sample have the safe box[15] six months after it was offered and 74% still use the savings technology. Comparing four savings technologies, Dupas and Robinson (2013b) point out that the primary appeal of a savings device is a safe and designated place to accumulate money for a specific purpose. In line with this, we also find high rates of take up and usage of the lockbox. In our sample, 97% of participants take-up the lockbox and 78% of them use the lockbox in year 1 of the study. In the long run follow-up which is conducted three years after the lockbox is offered, we see that 51% of our sample still has the lockbox and 50% of this group uses it. Those who use the lockbox maintain a substantial amount in the box and regularly add or withdraw from it.

Take up rates for the lockboxes were as high as 97% when it was offered in year 1. Conditional on take-up 78% farmers use the lockbox and save an average of 683 Ksh (or $ 8). In year two, 89% of farmers reported that they still had the lockbox. Conditional on having the lockbox, 63% used it and saved an average of 360 Ksh (or $ 4) respectively. On average farmers add or withdraw

[15]The safe box in Dupas and Robinson (2013b) is the same as the lockbox in our study.

from the lockbox once a week in year one and two. In the long run follow-up, three years after the lockbox was offered, 51% farmers still had the lockbox. Conditional on having the box, 50% report using it. The average amount saved was 339 Ksh (or $ 3). Farmers added to the lockbox twice a week and withdrew from it once a week, on average. Figure B.1 shows the savings amounts in the lockbox over time, pooled for year one and year two. We see that savings are consistently maintained in the lockbox through the study period. We see that savings are accumulated in the lockbox post harvest, maintained through the planting season and partially used in the lean season. In a similar setting in Kenya, Dupas and Robinson (2013b) note that 74% (71%) of participants use the safe box six (twelve months) after it was offered to them. Among those who use the safe box, average balances were 634 Ksh ($ 8.4) after six months and 311 Ksh ($ 4.1) after 12 months. Thus, descriptive statistics around take-up and usage are quite similar to our study.

Figure B.1 shows that farmers consistently save in the lockbox during the study period. We see that farmers who received a loan have higher savings in the lockbox. This leads us to ask three questions. First, does access to the loan increase total household savings? Second, does access to a lockbox increase total household savings? Lastly, does saving in a lockbox crowd out savings in formal bank accounts, ROSCAs, SACCOs and mobile money. We collect data for Total HH savings (cash savings banks, ROSCAs, SACCOs and mobile money) only in one survey round (Year 1, round 3). Thus, for this round we are able to test the effect of a lockbox on savings.

Table B presents the results separately for the treatment effect of a loan and the treatment effect of a lockbox, conditional on getting a loan by estimating Equation 1 and 2. We find that access to a loan does not have significant effects on household savings. We next examine whether combining credit access with a savings technology enables farmers to save more. Conditional on getting the loan, we see that farmers who were offered a lockbox show a 53% increase in total household savings, which is significant at the 5% level. Thus, farmers who were less cash constrained at harvest were able to use a lockbox to significantly increase savings.This increase in total household savings is a first piece of evidence of the value households attached to this savings technology. This implies that easing both credit and savings constraints simultaneously, can help the poor accumulate savings. Though we see that access to a lockbox decreases the total savings outside of a lockbox, this effect is statistically indistinguishable from zero. Thus, it is possible that farmers who received a lockbox move some of their savings from alternate savings devices to their lockbox, but we do not find any evidence of significant crowding out of savings.

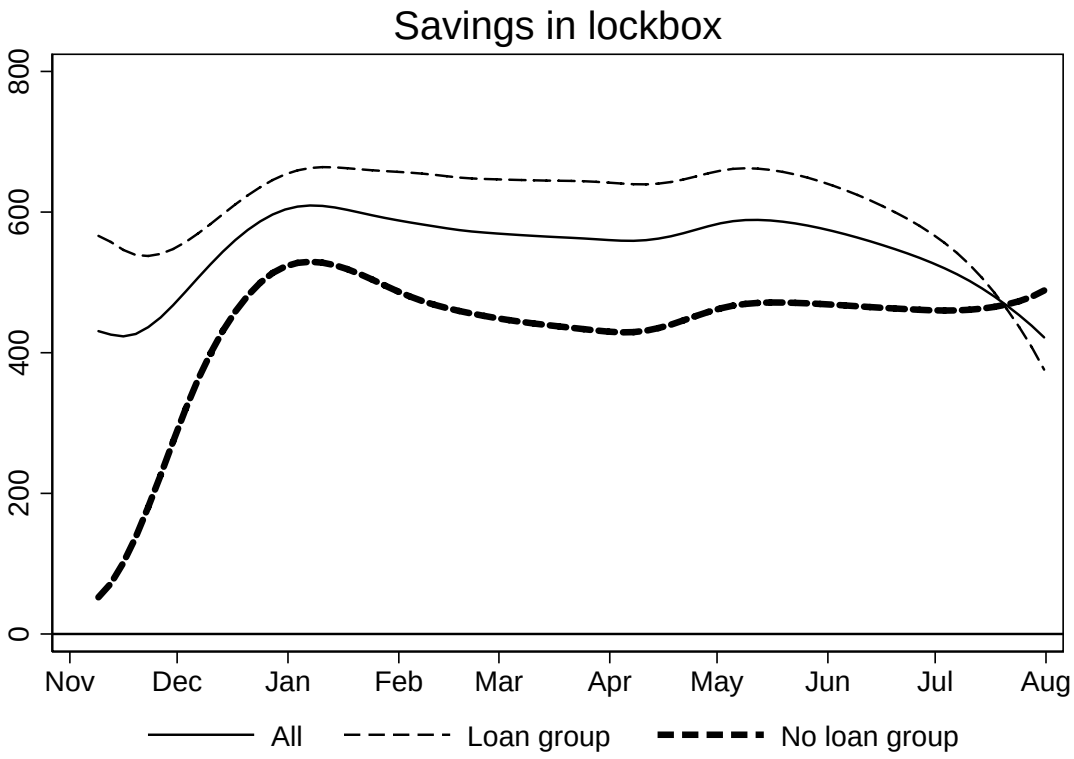


Figure B.1: **Savings in lockbox over time** Amount saved in the lockbox at the time of the survey. The data is pooled across Year 1 and Year 2 of the study.

Table B.2: **Treatment effect on Savings**: Data on savings was only collected in in the Year 1 - round 3 survey. Total Savings is the log of Total HH savings (measured in logged Ksh), at the time of the survey. It includes the amount saved in a bank account, ROSCA, SACCO, mobile money and the lockbox. Savings (excl. Lockbox) measures the log of total savings in all savings devices excluding the lockbox."Lockbox" is an indicator for being in the lockbox treatment group. The first two columns, show results for the Loan group and the last two columns show the results for the No Loan group. Regressions include strata dummies, and controls for survey date, with errors clustered at the group level. "Mean DV" and "SD DV" are the mean and standard deviation of the dependent variable among the control group.

	(1) Total Savings	(2) Savings (excl. Lockbox)
Panel A: Treatment effect of Loan		
Loan	-0.01	-0.10
	(0.21)	(0.22)
Observations	1299	1299
Mean DV	6.88	6.73
SD DV	3.10	3.18
R squared	0.07	0.07
Panel B: Treatment effect of Lockbox, conditional on Loan		
Lockbox	0.53	-0.20
	(0.26)	(0.27)
Observations	862	862
Mean DV	6.63	6.63
SD DV	3.40	3.40
R squared	0.09	0.09

Standard errors in parentheses

C Summary Statistics and Balance Tables

In this section, we first present balance tables for year 1 of the study. We observe balance on most baseline variables at the 1% and 5%. However, at the 10% level we have more than expected variables that are not balanced. We present a robustness check for this in Table C.2. We present the average impact of our treatments by estimating Equation 2 controlling for all baseline variables that are not balanced at 10%. Our results are robust for Farm investments, where we find a 10% (significant at 10%). For Total HH consumption, the magnitude remains positive, but is not significant. The main mechanism for the consumption effect, is the increase in household consumption in the lean season. We estimate Equation 2 including controls for imbalanced variables and present the results in Table C.3. We see that the treatment effect for round 3 (or the Lean season) remains robust. We find a 8% increase in lean season consumption (significant at 10%). The imbalance at baseline induces noise for the round 1 and round 2 treatment effects.

For the loan treatment, the Year 2 study was designed to follow the sample of farmers we studies in Year 1. Due to administrative issues, farmer group compositions changed in Year 2. As a result, 417 of the 1019 farmers in year two were new to the sample. We did not collect baseline data for these farmers. For farmers who were present in both years of the study, we also show a balance table for the year two in Table C.4 below. As expected, we observe balance on most variables.

We also check for balance in the long run follow-up in Table C.5. The long run follow up survey followed up on a total of 1500 individuals. This comprised of the entire year 2 sample (1,019 individuals) and a representative subset of the year 1 only sample (another 481 individuals). We restrict our long run study to 1008 farmers, of which 527 were present in both years and 481 from year one only.

Table C.1: **Summary statistics**

Baseline characteristic	Loan (T-C)			Lockbox, conditional on Loan (T-C)		
	obs	*std diff*	*p-val*	*obs*	*std diff*	*p-val*
Male	1,589	-0.08	0.11	954	-0.02	0.78
Number of adults	1,510	-0.09	0.06	903	0.07	0.34
Children in school	1,589	-0.04	0.46	954	0.06	0.35
Finished primary school	1,490	-0.13	0.02	890	-0.05	0.49
Finished secondary school	1,490	-0.04	0.46	890	-0.01	0.86
Total cropland (acres)	1,512	0.01	0.79	906	0.07	0.37
Number of rooms in household	1,511	-0.05	0.17	904	0.02	0.75
Total school fees	1,589	-0.06	0.18	954	0.18	0.02
Average monthly consumption (Ksh)	1,437	-0.03	0.55	858	-0.02	0.72
Average monthly consumption/capita (log)	1,434	0.02	0.72	855	-0.03	0.68
Total cash savings (Ksh)	1,572	-0.09	0.01	943	0.15	0.07
Total cash savings (trim)	1,572	-0.05	0.33	943	0.15	0.07
Has bank savings acct	1,589	-0.01	0.82	954	0.18	0.01
Taken bank loan	1,589	-0.02	0.73	954	0.06	0.40
Taken informal loan	1,589	-0.01	0.84	954	0.06	0.39
Liquid wealth (Ksh)	1,491	-0.03	0.55	893	0.14	0.09
Off-farm wages (Ksh)	1,589	0.01	0.85	954	0.15	0.07
Business profit (Ksh)	1,589	0.08	0.32	954	-0.04	0.50
Avg %Δ price Sep-Jun	1,504	0.00	0.94	900	-0.00	0.99
Expect %Δ price Sep12-Jun13	1,510	0.14	0.15	905	-0.09	0.15
2011 LR harvest (bags)	1,511	0.02	0.67	905	-0.00	0.98
Net revenue 2011 (Ksh)	1,428	0.03	0.75	857	-0.06	0.32
Net seller 2011	1,428	0.05	0.39	857	0.02	0.81
Autarkic 2011	1,589	0.03	0.51	954	-0.11	0.08
% maize lost 2011	1,428	0.03	0.57	850	-0.12	0.06
2012 LR harvest (bags)	1,484	0.02	0.74	890	0.02	0.81
Calculated interest correctly	1,580	-0.03	0.50	950	0.09	0.21
Digit span recall	1,504	-0.01	0.89	900	0.02	0.80
Maize giver	1,589	-0.00	0.99	954	0.09	0.21

Notes: Balance table for the Y1 study (restricted to the Y1 sample, for which we have baseline characteristics.) The first column gives the total number of observations. The next four columns correspond to the lockbox and loan treatment respectively. They give differences in means normalized by the standard deviation in the control group, with the corresponding p-value on the test of equality.
"Total school fees" are the total school fees paid by the household in the past 12 months. "Taken bank loan" is whether anyone in the household taken any loans from a commercial bank or commercial lender in the past 12 months. 'Taken informal loan" is whether anyone in the household taken any loans from a moneylender or someone else outside the household in the past 12 months."Liquid wealth" is the sum of cash savings and assets that could be easily sold (e.g. livestock). "Off-farm wages" is the total amount earned by anyone in the household who worked in a job for cash in the past month. "Business profits" are the total profits earned from all business run by anyone in the household. "Avg %Δ price Sep-Jun" is the percentage difference between the (self-reported) average market price for maize in September and June over the past five years. "Net revenue," "net seller," and "autarkic" refer to the household's maize marketing position. "Maize giver" is whether the household reported giving away more maize in gifts than it received over the previous 3 months.

Table C.2: **Balance - Treatment effect of Lockbox, conditional on Loan**

	(1) Net Revenues	(2) Total HH Consumption	(3) Farm Investments	(4) School Fees
Lockbox	105.33	0.02	467.00	-41.78
	(284.80)	(0.03)	(260.19)	(312.97)
School fees, KSH	13.65	0.00	19.15	43.20
	(4.84)	(0.00)	(3.79)	(5.93)
Has bank savings acct	825.29	0.18	741.73	800.86
	(283.44)	(0.03)	(266.18)	(268.70)
Total cash savings (KSH)	0.03	0.00	0.02	-0.00
	(0.02)	(0.00)	(0.01)	(0.01)
Off-farm wages (Ksh)	0.01	0.00	0.01	0.01
	(0.01)	(0.00)	(0.01)	(0.01)
Autarkic 2011	329.71	0.07	387.02	382.46
	(547.25)	(0.06)	(390.24)	(521.06)
% maize lost 2011	617.19	-0.15	-602.60	470.33
	(1601.43)	(0.17)	(870.91)	(1786.41)
Observations	2334	2329	799	2354
Mean DV	-358.80	9.52	4549.72	3400.94
SD DV	6503.00	0.64	3587.37	7455.92
R squared	0.06	0.16	0.18	0.12

Table C.3: **Total HH Consumption - Treatment effect of Lockbox, conditional on Loan**

	(1) Overall	(2) By round
Lockbox	0.02	
	(0.03)	
School fees, KSH	0.00	0.00
	(0.00)	(0.00)
Has bank savings acct	0.18	0.18
	(0.03)	(0.03)
Total cash savings (KSH)	0.00	0.00
	(0.00)	(0.00)
Off-farm wages (Ksh)	0.00	0.00
	(0.00)	(0.00)
Autarkic 2011	0.07	0.07
	(0.06)	(0.06)
% maize lost 2011	-0.15	-0.15
	(0.17)	(0.17)
Lockbox - R1		-0.03
		(0.05)
Lockbox - R2		-0.00
		(0.04)
Lockbox - R3		0.08
		(0.05)
Observations	2329	2329
Mean DV	9.52	9.52
SD DV	0.64	0.64
R squared	0.16	0.16

Table C.4: **Summary statistics and balance among baseline covariates in Year 2**

Baseline characteristic	Loan (T-C)			Lockbox, conditional on Loan (T-C)		
	obs	*std diff*	*p-val*	*obs*	*std diff*	*p-val*
Male	620	0.06	0.43	602	0.01	0.95
Number of adults	599	0.20	0.02	581	-0.10	0.23
Children in school	620	0.00	0.96	602	-0.06	0.50
Finished primary school	593	0.12	0.13	575	-0.17	0.07
Finished secondary school	593	0.08	0.31	575	-0.11	0.22
Total cropland (acres)	601	0.19	0.04	584	-0.09	0.28
Number of rooms in household	600	0.10	0.20	582	-0.06	0.44
Total school fees	620	0.03	0.70	602	-0.08	0.36
Average monthly consumption (Ksh)	575	0.02	0.80	557	-0.06	0.47
Average monthly consumption/capita (log)	572	-0.02	0.77	554	0.06	0.51
Total cash savings (Ksh)	611	0.24	0.03	593	-0.08	0.30
Total cash savings (trim)	611	0.64	0.00	593	0.05	0.58
Has bank savings acct	620	0.13	0.12	602	0.15	0.09
Taken bank loan	620	-0.10	0.20	602	-0.02	0.82
Taken informal loan	620	-0.01	0.92	602	-0.03	0.71
Liquid wealth (Ksh)	592	0.19	0.03	574	0.05	0.61
Off-farm wages (Ksh)	620	0.15	0.14	602	0.06	0.49
Business profit (Ksh)	620	0.33	0.21	602	-0.04	0.55
Avg %Δ price Sep-Jun	598	0.08	0.37	580	-0.02	0.79
Expect %Δ price Sep12-Jun13	600	0.27	0.09	582	-0.10	0.18
2011 LR harvest (bags)	601	0.32	0.05	583	0.06	0.65
Net revenue 2011 (Ksh)	565	0.08	0.38	549	-0.11	0.27
Net seller 2011	565	0.09	0.30	549	-0.01	0.92
Autarkic 2011	620	0.02	0.79	602	-0.05	0.58
% maize lost 2011	568	-0.01	0.93	553	-0.09	0.26
2012 LR harvest (bags)	590	0.03	0.76	572	-0.01	0.93
Calculated interest correctly	620	0.01	0.90	602	0.07	0.41
Digit span recall	598	-0.01	0.89	580	-0.09	0.33
Maize giver	620	0.03	0.71	602	-0.11	0.22

Notes: Balance table on Year 2 treatment status, restricted to the sample also present in Year 1, for which we have baseline characteristics). The first column gives the total number of observations. The next four columns correspond to the lockbox and loan treatment respectively. They give differences in means normalized by the standard deviation in the control group, with the corresponding p-value on the test of equality.
"Total school fees" are the total school fees paid by the household in the past 12 months. "Taken bank loan" is whether anyone in the household taken any loans from a commercial bank or commercial lender in the past 12 months. 'Taken informal loan" is whether anyone in the household taken any loans from a moneylender or someone else outside the household in the past 12 months."Liquid wealth" is the sum of cash savings and assets that could be easily sold (e.g. livestock). "Off-farm wages" is the total amount earned by anyone in the household who worked in a job for cash in the past month. "Business profits" are the total profits earned from all business run by anyone in the household. "Avg %Δ price Sep-Jun" is the percentage difference between the (self-reported) average market price for maize in September and June over the past five years. "Net revenue," "net seller," and "autarkic" refer to the household's maize marketing position. "Maize giver" is whether the household reported giving away more maize in gifts than it received over the previous 3 months.

Table C.5: **Summary statistics and balance among baseline covariates in the long run follow up**

Baseline characteristic	Loan (T-C)			Lockbox, conditional on Loan (T-C)		
	obs	*std diff*	*p-val*	*obs*	*std diff*	*p-val*
Male	814	0.26	0.03	1,005	0.01	0.86
Number of adults	784	-0.10	0.39	968	0.01	0.91
Children in school	814	-0.15	0.20	1,005	-0.01	0.93
Finished primary school	770	-0.11	0.33	950	-0.03	0.68
Finished secondary school	770	-0.01	0.91	950	-0.06	0.43
Total cropland (acres)	787	0.15	0.39	970	-0.03	0.65
Number of rooms in household	785	-0.12	0.09	969	-0.07	0.25
Total school fees	814	-0.11	0.25	1,005	0.02	0.79
Average monthly consumption (Ksh)	745	-0.03	0.77	918	-0.07	0.33
Average monthly consumption/capita (log)	742	0.10	0.41	915	-0.02	0.79
Total cash savings (Ksh)	804	-0.06	0.42	994	-0.03	0.72
Total cash savings (trim)	804	0.21	0.21	994	-0.01	0.91
Has bank savings acct	814	0.13	0.22	1,005	0.11	0.11
Taken bank loan	814	-0.07	0.48	1,005	-0.03	0.63
Taken informal loan	814	-0.08	0.43	1,005	0.03	0.63
Liquid wealth (Ksh)	775	0.17	0.26	958	0.07	0.37
Off-farm wages (Ksh)	814	0.17	0.21	1,005	-0.02	0.82
Business profit (Ksh)	814	0.35	0.38	1,005	-0.05	0.46
Avg %Δ price Sep-Jun	783	-0.00	0.99	965	0.00	0.95
Expect %Δ price Sep12-Jun13	785	0.08	0.66	968	-0.05	0.46
2011 LR harvest (bags)	786	0.03	0.87	969	0.03	0.72
Net revenue 2011 (Ksh)	738	-0.02	0.89	914	-0.02	0.79
Net seller 2011	738	0.11	0.34	914	0.01	0.94
Autarkic 2011	814	0.11	0.36	1,005	-0.11	0.09
% maize lost 2011	746	0.32	0.27	920	-0.06	0.37
2012 LR harvest (bags)	770	-0.18	0.10	953	0.06	0.42
Calculated interest correctly	813	0.03	0.80	1,003	0.09	0.22
Digit span recall	781	0.04	0.69	963	-0.06	0.44
Maize giver	814	-0.06	0.58	1,005	-0.07	0.34

Notes: The first column gives the total number of observations. The next four columns correspond to the lockbox and loan treatment respectively. They give differences in means normalized by the standard deviation in the control group, with the corresponding p-value on the test of equality.
"Total school fees" are the total school fees paid by the household in the past 12 months. "Taken bank loan" is whether anyone in the household taken any loans from a commercial bank or commercial lender in the past 12 months. 'Taken informal loan" is whether anyone in the household taken any loans from a moneylender or someone else outside the household in the past 12 months."Liquid wealth" is the sum of cash savings and assets that could be easily sold (e.g. livestock). "Off-farm wages" is the total amount earned by anyone in the household who worked in a job for cash in the past month. "Business profits" are the total profits earned from all business run by anyone in the household. "Avg %Δ price Sep-Jun" is the percentage difference between the (self-reported) average market price for maize in September and June over the past five years. "Net revenue," "net seller," and "autarkic" refer to the household's maize marketing position. "Maize giver" is whether the household reported giving away more maize in gifts than it received over the previous 3 months.

D Robustness checks

In Tables D.1 and D.2 we check robustness of treatment effects to including baseline controls and winsorizing the dependent variable at 5%. In both tables, Columns 1 to 2 present the results for Net revenues from maize, Columns 3 to 4 present the results for Total household consumption, Columns 5 to 6 present the results for Farm investments and Columns 7 to 8 present School fees results. Regressions without baseline controls and winsorization of the dependent variable are shown in columns 1, 3, 5 and 7 in both tables. In Table D.1, regressions with baseline controls are shown in columns 2,4, 6 and 8 and in Table D.2, regressions with winsorization of the dependent variable are shown in columns 2,4,6 and 8. The number of observations, the mean and standard deviation of the dependent variable for the control group, as well as the R- squared of the regression is presented in each column of the table. We present short run results by pooling year one and two of the study.

We see from Tables D.1 and D.2 that our results are robust to including baseline controls and winsorizing the dependent variable at 5%.

Table D.1: **Treatment effects** :The dependent variables are Net Revenues, Total HH consumption, Farm Investment and School Fees. Net revenues are measured by the value (in Ksh) of maize sales minus the value of maize purchases that round. The exchange rate during the study period ranged from 80 to 90Kenyan shillings per USD. TotalHH consumption is the log of HH consumption (measured in logged Ksh), aggregated from a detailed 30 day recall consumption module. Farm Investment is the value (in Ksh) of hybrid seeds, DAP (fertilizer), and CAN (fertilizer) used on maize plots in the season following the loan disbursal (because the Year 2 survey only measured the quantities used, average prices from Year 1 are used to get values in Year 2). This variable was only measured in round three for each year, as that is when farmers undertake this investment. School Fees are the expenditures on school fees over the past month (in Ksh). "Lockbox" is an indicator for being in the lockbox treatment group. Panel A shows the treatment effect of the loan treatment. Panel B shows the treatment effect of the lockbox, conditional on being offered the loan treatment. The results are pooled for year one and two of the study. Regressions include round-year fixed effects, strata dummies, and controls for survey date, with errors clustered at the group level. "Mean DV" and "SD DV" are the mean and standard deviation of the dependent variable among the control group.

	Net Revenues		Total HH Consumption		Farm Investments		School Fees	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Treatment effect of Loan								
Loan	533.44	465.82	0.04	0.03	-69.84	-38.19	3.85	-24.99
	(195.49)	(187.02)	(0.02)	(0.02)	(155.90)	(163.90)	(244.86)	(244.26)
Observations	6730	5533	6736	5307	2276	1906	6787	5649
Mean DV	-1616.12	-1616.12	9.55	9.55	5332.46	5332.46	3911.31	3911.31
SD DV	6359.06	6359.06	0.64	0.64	3596.71	3596.71	8281.46	8281.46
R squared	0.12	0.17	0.06	0.18	0.15	0.24	0.06	0.13
Panel B: Treatment effect of Lockbox, conditional on Loan								
Lockbox	175.60	91.69	0.07	0.05	496.03	456.38	418.45	131.42
	(237.98)	(216.04)	(0.03)	(0.03)	(223.13)	(213.59)	(310.71)	(305.90)
Observations	3436	3421	3443	3236	1172	1172	3473	3473
Mean DV	-358.80	-358.80	9.52	9.52	4549.72	4549.72	3400.94	3400.94
SD DV	6503.00	6503.00	0.64	0.64	3587.37	3587.37	7455.92	7455.92
R squared	0.10	0.17	0.07	0.18	0.18	0.28	0.10	0.15
Baseline controls included	No	Yes	No	Yes	No	Yes	No	Yes

Standard errors in parentheses

Table D.2: **Treatment effects** :The dependent variables are Net Revenues, Total HH consumption, Farm Investment and School Fees. Net revenues are measured by the value (in Ksh) of maize sales minus the value of maize purchases that round. The exchange rate during the study period ranged from 80 to 90Kenyan shillings per USD. TotalHH consumption is the log of HH consumption (measured in logged Ksh), aggregated from a detailed 30 day recall consumption module. Farm Investment is the value (in Ksh) of hybrid seeds, DAP (fertilizer), and CAN (fertilizer) used on maize plots in the season following the loan disbursal (because the Year 2 survey only measured the quantities used, average prices from Year 1 are used to get values in Year 2). This variable was only measured in round three for each year, as that is when farmers undertake this investment. School Fees are the expenditures on school fees over the past month (in Ksh). "Lockbox" is an indicator for being in the lockbox treatment group. Panel A shows the treatment effect of the loan treatment. Panel B shows the treatment effect of the lockbox, conditional on being offered the loan treatment. The results are pooled for year one and two of the study. Regressions include round-year fixed effects, strata dummies, and controls for survey date, with errors clustered at the group level. "Mean DV" and "SD DV" are the mean and standard deviation of the dependent variable among the control group.

	Net Revenues		Total HH Consumption		Farm Investments		School Fees	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Treatment effect of Loan								
Loan	533.44	473.70	0.04	0.03	-69.84	-73.23	3.85	51.76
	(195.49)	(158.52)	(0.02)	(0.02)	(155.90)	(138.83)	(244.86)	(170.53)
Observations	6730	6730	6736	6736	2276	2276	6787	6787
Mean DV	-1616.12	-1616.12	9.55	9.55	5332.46	5332.46	3911.31	3911.31
SD DV	6359.06	6359.06	0.64	0.64	3596.71	3596.71	8281.46	8281.46
R squared	0.12	0.14	0.06	0.05	0.15	0.16	0.06	0.07
Panel B: Treatment effect of Lockbox, conditional on Loan								
Lockbox	175.60	116.15	0.07	0.06	496.03	514.60	418.45	371.78
	(237.98)	(191.24)	(0.03)	(0.03)	(223.13)	(204.62)	(310.71)	(217.88)
Observations	3436	3436	3443	3443	1172	1172	3473	3473
Mean DV	-358.80	-358.80	9.52	9.52	4549.72	4549.72	3400.94	3400.94
SD DV	6503.00	6503.00	0.64	0.64	3587.37	3587.37	7455.92	7455.92
R squared	0.10	0.10	0.07	0.07	0.18	0.19	0.10	0.09
Baseline controls included	No	No	No	No	No	No	No	No
Dep. var. winsorized (5%)	No	Yes	No	Yes	No	Yes	No	Yes

Standard errors in parentheses

Table D.3 presents the interaction of the Loan and Lockbox treatments.We estimate large and statistically significant effects at 95% confidence of receiving both the loan and the lockbox on consumption and school fee investments, while estimated effects on farm investment are also positive though not significant. These patterns strengthen our results on the meaningful complementarities between the credit and savings products.

Table D.3: **Interaction of the Loan and Lockbox treatment**

	(1)	(2)	(3)	(4)
	Net Revenues	Total HH Consumption	Farm Investment	School Fees
Lockbox	-169.95	-0.06	36.69	-776.20
	(321.48)	(0.04)	(294.89)	(439.50)
Loan	342.25	-0.02	-175.35	-493.04
	(245.88)	(0.03)	(205.62)	(304.95)
Lockbox*Loan	428.87	0.14	445.00	1251.03
	(402.80)	(0.05)	(367.49)	(537.57)
Observations	5534	5546	1885	5595
Mean DV	-2227.80	9.62	5884.95	4413.64
R squared	0.11	0.06	0.15	0.07

E Consumption effects

In this section, we provide further insights and robustness checks on the consumption effects discussed in the Section IV.

In Table 1 we found that combining credit access with a savings technology enables farmers to increase total household consumption. In Table E.1 we show a break-up of the treatment effect by rounds of data collection. The positive and significant treatment effect for round 3 in Table 1 col.1 shows that the increase in consumption is most marked in the lean season. This is a time of particularly high farmer need in which the marginal utility of household consumption is presumably particularly high. This suggests that farmers use the savings accumulated in the lockbox to fund lean-season consumption. In Table E.2 (col. 2 and 3) do not find evidence that combining credit and savings access decreases the variance of consumption across the year.

We also observe a positive coefficient for rounds 1 and 2. Contrary to a classic "consumption smoothing" story, in which we would expect any increase in lean season consumption to be matched by dips in consumption in other seasons. Instead we see that consumption is higher throughout the year. This points to a second mechanism that may be at play, where a lockbox helps protect money from the kin tax imposed by family and friends.

Table E.1: **HH consumption - Treatment effect of Lockbox on Loan group**

	(1) Overall	(2) By round
Lockbox	0.07	
	(0.03)	
Lockbox - R1		0.06
		(0.04)
Lockbox - R2		0.06
		(0.04)
Lockbox - R3		0.09
		(0.04)
Observations	3443	3443
Mean DV	9.52	9.52
SD DV	0.64	0.64
R squared	0.07	0.07

Table E.2: **Consumption Smoothing**

	Total HH consumption		
	(1) Log total	(2) Standard Deviation	(3) Coefficient of Variation
Lockbox	0.07	1136.30	0.02
	(0.03)	(547.74)	(0.02)
Observations	3443	1130	1130
Mean DV	9.52	7294.94	0.39
SD DV	0.64	7191.00	0.22
R squared	0.07	0.09	0.07

In Table E.3 we look at treatments of lockbox (conditional on getting a loan) on money lent and maize given. We do find significant effects.

Next, we look at heterogeneity of treatment effects based on the amount of money and maize given. Consistent with the kin tax mechanism, we also see from Table E.4 that farmers who gave more money to friends and family than they received at baseline are significantly less likely to loan money to people in their social network when they have access to a lockbox. As discussed in the section IV, the welfare implications of this reduction in kin tax are not obvious.

Table E.3: **Treatment effects of lockbox on Money and Maize sharing, conditional on Loan**

	Money Lent		Maize Given	
	(1)	(2)	(3)	(4)
	Money loan amt	Money loan	Gift + Loan	Gift
Lockbox	16.28	0.01	1.81	0.04
	(20.61)	(0.02)	(2.05)	(0.05)
Observations	3477	3504	3504	3504
Mean DV	92.69	0.21	5.95	0.17
SD DV	554.28	0.40	22.95	0.58
R squared	0.13	0.03	0.03	0.03

Table E.4: **Heterogeneity by "Money giver and "Maize giver"**

	Money		Maize	
	(1)	(2)	(3)	(4)
	Money loan amt	Money loan	Gift + Loan	Gift
Lockbox	18.31	0.01	1.79	0.04
	(20.58)	(0.02)	(2.08)	(0.05)
Maize giver	19.29	0.04	1.62	0.04
	(12.56)	(0.01)	(0.69)	(0.02)
Interact	-36.86	-0.04	-1.48	-0.04
	(17.66)	(0.02)	(2.01)	(0.05)
Observations	3477	3504	3504	3504
Mean DV	92.69	0.21	5.95	0.17
SD DV	554.28	0.40	22.95	0.58
R squared	0.13	0.04	0.03	0.03

F Utility

We see that access to a lockbox for the Loan group, leads to significant increase in consumption. We try to quantify this in terms of utility.

We consider a CRRA utility function:

$$U(c) = \begin{cases} c^{1-\theta}/1-\theta \text{ if } \theta > 0, \theta \neq 1 \\ ln(c) \text{ if } \theta = 1 \end{cases}$$

where, θ is the degree of relative risk aversion that is implicit in the utility function

For a simple three period model, total consumption is given by:

$$C = (c_1) + (c_2) + (c_3)$$

where, c_1, c_2 and c_3 represent consumption in the post harvest, planting and lean seasons respectively.

Total utility is given by:

$$TotalUtility = U(C)$$

Accounting for the variability in consumption across the three periods,

$$VariableUtlity = U(c_1) + U(c_2) + U(c_3)$$

In Table F.1 we estimate the treatment effect of a lockbox on household utility (from consumption). We impose a standard functional form for utility, and find positive and statistically significant effects for both total utility summed up across all rounds, and for utility accounting for the variability in consumption across the three periods.

Table F.1: **Utility - Loan group**

	Total Utility			Variable Utility		
	(1) theta = 0.8	(2) theta = 1	(3) theta = 1.2	(4) theta = 0.8	(5) theta = 1	(6) theta = 1.2
Lockbox	0.70	0.08	0.01	1.40	0.21	0.03
	(0.30)	(0.03)	(0.00)	(0.68)	(0.10)	(0.01)
Observations	1046	1046	1046	1046	1046	1046
Mean DV	42.74	10.70	-0.59	101.75	28.60	-2.24
SD DV	4.42	0.51	0.06	10.13	1.45	0.21
R squared	0.12	0.12	0.12	0.13	0.12	0.12

If we ignore the variability in consumption across seasons, we understate the treatment effects.

G Investments

In this section we look treatment effects of Y1 treatments on Y2 outcomes.

Table G.1: **Treatment effect of Y1 treatment on Y2 outcomes** :The dependent variables are Farm Investment and School Fees in Year 2. Farm Investment is the value (in Ksh) of hybrid seeds, DAP (fertilizer), and CAN (fertilizer) used on maize plots in the season following the loan disbursal (because the Year 2 survey only measured the quantities used, average prices from Year 1 are used to get values in Year 2). This variable was only measured in round three for each year, as that is when farmers undertake this investment. School Fees are the expenditures on school fees over the past month (in Ksh). "Lockbox" is an indicator for being in the lockbox treatment group. Panel A shows the treatment effect of the loan treatment. Panel B shows the treatment effect of the lockbox, conditional on being offered the loan treatment. The results are pooled for year one and two of the study. Regressions include round-year fixed effects, strata dummies, and controls for survey date, with errors clustered at the group level. "Mean DV" and "SD DV" are the mean and standard deviation of the dependent variable among the control group.

	(1) Farm Investment (Y2)	(2) School Fees (Y2)
Panel A: Treatment effect of Y1 Loan		
Loan(Y1)	1808.66	432.21
	(768.47)	(3317.41)
Observations	586	1752
Mean DV	6607.11	5082.13
SD DV	3631.00	10429.29
R squared	0.05	0.06
Panel B: Treatment effect of Lockbox, conditional on Y1 Loan		
Lockbox (Y1)	488.73	1527.94
	(368.85)	(758.49)
Observations	390	1168
Mean DV	6154.95	4352.16
SD DV	3509.54	8354.11
R squared	0.04	0.06

Standard errors in parentheses

H Returners

There was some (small) selective attrition based on loan treatment status in Year 1; farmers who got the loan in Year 1 were 10 percentage points more likely to return to the Year 2 sample than farmers who did not get the loan in Year 1 (significant at 1%). This does slightly alter the composition of the Year 2 sample (see Table H.1). However, the Year 2 loan treatment status is stratified by Year 1 treatment status, so it does not alter the internal validity of the Year 2 results.

Table H.1: **Summary statistics for returners vs. non-returners**

Baseline characteristic	Non-Returner	Returner	Obs	Non-Return - Return	
				std diff	*p-val*
Treatment 2012	0.56	0.66	1,589	-0.20	0.00
Lockbox	0.29	0.31	1,589	-0.06	0.23
Male	0.28	0.25	1,816	0.07	0.13
Number of adults	3.01	3.12	1,737	-0.05	0.30
Children in school	2.89	3.23	1,816	-0.17	0.00
Finished primary school	0.73	0.77	1,716	-0.08	0.10
Finished secondary school	0.25	0.25	1,716	-0.01	0.81
Total cropland (acres)	2.26	2.50	1,737	-0.08	0.12
Number of rooms in household	3	3	1,738	-0.16	0.00
Total school fees	25,926	30,077	1,816	-0.11	0.02
Average monthly consumption (Ksh)	14,344.56	15,410.58	1,652	-0.09	0.10
Average monthly consumption/capita (log)"	8	8	1,649	-0.04	0.49
Total cash savings (Ksh)	5,355	6,966	1,797	-0.09	0.13
Total cash savings (trim)	4,675.61	4,918.86	1,797	-0.02	0.70
Has bank savings acct	0.38	0.46	1,816	-0.15	0.00
Taken bank loan	0.07	0.08	1,816	-0.04	0.46
Taken informal loan	0	0	1,816	-0.01	0.86
Liquid wealth (Ksh)	89,564	100,022	1,716	-0.10	0.05
Off-farm wages (Ksh)	3,508	4,104	1,816	-0.05	0.31
Business profit (Ksh)	2,069.13	2,159.55	1,816	-0.01	0.86
Avg %Δ price Sep-Jun	130.30	141.63	1,728	-0.15	0.00
Expect 2011 LR harvest (bags)	8	10	1,732	-0.09	0.05
Net revenue 2011 (Ksh)	-4,983.94	-4,156.75	1,633	-0.02	0.72
Net seller 2011	0.26	0.35	1,633	-0.19	0.00
Autarkic 2011	0.06	0.07	1,816	-0.03	0.53
% maize lost 2011	0.01	0.01	1,609	0.00	0.98
2012 LR harvest (bags)	9.26	11.94	1,708	-0.31	0.00
Calculated interest correctly	0.72	0.72	1,806	-0.01	0.91
Digit span recall	4.61	4.50	1,731	0.09	0.06
Maize giver	0.26	0.26	1,816	0.00	0.98
Delta	0.86	0.87	1,738	-0.08	0.09

Notes: Balance table for the Y1 study (restricted to the Y1 sample, for which we have baseline characteristics.) The first column gives the total number of observations. The next four columns correspond to the lockbox and loan treatment respectively. They give differences in means normalized by the standard deviation in the control group, with the corresponding p-value on the test of equality.
"Total school fees" are the total school fees paid by the household in the past 12 months. "Taken bank loan" is whether anyone in the household taken any loans from a commercial bank or commercial lender in the past 12 months. 'Taken informal loan" is whether anyone in the household taken any loans from a moneylender or someone else outside the household in the past 12 months."Liquid wealth" is the sum of cash savings and assets that could be easily sold (e.g. livestock). "Off-farm wages" is the total amount earned by anyone in the household who worked in a job for cash in the past month. "Business profits" are the total profits earned from all business run by anyone in the household. "Avg %Δ price Sep-Jun" is the percentage difference between the (self-reported) average market price for maize in September and June over the past five years. "Net revenue," "net seller," and "autarkic" refer to the household's maize marketing position. "Maize giver" is whether the household reported giving away more maize in gifts than it received over the previous 3 months.

I Long Run effects

In the long run, our sample includes 907 farmers who were offered a loan and 101 farmers who were not offered a loan . We caveat that our sample size for those only got a lockbox is fairly small, with only 29 participants in the who did not get a loan but received a lockbox. This group is very small in size because we followed a sub-sample of the year one only participants (481 out of 987 farmers) in the LRFU survey.

Table I.1: **Long run treatment effects** :The dependent variables are Net Revenues, Total HH consumption, Farm Investment and School Fees. Net revenues are measured by the value (in Ksh) of maize sales minus the value of maize purchases that round. The exchange rate during the study period ranged from 80 to 90Kenyan shillings per USD. TotalHH consumption is the log of HH consumption (measured in logged Ksh), aggregated from a detailed 30 day recall consumption module. Farm Investment is the value (in Ksh) of hybrid seeds, DAP (fertilizer), and CAN (fertilizer) used on maize plots in the season. This variable was only measured in round three for each year, as that is when farmers undertake this investment. School Fees are the expenditures on school fees over the past month (in Ksh). "Lockbox" is an indicator for being in the lockbox treatment group. Panel A shows the treatment effect of the loan treatment in Y1. Panel B shows the treatment effect of the lockbox, conditional on being offered the loan treatment in Y1. The results are pooled for year one and two of the study. Regressions include controls for survey date, with errors clustered at the group level. "Mean DV" and "SD DV" are the mean and standard deviation of the dependent variable among the control group.

	(1) Net Revenues	(2) Total HH Consumption	(3) Farm Investments	(4) School Fees
Panel A: Long run treatment effect of Loan				
Y1 Loan	350.50	-0.03	9.28	-3654.14
	(950.10)	(0.05)	(212.03)	(3854.68)
Observations	979	976	978	979
Mean DV	397.23	9.50	2531.77	38371.63
SD DV	13213.85	0.62	2992.94	48479.35
R squared	0.00	0.01	0.01	0.00
Panel B: Long run treatment effect of Lockbox, conditional on Loan				
Lockbox	-17.07	0.07	-62.07	4934.04
	(1501.10)	(0.05)	(252.48)	(3699.10)
Observations	616	613	613	613
Mean DV	869.84	9.44	2526.88	32951.73
SD DV	12922.87	0.59	2653.94	38654.26
R squared	0.00	0.01	0.01	0.00

Standard errors in parentheses

Table I.2: **Long run treatment effects** :The dependent variables are Net Revenues, Total HH consumption, Farm Investment and School Fees. Net revenues are measured by the value (in Ksh) of maize sales minus the value of maize purchases that round. The exchange rate during the study period ranged from 80 to 90Kenyan shillings per USD. TotalHH consumption is the log of HH consumption (measured in logged Ksh), aggregated from a detailed 30 day recall consumption module. Farm Investment is the value (in Ksh) of hybrid seeds, DAP (fertilizer), and CAN (fertilizer) used on maize plots in the season. This variable was only measured in round three for each year, as that is when farmers undertake this investment. School Fees are the expenditures on school fees over the past month (in Ksh). "Lockbox" is an indicator for being in the lockbox treatment group. Panel A shows the treatment effect of the loan treatment in Y2. Panel B shows the treatment effect of the lockbox, conditional on being offered the loan treatment in Y2. The results are pooled for year one and two of the study. Regressions include controls for survey date, with errors clustered at the group level. "Mean DV" and "SD DV" are the mean and standard deviation of the dependent variable among the control group.

	(1) Net Revenues	(2) Total HH Consumption	(3) Farm Investments	(4) School Fees
Panel A: Long run treatment effect of Loan				
Y2 Loan	1286.62	0.04	102.60	-1168.61
	(1094.42)	(0.05)	(190.12)	(2917.71)
Observations	938	939	940	936
Mean DV	1052.01	9.47	2174.42	37452.55
SD DV	16420.94	0.62	2655.25	45184.60
R squared	0.00	0.00	0.00	0.00
Panel B: Long run treatment effect of Lockbox, conditional on Loan				
Lockbox	1902.83	0.03	-291.96	2796.86
	(1564.26)	(0.08)	(291.00)	(4462.90)
Observations	497	496	498	495
Mean DV	2057.24	9.50	2318.84	35836.14
SD DV	15005.19	0.61	2771.48	39470.24
R squared	0.01	0.03	0.01	0.01

Standard errors in parentheses

J Treatment effect of Lockbox alone

Table J.1: **Balance - lockbox**

Baseline characteristic	Lockbox (T-C)			Lockbox in No Loan group (T-C)		
	obs	*std diff*	*p-val*	*obs*	*std diff*	*p-val*
Male	1,589	-0.04	0.52	635	-0.04	0.64
Number of adults	1,510	0.01	0.83	607	-0.05	0.62
Children in school	1,589	0.04	0.43	635	0.02	0.86
Finished primary school	1,490	-0.09	0.12	600	-0.13	0.18
Finished secondary school	1,490	-0.04	0.46	600	-0.08	0.37
Total cropland (acres)	1,512	-0.01	0.82	606	-0.13	0.14
Number of rooms in household	1,511	-0.05	0.28	607	-0.12	0.15
Total school fees	1,589	0.07	0.20	635	-0.06	0.53
Average monthly consumption (Ksh)	1,437	-0.06	0.29	579	-0.11	0.23
Average monthly consumption/capita (log)	1,434	-0.02	0.72	579	-0.01	0.90
Total cash savings (Ksh)	1,572	0.01	0.81	629	-0.06	0.53
Total cash savings (trim)	1,572	0.04	0.53	629	-0.09	0.33
Has bank savings acct	1,589	0.08	0.17	635	-0.10	0.28
Taken bank loan	1,589	0.01	0.83	635	-0.06	0.48
Taken informal loan	1,589	0.04	0.52	635	-0.00	0.99
Liquid wealth (Ksh)	1,491	0.04	0.47	598	-0.08	0.37
Off-farm wages (Ksh)	1,589	0.04	0.43	635	-0.07	0.39
Business profit (Ksh)	1,589	-0.04	0.45	635	-0.05	0.58
Avg %Δ price Sep-Jun	1,504	0.03	0.65	604	0.07	0.46
Expect %Δ price Sep12-Jun13	1,510	-0.06	0.26	605	0.04	0.71
2011 LR harvest (bags)	1,511	-0.01	0.85	606	-0.03	0.71
Net revenue 2011 (Ksh)	1,428	-0.03	0.61	571	0.15	0.20
Net seller 2011	1,428	-0.01	0.92	571	-0.06	0.51
Autarkic 2011	1,589	-0.09	0.09	635	-0.05	0.59
% maize lost 2011	1,428	-0.07	0.15	578	0.02	0.84
2012 LR harvest (bags)	1,484	-0.01	0.86	594	-0.07	0.46
Calculated interest correctly	1,580	0.04	0.47	630	-0.04	0.69
Digit span recall	1,504	-0.00	0.96	604	-0.04	0.67
Maize giver	1,589	-0.05	0.38	635	-0.28	0.00

In Tables J.2 and J.3 we check robustness of 3 to including baseline controls and winsorizing the dependent variable at 5%. In both tables, Columns 1 to 2 present the results for Net revenues from maize, Columns 3 to 4 present the results for Total household consumption, Columns 5 to 6 present the results for Farm investments and Columns 7 to 8 present School fees results. Regressions without baseline controls and winsorization of the dependent variable are shown in columns 1, 3, 5 and 7 in both tables. In Table J.2, regressions with baseline controls are shown in columns 2,4, 6 and 8 and in Table J.3, regressions with winsorization of the dependent variable are shown in columns 2,4,6 and 8. The number of observations, the mean and standard deviation of the dependent variable for the control group, as well as the R- squared of the regression is presented in each column of the table. We present short run results by pooling year one and two of the study.

We see from Tables J.2 and J.3 that our results are robust to including baseline controls and winsorizing the dependent variable at 5%.

Table J.2: **Treatment effects of lockbox alone** :The dependent variables are Net Revenues, Total HH consumption, Farm Investment and School Fees. Net revenues are measured by the value (in Ksh) of maize sales minus the value of maize purchases that round. The exchange rate during the study period ranged from 80 to 90Kenyan shillings per USD. TotalHH consumption is the log of HH consumption (measured in logged Ksh), aggregated from a detailed 30 day recall consumption module. Farm Investment is the value (in Ksh) of hybrid seeds, DAP (fertilizer), and CAN (fertilizer) used on maize plots in the season following the loan disbursal (because the Year 2 survey only measured the quantities used, average prices from Year 1 are used to get values in Year 2). This variable was only measured in round three for each year, as that is when farmers undertake this investment. School Fees are the expenditures on school fees over the past month (in Ksh). "Lockbox" is an indicator for being in the lockbox treatment group. Panel A shows the treatment effect of the loan treatment. Panel B shows the treatment effect of the lockbox, conditional on being offered the loan treatment. The results are pooled for year one and two of the study. Regressions include round-year fixed effects, strata dummies, and controls for survey date, with errors clustered at the group level. "Mean DV" and "SD DV" are the mean and standard deviation of the dependent variable among the control group.

	Net Revenues		Total HH Consumption		Farm Investments		School Fees	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lockbox	-217.48	39.69	-0.06	-0.01	105.29	104.66	-803.48	-424.95
	(326.69)	(312.78)	(0.04)	(0.04)	(311.66)	(297.06)	(455.64)	(447.26)
Observations	2098	2061	2103	2008	713	713	2122	2122
Mean DV	-1043.90	-1043.90	9.56	9.56	5000.87	5000.87	4166.54	4166.54
SD DV	6378.11	6378.11	0.64	0.64	3498.52	3498.52	8625.46	8625.46
R squared	0.18	0.22	0.10	0.22	0.18	0.26	0.08	0.15
Baseline controls included	No	Yes	No	Yes	No	Yes	No	Yes

Standard errors in parentheses

Table J.3: **Treatment effects of lockbox alone** :The dependent variables are Net Revenues, Total HH consumption, Farm Investment and School Fees. Net revenues are measured by the value (in Ksh) of maize sales minus the value of maize purchases that round. The exchange rate during the study period ranged from 80 to 90Kenyan shillings per USD. TotalHH consumption is the log of HH consumption (measured in logged Ksh), aggregated from a detailed 30 day recall consumption module. Farm Investment is the value (in Ksh) of hybrid seeds, DAP (fertilizer), and CAN (fertilizer) used on maize plots in the season following the loan disbursal (because the Year 2 survey only measured the quantities used, average prices from Year 1 are used to get values in Year 2). This variable was only measured in round three for each year, as that is when farmers undertake this investment. School Fees are the expenditures on school fees over the past month (in Ksh). "Lockbox" is an indicator for being in the lockbox treatment group. Panel A shows the treatment effect of the loan treatment. Panel B shows the treatment effect of the lockbox, conditional on being offered the loan treatment. The results are pooled for year one and two of the study. Regressions include round-year fixed effects, strata dummies, and controls for survey date, with errors clustered at the group level. "Mean DV" and "SD DV" are the mean and standard deviation of the dependent variable among the control group.

	Net Revenues		Total HH Consumption		Farm Investments		School Fees	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lockbox	-217.48	-211.32	-0.06	-0.06	105.29	32.58	-803.48	-714.89
	(326.69)	(265.69)	(0.04)	(0.04)	(311.66)	(269.11)	(455.64)	(296.96)
Observations	2098	2098	2103	2103	713	713	2122	2122
Mean DV	-1043.90	-1043.90	9.56	9.56	5000.87	5000.87	4166.54	4166.54
SD DV	6378.11	6378.11	0.64	0.64	3498.52	3498.52	8625.46	8625.46
R squared	0.18	0.21	0.10	0.10	0.18	0.18	0.08	0.10
Baseline controls included	No	No	No	No	No	No	No	No
Dep. var. winsorized (5%)	No	Yes	No	Yes	No	Yes	No	Yes

Standard errors in parentheses

Lockbox savings and maize storage could conceptually be substitutes or complementary savings devices. We find that farmers who were not offered a loan (and as a result, are more cash constrained at harvest), significantly reduce the maize inventories they hold when offered a lockbox. Specifically, maize inventories decrease by 41% for this group (significant at 95% confidence, Table 3, col. 5).This suggests that lockbox saving and maize storage are substitute savings mechanisms. To illustrate their decision problem, consider a farmer who received only a lockbox. She could choose either to store maize post harvest (to sell later at a higher price) or could sell the maize immediately after harvest and save the money in the lockbox. Several factors and beliefs could shape this choice. For one, farmers are aware that maize prices tend to increase in the months after harvest (see Appendix II), which would imply that maize storage should earn a higher return than keeping cash in a lockbox. However, farmers may also perceive certain risks to maize storage, including its greater visibility to family and friends (or thieves) relative to a lockbox, which can be easily hidden. Saving in a lockbox is also more liquid than a sack of maize, which needs to be taken to market and sold. For farmers who are sufficiently highly risk averse and liquidity constrained, the benefits to saving in a lockbox may outweigh the upside returns of maize storage.

Provision of a lockbox also has a meaningful effects on household borrowing: among farmers who did not receive a loan, borrowing declines by 57% (significant at 99% confidence, Table 3, col. 6) when offered a lockbox. It thus appears that precautionary savings and borrowing act as substitutes among these Kenyan farmers: when savings constraints are eased (by receipt of the lockbox), cash constrained farmers dramatically reduce their borrowing (which can be very expensive in this context). Note that this decrease is concentrated in the lean season (see Table XX).

Table J.4: **Treatment effect of the Lockbox alone**

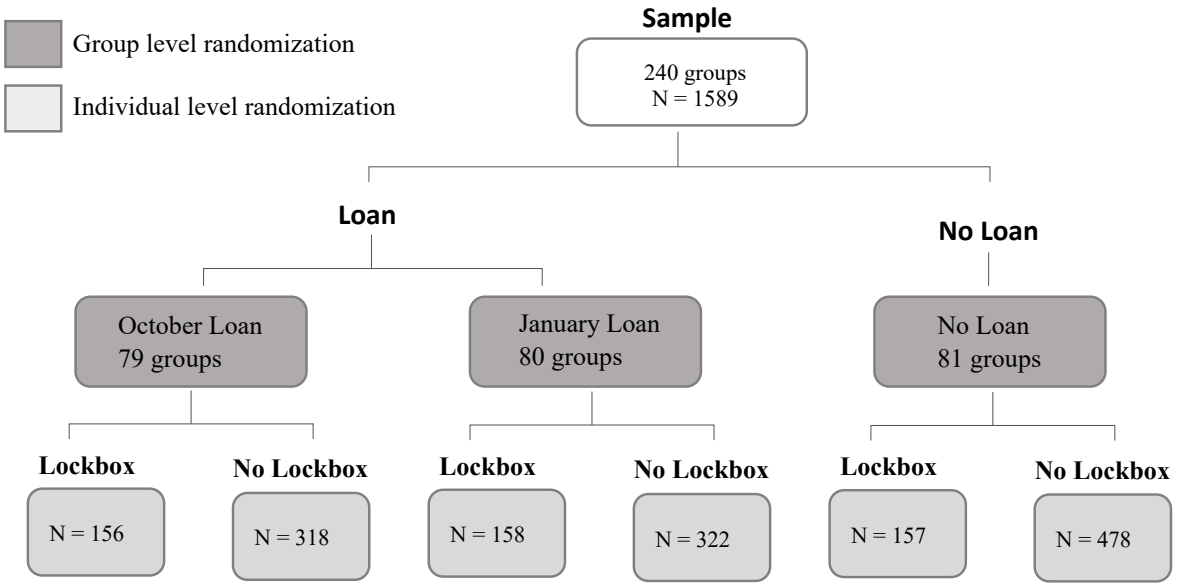
	(1) Maize inventory	(2) Borrowing
Lockbox	-0.41	-0.57
	(0.17)	(0.20)
Observations	2115	2139
Mean DV	2.46	1.99
SD DV	3.47	3.58
R squared	0.35	0.08

Notes: The dependent variables are Maize inventories and Total household borrowing. Inventories are measured by the number of 90kg bags of maize held by the household at the time of survey. Borrowing is the amount in Ksh that the household reporting having received a loan from a commercial bank, moneylender, family member, or friend in the previous round. "Lockbox" is an indicator for being in the lockbox treatment group. The results are pooled for year one and two. Regressions include round-year fixed effects, strata dummies, and controls for survey date, with errors clustered at the group level. "Mean DV" and "SD DV" are the mean and standard deviation of the dependent variable among the control group.

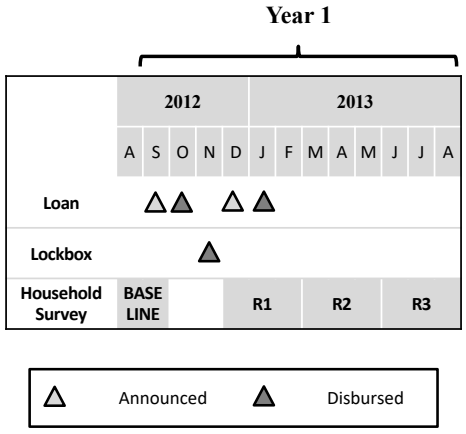
K Loan Timing

In Table K.1 we check for robustness of results in Table 2 to including baseline controls. We show that the results are robust to including baseline controls. Further, with the inclusion of controls, the effect of the lockbox on farm investments is statistically significantly larger for the October loan group. In summary, we see that farmers earn a much higher return (higher net revenues) to the October loan in comparison to the January loan. This provides evidence that the savings technology is most impactful when household have greater returns from a productive investment in hand.

Figure K.1: **Experimental design**



(a) **Study design**: There were two levels of randomization in year one- a loan and lockbox treatment. The loan treatment was randomized at the group level. Loans were randomly offered in October and January. The lockbox treatment was randomized at the individual level.Numbers of randomized units are given in the boxes.



(b) **Study timeline**: This figure depicts the harvest periods, timing of interventions and the survey waves.

Table K.1: **Treatment effects by loan timing (with baseline controls)** :The dependent variables are Net Revenues, Total HH consumption, Farm Investment and School Fees. Net revenues are measured by the value (in Ksh) of maize sales minus the value of maize purchases that round. The exchange rate during the study period ranged from 80 to 90Kenyan shillings per USD. Total HH consumption is the log of HH consumption (measured in logged Ksh), aggregated from a detailed 30 day recall consumption module. Farm Investment is the value (in Ksh) of hybrid seeds, DAP (fertilizer), and CAN (fertilizer) used on maize plots in the season following the loan disbursal (because the Year 2 survey only measured the quantities used, average prices from Year 1 are used to get values in Year 2). This variable was only measured in round three for each year, as that is when farmers undertake this investment. School Fees are the expenditures on school fees over the past month (in Ksh). "Lockbox" is an indicator for being in the lockbox treatment group. Panel A shows the treatment effect of the loan treatment. Panel B shows the treatment effect of the lockbox, conditional on being offered the loan treatment. Columns 1,3,5 and 7 shows the treatment effects for October and January loans of the Y1 treatment. Columns 2,4,6, and 8 show the treatment effects for the October loan. The results are pooled for year one and two of the study. Regressions include baseline controls, round-year fixed effects, strata dummies, and controls for survey date, with errors clustered at the group level. "Mean DV" and "SD DV" are the mean and standard deviation of the dependent variable among the control group.

	Net Revenues		Total HH Consumption		Farm Investment		School Fees	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Oct	Jan	Oct	Jan	Oct	Jan	Oct	Jan
Panel A: Treatment effect of Loan (Oct and Jan)								
Loan	555.23	34.57	0.03	0.00	-204.19	-219.90	-231.91	-101.26
	(250.25)	(245.12)	(0.03)	(0.03)	(228.84)	(217.62)	(286.80)	(287.14)
Observations	2520	2518	2414	2420	867	869	2572	2571
Mean DV	-1616.12	-1616.12	9.55	9.55	5332.46	5332.46	3911.31	3911.31
SD DV	6359.06	6359.06	0.64	0.64	3596.71	3596.71	8281.46	8281.46
R squared	0.10	0.15	0.17	0.17	0.18	0.13	0.12	0.13
Panel B: Treatment effect of Lockbox, conditional on Loan (Oct and Jan)								
Lockbox	-26.72	237.98	0.08	0.06	621.55	505.18	762.34	-463.28
	(312.31)	(345.79)	(0.04)	(0.04)	(352.71)	(373.76)	(415.09)	(407.64)
Observations	1258	1256	1184	1190	430	432	1272	1271
Mean DV	708.05	284.57	9.45	9.47	3715.63	3823.85	2614.39	3207.12
SD DV	6227.68	6197.31	0.62	0.63	3225.57	3194.25	5947.33	7063.82
R squared	0.12	0.23	0.16	0.17	0.26	0.18	0.14	0.14

Standard errors in parentheses

In Table K.2 we test if the the treatment effects of the lockbox are significantly different for the October and January Loans. We create an "October" dummy which takes a value of 1 for the October loan and 0 for the January loan. Similarly, we create a "January" dummy. We then interact these with the lockbox treatment.

For school fee repayments, we see a significant negative effect of getting only a loan in October or only a lockbox. However, it is worth noting that providing a loan in October with a lockbox offsets the negative effects of receiving only one of the two products. We also find that the October and January loans have significantly different treatment effects for school fee repayments. We also see that the interaction of loan and lockbox treatments is significantly different for the October and January loans. This highlights the complementarity of the two financial products. Therefore, to encourage school fee payments which occur with a lag after harvest one could offer a loan at harvest with a lockbox that helps move money inter-temporally.

It is intuitive that the effects of timely cash or a tool to move cash across time are similar.

Table K.2: **Loan timing and Lockbox Interaction**

	(1)	(2)	(3)	(4)
	Net Revenues	Total HH Consumption	Farm Investments	School Fees
Oct Loan	494.66	-0.03	-456.42	-1019.69
	(351.50)	(0.04)	(292.74)	(360.47)
Jan Loan	-86.08	-0.02	-492.73	-341.63
	(374.21)	(0.04)	(271.25)	(360.00)
Lockbox	-1.09	-0.07	-39.35	-1063.16
	(424.13)	(0.05)	(378.56)	(419.59)
Oct Loan*Lockbox	209.71	0.15	531.94	2047.88
	(547.27)	(0.07)	(530.09)	(576.68)
Jan Loan*Lockbox	202.07	0.09	698.60	548.99
	(603.21)	(0.07)	(515.60)	(579.00)
Observations	3795	3792	1299	3843
Mean of Dep Variable	-1043.90	9.56	5000.87	4166.54
SD of Dep Variable	6378.11	0.64	3498.52	8625.46
R squared	0.03	0.03	0.07	0.06
P-val Oct loan=Jan loan	0.10	0.75	0.89	0.04
P-val Oct int = Jan int	0.99	0.34	0.74	0.01

L Loan + Lockbox against a Pure Control group

In this section, we compare farmers who got the loan and lockbox treatment against a pure control group (who got no loan or lockbox). We see positive and significant effects for the Net Revenues and Total HH Consumption. The effects for Farm Investment and School Fees are statistically indistinguishable from zero.

Table L.1: **Treatment effect of a Loan and Lockbox (vs. pure control)**

	(1)	(2)	(3)	(4)
	Net Revenues	Total HH Consumption	Farm Investments	School Fees
Loan + Lockbox	621.22	0.06	185.12	-6.01
	(295.95)	(0.04)	(246.82)	(370.91)
Observations	2500	2510	855	2533
Mean DV	-1043.90	9.56	5000.87	4166.54
SD DV	6378.11	0.64	3498.52	8625.46
R squared	0.14	0.07	0.15	0.09