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Intertemporal Choice and Income Regularity: Non-Fungibility in a Lab-in-the-Field Experiment

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Abstract

This paper tests whether the choice of when to be paid depends on the income type. A lab-in-the-field experiment in Kenya asked dairy cooperative members to allocate both an irregular windfall and their regular milk payments between two dates. Participants allocated the windfall to the earlier of the two dates, in line with theory, but allocated milk payments to the later date. Survey evidence suggests that allocations of regular dairy income were significantly more patient because farmers earmarked milk payments, but not the irregular windfall, for bulky expenditures. Given that compliance with informal contracts depends on whether the timing of payment aligns with recipient preferences, these findings have implications for contract design in rural value chains.

JEL: D03, Q13, O12.
Keywords: time preferences, mental accounting, fungibility, collective marketing.

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1 Introduction

Aggregators such as cooperatives, producer groups, and contract farming arrangements can help smallholder farmers reduce transaction costs in accessing markets and improve productivity. These institutions generate economies of scale by bulking output from many small producers, which can improve prices, stability, and access to inputs (Reardon et al., 2009). However, they typically rely on informal contracts that are difficult to enforce, making side-selling of produce a major challenge (Minot and Sawyer, 2016). Farmers in need of cash may side-sell—even at prices below the contract price—because aggregators tend to defer payments instead of paying upon delivery (Vargas Hill et al., 2015; Geng, Kramer, and Janssens, 2017). At the same time, farmers with limited access to sound savings devices may actually prefer deferred payments (Casaburi and Macchiavello, 2016). The optimal design of informal contracts in agricultural value chains will hence depend not only on *how much* farmers are paid but also on *when* they prefer to be paid.

We therefore elicit farmers' willingness to defer payments from their cooperative, and, in order to better understand such preferences, the willingness to defer experimental windfalls. In experiments that elicit preferences for when to receive irregular windfalls, the demand for earlier (and smaller) as opposed to later (but larger) payments is often too high to reconcile with observed savings rates (Frederick, Loewenstein, and O'Donoghue, 2002; Camerer et al., 2015). Individuals sometimes even prefer deferred payments, for instance through a "13th salary" at the end of the year, or committed savings devices with negative real interest rates (Ashraf, Karlan, and Yin, 2006; Bryan, Karlan, and Nelson, 2010). Observational studies find higher marginal propensities to consume for irregular income such as tax refunds or dividends (Souleles, 1999; Baker, Nagel, and Wurgler, 2007). When optimizing the timing of payments for agricultural produce, it is important to understand how and why such preferences depend on the income type.

We hypothesize that individuals are more patient regarding regular income payments than regarding irregular windfalls for four reasons. First, individuals may have scheduled regular bulky expenditures to align with regular income payments, whereas such expenditures are not clustered around irregular windfalls. Second, mental accounts may govern decision over regular income even without explicit savings goals (Thaler, 1999), but such accounts will not exist for unusual income. Third, for windfall gains, reference-dependent theories of intertemporal choice predict hand-to-mouth consumption, while individuals will prefer maintaining the status quo for already planned income paths (Kőszegi and Rabin, 2009; Kramer, 2016). Finally, payments from regular income sources may also be more visible and potentially controlled by other household members, so that individuals may want to set them aside by deferring payments, whereas it is easier to hide and keep

a windfall. Each of these mechanisms predicts more patient choices for more regular income types.

We test this prediction by means of a lab-in-the-field experiment with dairy farmers in Kenya. They aggregate output through a dairy cooperative that defers milk payments until the next month. We asked participants to allocate their milk income from the cooperative between this deferred payment date and an earlier date. We also asked the same participants to allocate an irregular type of income, namely a gift for participating in the study, between an earlier and a later payment date. The vast majority of participants preferred to defer milk payments until the next month. In contrast, the same participants rarely chose to defer the gift to the later payment date, indicating that the high demand for deferred milk payments is specific to that income type.

While our experimental design does not allow us to identify the specific channel that is driving these results, survey data collected among the same sample of farmers suggests that we observe this gap because of income accounting. Participants self-reported deferring the milk payment in order to save for lump-sum expenditures such as agricultural inputs or school fees, instead of being tempted to spend their dairy income on something else. For participants who planned to spend their milk payment on more frequent, smaller expenditures such as food and other daily needs, the gap in preferences for deferred milk payments versus windfalls was weaker. These findings are consistent with the theory that in order to save for bulky expenditures, participants earmark their regular income (milk payments), but not irregular income (the gift).

This paper relates to three strands of the literature. First, we provide experimental evidence of income accounting. Income accounting means that different types of income are treated differently in consumption-savings decisions (Thaler, 1990, 1999). Empirically, spending decisions often violate fungibility across income types. For instance, child clothing expenditures are more sensitive to changes in child allowances than to changes in other income (Kooreman, 2000); positive income shocks from staple versus cash crops increase spending on public versus prestige goods (Duflo and Udry, 2004); Villa, Barrett, and Just (2011) find evidence of non-fungibility across agricultural and wage income; and labor supply responds differently to non-labor than to labor income shocks (Dupas, Robinson, and Saavedra, 2016). Income accounting is also a leading explanation in studies that document a higher propensity to consume out of irregular income sources (Souleles, 1999; Baker, Nagel, and Wurgler, 2007). Such source-dependence could be related to unobserved differences in attributes of regular versus irregular income types, including for instance the recipient, front-end delays and interest rates. In our experiment, we can control for these potential confounds.

Second, we shed light on the stability of intertemporal allocations of income. Several studies (for example Meier and Sprenger, 2015; Chuang and Schechter, 2015; Halevy, 2015; Janssens, Kramer, and Swart, 2017) estimate discount rates using experimental windfalls for the same indi-

viduals at different points in time. Time preferences vary over time, in part due to random noise in decision making and in part due to liquidity constraints. Time preferences also depend on the commodity in which income is paid (Ubfal, 2016). Closest to the present study, Hvide and Lee (2016) find that allocations of money earned through a physical effort task in the lab were more patient than allocations of experimental windfalls. We provide evidence that this finding generalizes to regular income earned outside of a laboratory environment, in a context of recurring earnings from a dairy cooperative. This implies that we may elicit different preferences depending on whether we base our inference on allocations of windfalls or of regular income.

Third, we contribute to the literature on linkages between rural output and financial markets. Using panel data for farmers in a similar setting as ours, but for a different dairy cooperative, Geng, Kramer, and Janssens (2017) suggest that deferring payments increases side-selling during periods in which dairy farmers are in urgent need of cash. Neglecting this demand for liquidity puts at risk the farmer's loyalty to the cooperative and thereby also possible side benefits of collective marketing (Muriuki, 2011; Minot and Sawyer, 2016). Casaburi and Macchiavello (2016) however argue that farmers may sell to a cooperative, even at below-market prices, precisely because they value deferred payments as an option to save with a trustworthy institution. Since we find a strong preference for deferred milk payments, we replicate their findings. In addition, we show that this finding is source-dependent; it does not generalize to irregular windfalls. Hence, it is not driven by a selection into cooperatives of farmers with unusually low discount rates across income types, or an unusually high demand for commitments to save income in general.

The remainder of this paper is structured as follows. The next section presents the experimental methods and procedures. Section 3 describes the study context in more detail, including sampling procedures, participant characteristics, and their relation with the cooperative. Section 4 summarizes farmers' intertemporal allocations of the gift and milk payments, and interprets the results. The final section concludes.

2 Methods

2.1 Background

The experiment was conducted with dairy farmers who supply milk to Metkei Dairies Ltd., a farmer-owned dairy hub in the Rift Valley region in western Kenya. Metkei collects milk from 1,000 to 1,500 dairy farmers, cools the milk in two cooling centers, and sells it to larger processing companies. Metkei receives milk twice per day: once in the morning and once in the afternoon.

In the morning, farmers can either deliver the milk themselves to one of the two cooling plants or deliver via a Metkei transporter who passes from village to village and collects milk at the farm-gate for a small deduction from the milk price. In the afternoon, no central transport is available, making afternoon delivery feasible only for farmers who live close enough to a cooling plant to deliver the milk themselves. Farmers have no cooling facilities and cannot store milk produced in the afternoon for the next morning's milk collection. Metkei prices vary from month to month.

Outside Metkei, farmers can sell their milk to other cooperatives that operate similarly as Metkei, serving formal milk markets, and to neighbors and traders who serve local (informal) markets.[1] It is common to send the morning milk to Metkei and keep the afternoon milk for consumption or for selling it in the local market. Buyers in the local market tend to pay cash on delivery—at prices that can potentially vary from day to day—to any household member who sells the milk. In contrast, Metkei (like other cooperatives) pays only once per month, and pays only the supplier registered with Metkei (often the male household head). Payments are typically deferred until the eleventh of the next month because that is when the monthly payment from the processing company is on the way.

Farmers can request advance payments for up to 50 percent of the milk delivered in a given month from the 21st of that month onwards. However, these advances are costly. In order be paid three weeks before the regular payment date, farmers are charged a 7.5 percent interest rate, discouraging farmers from taking out advances unless they really need the money.[2] Despite these large fees, administrative data indicate that 35 percent of all Metkei farmers took out an advance at least once in the nine months before the study, and for those who did, advance payments accounted for more than 30 percent of the total monthly milk payment (or 60 percent of the amount that farmers could take out as an advance). Hence, the demand for liquidity is high. Recognizing the cash constraints faced by their members, and looking for ways to improve its services and attract more milk, Metkei was interested in measuring farmers' demand for early milk payments.

2.2 Experimental Tasks

The experiment elicited study participants' preferred allocations of milk payments between an earlier and a later date. This was done in two rounds. During the first round, we elicited farmers'

[1] Most farmers see another cooperative as their main option for selling milk outside Metkei. When asked to list their main alternative to their regular Metkei cooperative, 44 percent of farmers reported other cooperatives outside Metkei, followed by Metkei collection centers that were not included in the study (28 percent), and neighbors, traders, and other informal milk buyers (28 percent).

[2] Without compounding, this is equivalent to an annual interest rate of 130 percent, and compounding would result in an even higher annual interest rate.

preferences for when to receive their milk payments. In the second round, we asked farmers to allocate both their regular milk payments and an irregular gift between earlier and later payment dates, creating within-subject variation in preferences for when to be paid different types of income. The main analyses focus on this second round in order to maximize comparability of the two allocation types. First-round allocations will be presented later as a robustness check.

2.2.1 Main Experimental Tasks: Allocation of Milk Payments in Round 2

During the second round, we asked study participants to make the following decision, for each of the four weeks after the interview:

"For milk delivered between Friday ... [start date] and Thursday ... [end date], which is ... [one, two, three, or four] weeks from now, for how many kilograms of milk do you prefer to be paid at the end of that week?"

Thus, farmers indicated for how much of the milk delivered between Friday and Thursday they preferred to receive a payment on the subsequent Friday. The remainder would be paid on the later, standard payment date, with both the early and the later payments maintaining the Metkei milk price prevailing at the time of delivery. Figure 1 illustrates a timeline for two example interview dates. A participant interviewed on January 30 allocated milk delivered in the week of February 1 (and the weeks of February 8, 15, and 22) between an early payment on February 8 (and February 15, 22, and 29) and a later payment on March 11. Likewise, if interviewed on February 11, the farmer allocated milk payments from the week of February 12 (or February 19th) between an early payment on February 19 (or February 26) and a later payment on March 11, and milk from the week of February 26 (or March 3) between an early payment on March 3 (or March 10) and a later payment on April 11.

Metkei handled both payments. To reduce transaction costs associated with receiving an extra (early) payment, participants could choose to receive this payment via mobile money or at the collection point, whichever was more convenient for the participant. All participants had access to a mobile money account with M-Pesa, the largest mobile money provider in Kenya, and the study paid for any fees associated with sending the money into their mobile money account. Farmers were used to receiving their monthly (later) payments through the collection point or transporter. We did not deviate from this approach.

In order to ensure that farmers could still take out in-kind advances for other services, Metkei restricted the maximum weekly payment to 50 percent of the total quantity delivered in a given week. This is consistent with the rule for regular cash advances that farmers were familiar with (although we emphasized that the weekly payments were free of charge, as opposed to the advance

payments). Hence, our weekly payment to the farmer was either the amount that the farmer had asked to be paid for, or a payment for 50 percent of the milk delivered throughout the previous week (whichever was lower, since otherwise the payment would exceed the maximum amount allowed to be paid in advance).[3]

2.2.2 Main Experimental Tasks: Allocation of the Gift in Round 2

During the same interview, participants were also asked to allocate a gift of KSh 250, approximately US$ 2.50, or half the budget in the median farmer's milk payment allocations) between the Friday of the same week and the Friday three weeks later (see the bottom row labeled "Gift" in both examples from figure 1). Both payments were made via mobile money. Farmers received an extra KSh 65 on both dates regardless of their choice:

"In addition to the KSh 65 that we are sending you both ... [early date] (this Friday) and ... [later date] (Friday three weeks from now), how much out of KSh 250 do you prefer to receive this Friday?"

Similar to the allocations of milk payments, the allocation of the gift involved a linear budget, without return or penalty on deferred payments. Hence, a standard model with discounting of future income predicts that participants will prefer to have both types of income to be paid on the early date. Further, the number of days between the early and the late payment date was 21 days, comparable to the median delay in the milk payment.[4] As was the case for milk payments, gift allocations were elicited by our enumerators, and payments on the earlier date were done via mobile money. Finally, because preferences were elicited from the same farmers during the same interview, any differences in allocations cannot be driven by differences in participant characteristics, changes in background wealth, or time-varying preferences. This approach also rules out liquidity constraints as an explanation for differences in intertemporal choice across types of income (in contrast to, for example Dean and Sautmann, 2016 and Janssens, Kramer, and Swart, 2017).

Choices also differed in a number of aspects. First, the front-end delay for the gift ranged from 1 to 7 days, whereas the shortest front-end delays for milk payment allocations ranged between 8

[3] We dropped this restriction for a few farmers who delivered only afternoon milk to Metkei, because most farmers were not used to delivering their afternoon milk to Metkei and using it to pay for Metkei services. For them, we maintained 100 percent of expected milk production as the effective budget in allocations of milk payments between the earlier and the later, standard payment date. Results are robust to the inclusion or exclusion of this sample, and to recoding their effective milk budget to 50 percent of expected milk production.

[4] The delay of the milk payment, however, ranged from 7 to 35 days, depending on the number of days until the next regular payment date. Because regular payments are made on the eleventh of the next month, the regular payment date for milk delivered toward the end of a month comes much sooner than the regular payment date for milk delivered at the beginning of a month.

and 14 days.[5] Second, the gift was only half the value of the weekly milk budget that the median farmer could allocate over time, resulting in substantially lower experimental stakes for the gift. Third, the gift was sent via mobile money, but the later milk payment was collected in cash from the collection point, and participants could choose to receive their weekly milk payment in the same way. Choosing to also receive weekly payments at the collection point could create additional transaction costs related to more frequent travel. Fourth, the gift allocation was made at the end of the interview, after participants had already made their milk payment allocation, and this may have introduced order effects. We had to apply these procedures for practical reasons. We will show that our results are robust to controlling for these differences in front-end delays, experimental stakes, and potential transaction costs; and that order effects are unlikely to explain our results.

2.2.3 Experimental Tasks Used as a Robustness Check: Round 1

The experiment elicited a number of milk payment allocations also during the first round, which we use as a robustness check. These allocations differ from second-round allocations in a number of respects. To start, participants allocated a payment between the end of the week and the eleventh of the next month for two weeks instead of one week at a time. This means that every allocation applies to a two-week period instead of only one week.

Further, first-round allocations varied the return on deferred payments by varying the price for milk that participants chose to be paid for on the earlier payment date. Given that the price for milk paid on the regular (later) payment date was fixed at the prevailing Metkei price, a decrease in the earlier milk price increases the return on deferred payments. In first-round allocations, the earlier milk price was either (1) identical to the prevailing Metkei price, that is, a *zero* return on deferring payments; (2) KSh 2 (about 7 percent) higher, that is, a *negative* return on deferring payments; or (3) KSh 2 lower, that is, a *positive* return on deferring payments. All first-round participants made choices for each of the three scenarios.

Finally, the first round included choices for a short-duration offer, in which participants could receive weekly payments over the next two weeks (and thus over only one two-week period), versus a long-duration offer, in which they could receive weekly payments in each of the next four two-week periods. [6] Participants made these choices for each of the three price scenarios. Hence,

[5] The front-end delay is the number of days between the interview and the early payment date. For interviews conducted on a Thursday, the first week would start on Friday and the first possible weekly payment would take place on the next Friday, 8 days later. Interviews conducted on a Friday had the longest front-end delay: the first week would start on the subsequent Friday, and the first weekly payment would therefore be made on the Friday 14 days later. For the gift payment, the front-end delay was shorter. However, note that the front-end delay was still equal to at least 1 day, so that no participant could choose to receive the gift payment directly during the interview.

[6] We included this variation because we were worried that the strong preference for deferred payments found in Casaburi and Macchiavello

for every participant, we have in total 4×3 allocations for the long-duration offer, and 1×3 allocations for the short-duration offer, yielding 15 allocations in total. At the end of the first-round interview, we randomly selected a price, and either the short-duration or the long-duration offer. The allocations for this randomly selected scenario were implemented by Metkei during the period between the first and the second round.[7]

We started with this more complex design in the first round (compared with the second-round design) with the aim of assessing under which parameters farmers are interested in weekly payments. In addition, we aimed to create exogenous variation in the take-up of weekly payments in order to be able to assess the impacts of weekly payments on the quantity of milk that farmers deliver to the cooperative. However, as we will show, the demand for weekly payments was very limited, irrespective of the milk price for early payments or the duration of the offer. We therefore simplified the second-round design, and included the allocation of a gift in order to assess whether the strong preference for deferred payments observed in the first round generalizes to other, less regular, income types.

2.3 Procedures

Appendix table A2 provides a study timeline. The study was carefully designed to ensure that participants were well informed about the decisions they were asked to make and that they trusted Metkei to make the payments according to their allocation. In November-December 2015, prior to the intervention, the study team, together with Metkei staff, organized sensitization sessions to inform participants about the upcoming choices, to raise awareness, and to build trust. The team further distributed flyers at the milk collection points and via the transporters, followed by the first-round interview. In addition to the first-round milk payment allocations described above, we collected data on demographic and socioeconomic characteristics as well as milk production, practices, and spending. We also elicited incentivized measures of risk aversion using a Binswanger lottery. The study coordinator paid earnings from this lottery via mobile money on the first Friday after the interview.

(2016) could be due to the short duration of their experiment (in the main experiment, farmers could receive early payments for a duration of a week, and in a robustness check, this was a month). We feared that participants would have informal contracts with buyers in the local market to deliver their milk to these buyers, so that providing liquidity through the cooperative could reduce side-selling only if the cooperative would offer early payments for a long enough period.

[7] Appendix table A1 describes all income allocation options presented to the participants during the first and second rounds. In the first round, we implemented every choice with some probability in order to incentivize participants to state their preferences truthfully. We randomly assigned half of the participants to the first scenario, in which they made choices for each of the next four two-week periods (an eight-week offer), and the remaining half to the two-week scenario. For the prices, we assigned 98 percent of the participants to the same-price scenario and 1 percent each to the higher- and lower-price scenarios.

In February–March 2016, we visited the same participants for the second interview. In that interview, participants were presented with two allocation tasks—the allocation of payments for milk delivered in the subsequent four weeks and the gift for participating in the survey—between an earlier and a later payment date. Participants made separate decisions regarding milk payments for each of the subsequent four weeks. All choices were recorded on a sheet of paper, which the participants kept as a reminder of what they had chosen and earned during the survey period. Both allocation tasks were preceded with detailed instructions and test questions to make sure participants had understood the setup, including the fact that there would be no additional cost for receiving the weekly payments. The gift allocation was introduced as a reward for participation, but only at the end of the survey, and after an intentional break with survey questions.

During the eight and four weeks after the first- and second-round interviews, respectively, participants received their weekly payments if they had allocated milk payments to the earlier payment date. In order to implement their preferences, we retrieved the quantity of milk delivered since the previous Friday from the administrative database on Thursday evenings. We matched these deliveries with participants' selected milk payment allocations, calculated the weekly payment to be made, and sent a list of payments to be made to the person responsible for payouts at Metkei. She made the payments on Friday mornings. The study coordinator directly sent gift payments via mobile money on the assigned dates.

3 Study context

3.1 Sampling and attrition

We sampled study participants using the following procedures. First, from all farmers to whom Metkei made a payment in September 2015, we omitted the 2 percent who delivered, on average, more than 25 kilograms of milk per day. This group included a few larger farmers who collect milk from other farmers under their own supplier number, and who should therefore be omitted from the sampling frame, as well as large farmers to whom Metkei was not ready to offer weekly payments because they were not expected to be as cash constrained as smaller farmers. For logistical reasons, we then selected all farmers who self-delivered to one of the collection points, and all farmers who delivered through one of the three largest transporters.[8] This procedure left us with a sampling

[8] In this way, we could focus on a confined geographic area and allow enumerators to follow the transporters on their route, which simplified survey logistics.

frame of 533 farmers.

Initially, we planned to randomly select 240 farmers from the set of 313 farmers who self-delivered to Metkei in September 2015, and another 120 farmers from the 220 who delivered via a transporter, both stratified by whether the total quantity of milk delivered to Metkei was above or below the median. The remaining farmers would be kept as replacements. However, once we started the interviews with self-delivery farmers, it turned out to be very challenging to find many of these farmers, because Metkei did not always have addresses or up-to-date phone numbers. In order to still include 360 households in the study, we decided to conduct interviews with all farmers we could locate from the 533 farmers in the sampling frame. We worked with milk transporters and staff at the Metkei collection centers to locate as many dairy farmers as possible. The enumerators were able to conduct first interviews with 64 percent of the self-deliverers and 74 percent of the transporter deliverers in the sampling frame. In total, they conducted first interviews in 363 households.

The study interviewed households twice. In the first round in November-December 2015, it targeted the person responsible for the decision of where to sell milk. If a different person was selling the afternoon milk and stated interest in delivering this milk to Metkei, we conducted an interview with that person as well. During the first round of interviews, there were only 11 such afternoon suppliers, resulting in a sample of 374 first-round participants. In the second round in February-March 2016, enumerators were able to interview 90 percent of first-round participants. They also interviewed an additional 28 suppliers from the same households who had not been included in the first round, for instance because they were not interested in delivering their milk to Metkei. As a result, the second round included 355 participants.

Appendix table A3 summarizes response rates and attrition in both rounds. We were able to interview 338 participants (90.4 percent) of the 374 subjects identified during the first round. Attrition was hence limited. We also find that it cannot account for our main results: first-round participants who agreed to be re-surveyed during the second round made, on average, similar allocations as first-round participants who were not re-surveyed during the second round, and in analyses that include both first- and second-round allocations, findings are robust to the exclusion of participants who were not surveyed in both rounds.[9]

[9] Findings are available upon request.

3.2 Participant Characteristics

Table 1 describes participant characteristics. Panel A provides demographic characteristics for all study participants included in the analyses.[10] Panels B and C summarize time-varying characteristics during the first and second round, respectively. Columns (1) and (2) present statistics for all participants in a given round. Columns (3) and (4) provide summary statistics for the sample of 327 suppliers who participated in both rounds. Column (5) tests for statistically significant differences between the full sample and the balanced panel included in both rounds.

The average participant was 45 years old and had around 14 years of experience with dairy farming. Fewer than half of the participants were women. Because only the second round includes additional household members–predominantly female–who sold their milk outside Metkei, the share of women is lower in the sample of participants interviewed in both rounds than in the full sample ($p < 0.10$).[11] Nearly 80 percent of participants had completed primary school but less than half has completed secondary school. For the vast majority, dairy farming was the main daily activity and the main source of income, often along with crop farming.

During the first round, a few participants (18 percent) reported delivering afternoon milk to Metkei. Participants had on average fewer than three lactating cows and produced around 13 kilograms of milk on the day prior to the interview. They reported using this milk mainly for home consumption (48 percent), or supplying it to Metkei (46 percent). Participants reported selling only a small share of their milk (5 percent) to other buyers. This is much lower than in (Geng, Kramer, and Janssens, 2017), potentially due to underreporting of side-selling. Indeed, based on administrative data from Metkei on suppliers' daily deliveries, farmers delivered only 36 percent of their self-reported production to Metkei on the day prior to the interview. Thus, if farmers reported unbiased consumption figures, they must have overstated the share delivered to Metkei by about 10 percentage points. Metkei offered on average KSh 33.7 per kilogram of milk, net of milk transportation costs. This was KSh 1.7 higher compared to milk prices in the local market.[12]

From the first to the second round, we observe a reduction in the proportion of participants

[10] We excluded six first-round and four second-round participants from the analyses for reasons outlined in Appendix table A3, including one participant without milk production due to her cows being dry, four participants who did no longer supply to Metkei at the time of the interview, four participants who could not make a decision, and one participant who was mistaken for someone else.

[11] In Kenya as well as other parts of eastern Africa, dairy farming is traditionally a female income-generating activity, but men have become increasingly involved as dairy farming has become more commercialized. Our share of female farmers was relatively low compared with the samples of other studies because we targeted the participants in the household who were in charge of making decisions about milk income, not necessarily those spending most time on activities related to dairy farming.

[12] This price gap is larger when prices are figured without deducting transportation costs. Transportation costs for milk delivered to Metkei are on average higher than the transportation costs for milk sold in the local market.

who reported selling their afternoon milk to Metkei, especially among the balanced sample that participated in both rounds. The number of lactating cows and amount of milk produced did not change substantially. Self-reported side-selling was higher in the second-round sample than in the first-round sample. This is a composition effect; it was reported more frequently among household members added in the second round than among those included already in the first round. Nevertheless, the quantity of milk delivered to the cooperative increased between the two rounds due to a reduction in milk consumption. In December, many households have children at home. In the months afterward, these children go back to (boarding) school, resulting in substantially lower milk consumption. In addition, during the second round, Metkei was no longer offering a higher price; on average, participants reported receiving about a KSh 3 (11 percent) higher milk price when selling their milk outside of the cooperative.

3.3 Reasons for selling to Metkei

One explanation for why farmers sell to Metkei, despite opportunities to receive a higher price for milk sold in the local market (at least during the second round), is that Metkei provides other valuable services. Appendix table A4 shows that almost all farmers who reported that they could also sell their milk to neighbors or traders stated that only Metkei accepts their milk throughout the year and in any quantity, whereas the alternative buyer does not. This was however rarely the main reason for selling milk to Metkei. Moreover, farmers can purchase veterinary services, animal feed, fertilizers, and other inputs from Metkei. They can choose to pay for these services in kind, meaning that costs are deducted from the next milk payment. There are no charges for taking out these in-kind advances. Prior to our study, 43 percent of participants planned to use their milk account for such services in the next eight weeks (see Appendix table A5). Few farmers, however, reported the possibility of in-kind payment for extension and training services or inputs at lower prices as the main reason for delivering their milk to Metkei (see Appendix table A4).

Metkei also provides farmers with a means to save money. This is seen as a valuable service: 90 percent of dairy farmers who stated that they could also sell their milk to neighbors or traders reported that Metkei can be trusted more to save money for later, and this was the most important reason for selling their milk to Metkei for 42 percent of them (see Appendix table A4). In providing this service, Metkei acts as a commitment savings device. The question, however, is whether there is a downside to this ex-ante commitment. Farmers can take out cash advances, but need to pay high fees for this service. Nonetheless, 20 percent of participants reported having taken advances during the eight weeks prior to the second round interview, mostly to pay for school fees and health

expenditures or emergencies (see Appendix table A5). More than half said they needed this money urgently and could not have obtained it elsewhere. Hence, although some farmers can side-sell to neighbors and traders, the demand for liquidity from the cooperative is high.[13]

4 Results

4.1 Intertemporal Allocations of Milk and Gift Payments

Participants allocated both their milk payments and a gift between an earlier and a later payment date. The most straightforward way of comparing the two types of income allocations is to summarize choices in terms of the share of the total payment under consideration (the "budget") that is allocated to the early payment date. Two first-round participants and one second-round participant allocated more than 50 percent of their expected milk production to the early payment date, although their budget was 50 percent of expected milk production. For ease of presentation, we censor their share of income allocated to the early payment date such that this share cannot take on values greater than one, but results are robust to using the noncensored share. For the gift, the budget to be allocated between the two dates is KSh 250.

Figure 2 presents the distribution of intertemporal allocations in the second round separately for all four milk income allocations (in gray) and for the gift income allocation (in white). It shows a stark difference between the allocations of milk payments and of the gift. When allocating milk income, most participants chose to defer the receipt of the entire milk payment to the regular, later payment date, allocating none to the early payment date. In contrast, a large majority of participants chose to receive the entire gift on the early payment date. Only very few allocations fell in the interior of the distribution, where some but not all money was allocated to the early payment date.

Figure 2 treats every choice as one observation, meaning that for every participant, the figure includes four milk payment allocations: one for each week in the four-week period following the interview. Table 2 instead summarizes the choices at the participant level, showing that 93 percent of all participants selected no weekly milk payment, whereas only 7 percent chose not to receive any gift income "early". At the same time, less than 1 percent chose to receive the maximum possible milk payment early in every week as opposed to 83 percent who chose to receive the entire gift on the early payment date. Conditional on choosing to receive payments on both the

[13] For farmers who reported neighbors, traders or hawkers as their main alternative buyer, only 44 percent of advance-takers needed money urgently and could not have gotten it elsewhere, as compared to 59 percent of advance-takers who reported another cooperative–also deferring payments–as their main alternative buyer.

early and the later date (7 percent for allocations of milk payments and 10 percent for allocations of the gift), participants split the budget equally between the two dates, independent of the income type. Finally, the correlation between both choices is very small and statistically insignificant. Participants deferring their milk payments are not more likely to also defer their gift.

Table 3 assesses the robustness of the design of the two experimental tasks. Treating every choice as one observation, the table regresses the share allocated to the early date on a binary indicator for allocations of milk payments (using gift allocations as a base), controlling for other choice attributes. Standard errors are clustered by participant. Columns (1)–(4) focus on second-round allocations only. Columns (5) and (6) include both first-round and second-round allocations. Odd-numbered columns display the results of regressing the share of a budget allocated to the early payment date on a binary variable indicating milk payments and other controls as shown in the table. Even-numbered columns estimate the same model including respondent fixed effects.[14]

Columns (1) and (2) show that participants allocated on average 85 percentage points less of their milk budget than of their gift to the earlier payment date. Columns (3)–(4) test to what extent differences in front-end delays, or a magnitude effect (Frederick, Loewenstein, and O'Donoghue, 2002; Andersen et al., 2013), can account for the stark differences between the intertemporal allocations of milk payments and the gift. Columns (5) and (6) add first-round allocations of milk payments, for which we have variation in the milk price for weekly payments (that is, a return on waiting) and in the duration of the offer (that is, whether participants made an allocation only once or for several periods). The low demand for early milk payments cannot be explained by front-end delays or the delay between the two payment dates. Moreover, we do not find evidence of a magnitude effect since the share of the milk budget allocated to the earlier payment date does not depend on the milk budget size.[15]. Demand increased when participants received KSh 2 extra per kilogram of milk paid early, but even then most participants rejected the early payment option.[16]

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[14]Because participants made intertemporal allocations of both milk payments and the gift, the main variable of interest, "milk payment," is balanced across participants, and we do not need to control for respondent characteristics such as age, gender, or relationship to the household head. In order to improve precision, the even-numbered columns nonetheless control for respondent fixed effects.

[15]The effect of front-end delays does not differ for gift versus milk payment allocations. We convert the size of the gift into kilograms of milk using the median net milk price reported by farmers. Since there is no variation in the size of the gift, and since we include a dummy for the allocation type, the coefficient on the budget size is identified using variation across milk budget sizes in the different weeks for which a participant made an allocation. In order to test for the potential existence of a relative magnitude effect, we also regressed the share of the gift allocated to the early payment date on the average milk budget size. The coefficient was small and statistically insignificant, suggesting that the size of the gift relative to a participant's milk budget did not influence the results

[16]Many participants chose a corner allocation, that is, to allocate their entire budget to either the early or the later payment date but not to both. We therefore also estimate a logit model for binary dependent variables in Appendix table A6, coding choices as binary variables. In Columns (1)–(3), the dependent variable takes a value of 1 if at least part of the budget is allocated to the early payment date. In Columns (4)–(6), it takes a value of 1 if the entire budget is allocated to the early date. The estimated difference between the two allocation types remains large and significant in all specifications.

One possible concern is that the available "milk budget" can differ from the marketable milk budget because households consume a significant share of the milk, or because they plan on selling their milk outside Metkei. Because we define the milk budget as 50 percent of expected production instead of the expected quantity of milk sold to Metkei, we may overstate the milk budget and hence understate the share of milk income that is allocated to early payments. Therefore, table 3 also controls for the self-reported share of milk production consumed on the day prior to the interview. This variable is unrelated to the share of income allocated to the early payment date. Calculating the share of income allocated to the early payment date using the actual quantity of milk that a participant delivers to the cooperative (measured by the cooperative in preparation for making the monthly milk payments) does not affect our results either (see Appendix table A7).

Another concern is that the allocations are influenced by order effects. We informed participants about the gift, and elicited the gift allocation, only at the end of the interview, with an intentional break of survey questions between the two allocation types. Thus, milk payments will not have been influenced by the gift allocation. At the same time, participants may have allocated the gift to the earlier payment date because they had already deferred their milk payment. If payments from the two income sources are indeed treated as substitutes, we should observe a negative correlation between the share of the gift and the average share of milk payments allocated to the earlier payment date. This is however not what we find: In table 2, there is no correlation between these two variables, indicating that the two income sources are not treated as perfect substitutes for one another, and that order effects are unlikely to explain our results.[17]

In summary, participants allocated regular payments very differently than the way they allocated an irregular gift. Most of them prefered to receive the entire gift on the early payment date but allocated their entire milk payment to the later date. The allocations of the gift conform with standard economic predictions for discounters of future income, for whom it is desirable to receive the income as soon as possible.[18] However, when it comes to regular milk payments, the vast majority of participants defer this payment. We cannot attribute this finding to differences in front-end delays, the magnitude the of experimental stakes, or our definition of the available milk budget; and also order effects are an unlikely explanation. Further, the demand for early milk payments is relatively insensitive to changing the return on deferred payments.

[17] We find a statistically insignificant correlation ($\rho = 0.09$, $p = 0.44$) even when restricting the sample to participants whose late payment date for the gift fell on the eleventh of the next month (i.e. the same date as the next milk payment).

[18] Given that we did not measure whether participants spent their gift immediately or set (some of) the payment aside, we do not claim to measure discount rates over consumption.

4.2 Trust and transaction costs

4.2.1 Allocations of milk payments

Table 4 presents self-reported reasons for never selecting the weekly milk payments. Among participants who never selected a weekly payment in the second round, nearly all–95 percent–indicated a preference for setting their milk payments aside for lump-sum expenditures or emergencies, instead of facing the temptation to spend the money on something else. This is the most important reason for 78 percent of the participants. Participants thereby express a demand for commitment savings. Alternative explanations, in particular the high transaction costs of receiving an extra payment ("amount too small"), having to share early payments with others, and worries that the early payments could harm the cooperative, are indicated as *a* reason by some participants, but rarely the *main* reason.

A lack of trust in receiving the early payments was never mentioned as a reason for rejecting the early payments, let alone as the main reason for doing so. The study was indeed carefully designed to that ensure participants trusted Metkei to make the early payment. Metkei made both milk payments, not only the regular (later) payments; endorsed the study to the participants; and enjoyed high trust from participants.[19] Further, the few participants who opted to receive early payments in the first round had received these payments, improving their trust in implementation, and potentially the trust of their neighbors witnessing these payments.

We also took care to limit transaction costs associated with receiving early milk payments. Because weekly payments may be perceived as necessitating additional travel to the collection point, we offered participants the option to receive their weekly payments directly via mobile money at no extra charge, and 60 percent chose the mobile payment. Despite that option, participants did not opt for weekly payments even in the higher-price scenario, which provided some compensation for potential withdrawal fees (see table 3). Moreover, self-deliverers who lived near the collection points could pick up their weekly payment at no additional cost when delivering their milk, but even they were not significantly more likely to select weekly payments (see Appendix table A8, which estimates the share of income allocated to the early date, disaggregated by means of delivery: via a transporter or self-delivery).

A few participants (9.4 percent) expressed a worry that the early payments might harm the cooperative and hence future prices. Only 0.3 percent of participants reported this as the main reason

[19] During the first-round survey, the Metkei cooperative received an average of 8.2 on a 10-point scale with 1 as the lowest and 10 the highest possible trust. The main alternative buyer for participants' milk received a 5.0 on average.

for not taking early payments. Participants' distrust, or a preference to comply with cooperative rules, may have been stronger in the first round, since they had not yet seen the cooperative committing to early payments at that time. However, controlling for expected milk production, first-round demand for early milk payments was 3.8 percentage points higher than that in the second round (see table 3). These findings provide further indication that distrust, a preference for complying with cooperative rules, and transaction costs do not explain the strong demand for deferred payments, thereby corroborating farmers' self-reported reasons for rejecting early payments.

4.2.2 Allocations of the gift

Next, we will argue against the hypothesis that the share of the gift allocated to the early payment date was high due to distrust or transaction costs. A first concern could be that participants may prefer receiving the full gift on the early date in order to receive a payment only once. Because participants received a payment of KSh 65 (about US$0.65) at both the early and the later date, regardless of their allocation of the KSh 250 budget over both dates, transaction costs were equal for the two payment dates, and there was no penalty for being paid on both dates. If motives related to transaction costs rather than discounting were driving the gift allocations, participants should have been indifferent between allocating all income to either the early or the later date. Hence, allocations to the later payment date should have been equally as likely as allocations to the early payment date. Nonetheless, only 6.8 percent chose to receive the entire gift on the later date (see table 2), suggesting that payments on the later date were discounted. Thus, high demand for milk payments is not because people are generally very patient, independent of the income type.

Another concern could be that participants trusted the experimenter to pay the gift only on the earlier date, not on the later date. This is a concern mainly in experiments that make the earlier payment during the interview itself, which participants will perceive as a guaranteed or more reliable payment, while the later payment involves the experimenter coming back at a later date, which participants may feel is not guaranteed to happen. In our experiment, the sooner payment was made a few days after the interview. This front-end delay makes trust less of a concern (Chabris, Laibson, and Schuldt, 2010).[20] Moreover, 90 percent of participants had received a payout from a Binswanger-type lottery after the first-round interview, thus having seen the experimenters keep their promises.[21] We conclude that the preference for early payments in gift allocations cannot be

[20] It could still be that trust depends on the time horizon, for instance if the late payment date is after the end of the main study period and participants worry that they then have less clout to enforce the gift payment. However, both proposed gift payment dates were within the four-week period for which the participants made milk payment choices, and farmers knew how to contact us if they did not receive an expected payment.

[21] These payoffs ranged between KSh 125 and KSh 950 (about $1.25 to $9.50) and were sent via M-Pesa, in the same way we sent the second-

explained by participants being concerned that they would receive the gift only when allocated to the earlier date.

4.3 Mechanisms related to the regularity of milk payments

The milk payments are a regular type of income, whereas the windfall (gift) is an irregular income type, that is, a one-time compensation for participating in the survey. This section will discuss four mechanisms to explain the non-fungibility of irregular versus regular income in intertemporal choice: timing of lump-sum expenditures, income accounting, reference-dependent preferences, and income visibility.

4.3.1 Timing of bulky expenditures

First, it is likely that participants have arranged their finances so that bulky expenditures occur in the days after the eleventh of a month, which is when they will have more cash on hand due to the timing of their regular milk payment. Participants may prefer saving their milk payments until that point in time because they need the money to pay for planned expenditures around the eleventh of the month. Deferred gift payments cannot be used in the same way as they do not always occur around the eleventh of the month.

To explore this mechanism, we first analyze when farmers plan to spend money on large and predictable expenditures that occur at most once a month. Participants reported during the survey for each of the four weeks following the second round whether they were expecting any large expenditures in that week. In Appendix table A9, we regress this variable—measured at the participant-week level—on a dummy variable for whether that week includes the eleventh of the month. Column (1) shows that participants who planned any bulky expenditures were 13.8 percentage points more likely to expect such spending around the eleventh of the month ($p < 0.01$). This was driven by bulky agricultural expenditures, which were reported most frequently; the second- and third- most frequently reported expenditure categories, dairy farming investments and school fees, were not significantly more likely to be planned around that time.[22]

Moreover, Table 6 Column (1) confirms that the choice gap is not significantly different for participants who expected a bulky expenditure in the week with the eleventh of the next month in

round gift.

[22] Agricultural expenditures constitute 55.4 percent of total expected expenditures. Participants who expected bulky agricultural expenditures in the four weeks following the second-round interview on average reported that 32.7 percent of these expenditures would fall around the eleventh of the month. Of total expenditures, participants expected to spend on average 28.2 percent in the week with the eleventh of the month.

the second round. In Column (2), the same holds for participants whose expected expenditures in that week exceeded their expected income for that same week. Thus, we do not find a preference for gift payments on the eleventh of the month, and we do not find stronger differences between milk payment and gift allocations among participants who will have larger cash needs around the eleventh of the month.[23]

4.3.2 Income accounting

Regularity also allows farmers to engage in income accounting. Although explicit savings goals for expenditures timed around the regular milk payment do not appear to explain our results, farmers may assign dairy income from the cooperative to a mental account that is designated to save for bulky expenditures such as school fees, agricultural investments, medical expenditures, and emergencies. In contrast, revenues from selling milk or other produce on local markets are assigned to a different mental account, one used for small purchases. In the taxonomy of income accounts proposed by Thaler (1990), the cooperative milk payment is assigned to a "future income account", whereas the gift is assigned to a "current income account". The offer of more frequent milk payments is then perceived as an offer to use funds from the future income account for liquidity purposes–and is therefore rejected, even when a higher price is offered for milk paid early. Conversely, spending rules of the current income account, as well as standard discounting, predict a preference for the early payment option in the gift allocation.

Survey data support the view that farmers engage in income accounting. In the second round, we asked participants how they were planning to spend the income from selling milk on the day before the interview. The first four columns in Appendix table A10 show that most participants had sold their morning milk to the cooperative (313 versus 11 participants), while afternoon milk was sold more often to another buyer (88 versus 23 participants). Dairy income from the cooperative was often used for bulky expenditures such as school fees and agricultural inputs, especially the proceeds from selling *morning* milk, whereas income from other buyers was generally used for

[23] To assess whether the timing of agricultural expenditures may explain the gap between the shares of the gift versus milk payments allocated to the early payment date, we can also use the fact that for 81 participants, the late gift payment was scheduled for the eleventh of March, hence coinciding with the day of a regular milk payment. If there was a preference to receive payments around that time, independent of the source of income, we would expect these participants to allocate a larger share of the gift to the late payment date. We find no evidence of this hypothesis, regardless of whether we compare these allocations with all other gift allocations, or with only those allocations where the *early* payment falls on the 12th of a month, and for which this mechanism would hence suggest opposing preferences for the timing of payment (results available upon request). Note that without uncertainty about future incomes and expenditures, the regular milk income may be just sufficient to meet the specific savings goal for the eleventh of the next month, so that there is no reason to allocate also the gift payment to the late date. However, in our setting it appears unlikely that participants can perfectly predict their future income and expenditures, which is further discussed in Section 4.4 below.

food and other daily expenditures.[24]

To explore these relationships further, table 5 estimates the allocation gap separately for different types of participants. Odd-numbered columns include only second-round allocations. Even-numbered columns also include first-round allocations. Columns (1) and (2) distinguish between those who are planning to use the income from milk delivered to the cooperative for lump-sum expenditures (the reference category) versus food and other small purchases. Controlling for gift allocations, the latter category of participants is more likely to choose early milk payments, suggesting a stronger demand for liquidity. Columns (3) and (4) show that the same applies to participants who deliver afternoon milk to Metkei, which is typically used for smaller and more frequent purchases such as food (see Appendix table A10).

These findings, along with the stated income uses, suggest that farmers treat their milk income differently depending on whether it is from the cooperative or another buyer, whether it is morning or afternoon milk, and whether it is commonly used to pay for daily expenditures. Hence, findings support the view that participants engage in income accounting.

4.3.3 Reference dependence

Another reason for why regularity may matter is reference dependence. In theory, when reference points are based on expectations held before consumption, the marginal propensity to consume out of windfall gains (for instance an irregular gift for participating in a survey) is higher than the propensity to consume out of anticipated income (the milk payment in our case) (Kőszegi and Rabin, 2009). Because the participants were already expecting milk payments on the eleventh of the next month, a reallocation would result in lower future consumption than expected, creating a utility loss in the future. A loss-averse participant will weigh this utility loss more heavily than the corresponding utility gain from consuming more in the present, inducing the participant to maintain the status quo and reject the weekly milk payments. This is related to the idea of a status quo bias driven by loss aversion (Kahneman, Knetsch, and Thaler, 1991).

Although we cannot formally rule out that our findings are driven by reference dependence, the self-reported reasons for rejecting weekly payments suggest that farmers value deferred milk payments because they help with saving for bulky expenditures such as school fees or agricultural spending. Such expenditures can be best thought of as durables or investments that do not directly generate consumption utility; the benefit from such investments are consumed throughout a longer

[24] This pattern holds true even for the 15 participants who had delivered both morning and afternoon milk to the cooperative on the day before the interview: Although these participants were not going to be able to actually distinguish between incomes from morning and afternoon milk upon receipt of their cooperative milk payment on the eleventh of the next month, they were planning to spend them differently.

period of time. It is not clear to what extent reference-dependent consumption utility could drive preferences to save for those types of expenditures.

Moreover, in the first round, we created unanticipated changes in milk payments by offering in one of our treatments 2 KSh more per liter of milk for which the farmer had requested an earlier payment. Reference-dependent farmers should have reacted to this surprise income shock in their milk payment allocations. However, we find a low elasticity of allocations with respect to changes in the milk price (see table 3), suggesting that expectations-based reference points may not be as relevant as income accounting in our setting.[25]

4.3.4 Visibility of income

Finally, regularity may matter due to the visibility of such income to others, for instance one's husband, who may be tempted to spend the money. A dairy farmer may not want to get some of the milk money paid at the end of the week out of concern that her husband may take it and spend it; by deferring the payment, she will not have to worry about her husband spending the money because it is locked away with the cooperative. Conversely, she can hide irregular income, such as the experimental gift, and keep it with her for an emergency, because her husband will not know she received the money. In our context, we would expect this effect to be strongest for women because in the local Kalenjin culture, men are traditionally perceived to be in charge household finances. For similar reasons, we would expect the gap to be smaller among self-identified household heads.

Columns (5) and (6) of table 5 therefore assess whether the choice gap is larger for female than for male dairy farmers. Women are not significantly *less* likely to select an early milk versus an early gift payment. Conversely, Columns (7) and (8) show that self-identified household heads are not significantly *more* likely to select weekly payments.[26] To further complement these findings, note that having to share weekly payments with family or friends was the *main* reason for rejecting payments for only 3.6 percent of participants.

In summary, we explored to what extent the existence of planned lump-sum expenditures, income accounting, reference dependence and the visibility of income to others could explain why allocations of regular income tend to be more patient than allocations of windfall payments. Our analyses suggest that in our setting, the observed differences between intertemporal allocations cannot be accounted for by planned expenditures, reference dependence or intra-household bargaining

[25] It is worth noting that this elasticity may also have been low because these changes in milk price did not induce substantial variation in prospective milk income. Casaburi and Macchiavello (2016) offered a larger increase in the daily price of milk (16 percent, as compared with our 7 percent increase in the weekly price) and also found their offer rejected by a large majority of farmers.

[26] Also women who were not household heads were not significantly less likely to select weekly payments (results available upon request).

motives alone.

Rather, our findings are consistent with the view that dairy farmers apply different mental accounts to different sources of income. Income from morning milk delivered to the cooperative is earmarked for lump-sum expenditures, whereas income from milk sold to buyers in the local market, as well as irregular windfalls, is spent on smaller but more frequent expenditures. Combined, the experimental and survey evidence suggest that income accounting, in conjunction with deferred milk payments helping savings-constrained farmers to save for bulky expenditures, is most likely to explain our findings.

4.4 Weekly payments versus advances

This final section explores the implications for the design of informal contracts in agricultural value chains, and in particular, whether our findings imply that aggregators should always defer payments. We were surprised by the low demand for weekly milk payments, given the high demand ex ante for costly advances described in Section 3.3. Partly, this may be because participants can cover at least small liquidity needs by side-selling milk to neighbors or traders; but it could also be that farmers could not predict their liquidity needs at the time of the experiment, and did not want to commit to receiving the payments early.

Consistent with the former conjecture, Columns (9) and (10) of table 5 show that controlling for choices regarding the windfall, the demand for weekly milk payments was lower for participants who stated that they had sold their milk to buyers outside Metkei in the first or second round. These participants appear to have access to neighbors or traders who pay cash upon delivery, and they should hence be able to cover small liquidity needs by side-selling. These may be the farmers who turn to Metkei mostly to satisfy their demand for commitment savings. This finding suggests that in a setting with fewer side-selling opportunities, the demand for more frequent payments by the cooperative would likely be greater.

But the main distinction between weekly payments and the more popular advances in the eyes of the participants is the lack of flexibility of the former. Table A5 shows that 22 percent of participants who rejected weekly payments expected to take advances within the next four weeks. More than 85 percent of them said they preferred this way of receiving liquidity because the decision to take an advance could be made spontaneously, or because the advance payment could be received on any day of the week. Hence, participants value advances as an insurance against unexpected liquidity demands. By contrast, weekly milk payment do not provide this service, and are moreover perceived as putting at risk the respondent's savings goals.

Even for advances, participants' views are nuanced. On one hand, 87 percent stated they would be better off if advances were available at a lower fee and 39 percent state they would side-sell milk in case of an emergency if advances were not available. On the other hand, less than half of participants thought it would be better for them if advances were available already in the first two weeks of a month, and only 27 percent reported that they would benefit if advances could be taken against all milk delivered to Metkei (instead of allowing advances for up to 50 percent) in a month (table A5). A sizeable minority of 24 percent even stated that they would be better off without the possibility of taking advances, and 11 percent indicated they would like the advances to be *more* expensive.

Summarizing, although we find limited heterogeneity in farmers' demand for the weekly milk payments, we find more heterogeneity in the demand for advances. These advances can help farmers meet their liquidity demands if they arise, without having to commit to taking out early milk payments even if farmers do not experience urgent cash needs. Advances are hence preferred over weekly payments, but there is substantial heterogeneity in the extent to which farmers prefer advances being more accessible—making them more flexible, but weaker as a commitment savings device–versus less accessible, with higher fees or eliminating advances altogether–so that advances become a strong commitment savings device.

5 Conclusion

We find that dairy farmers of a Kenyan cooperative preferred to defer their milk payments but chose to receive an experimental gift at the earlier of two possible payment dates. Potential confounding factors such as differences in stakes, front-end delays, trust, and transaction costs do not seem to account for this discrepancy. Our results are consistent with both the experimental literature, which generally finds a preference for early over late receipts of windfalls (compare Frederick, Loewenstein, and O'Donoghue, 2002), and with field evidence revealing lower discount rates for more regular income types and a demand for commitment savings or deferred payments (Ashraf, Karlan, and Yin, 2006; Bryan, Karlan, and Nelson, 2010; Casaburi and Macchiavello, 2016).

Our findings are not an artifact of the cooperative we chose to work with. In a comparable study in a different part of Kenya, 83 of 96 dairy farmers (86 percent) declined the offer to be paid for their milk upon delivery (Casaburi and Macchiavello, 2016), mirroring our 93 percent of second-round participants who never chose weekly payments. Moreover, 73 percent of those farmers referred to self-control problems or the need to achieve savings targets as motivating their decisions, comparable to our 78 percent. In both studies, farmers appeared to use the deferred milk

payments as a commitment device to overcome their limited access to sound savings instruments. However, we show that this finding is income source-dependent as we are unable to replicate it for allocations of an experimental gift. This supports the conclusion by Cohen et al. (2016) that intertemporal choice over regular income does not always reflect domain-general time preferences.

We propose the timing of lump-sum expenditures, income accounting, reference dependence and income visibility as four mechanisms through which the regularity of the income may matter for intertemporal choice. Although our experiment does not allow us to distinguish clearly between these mechanisms, survey evidence and heterogeneity in milk income allocations suggest that farmers assign milk income from the cooperative, but not gift income, to a mental savings account for bulky expenditures. An area for future research would be to further distentangle the origins of non-fungibility in intertemporal choice, and to investigate whether it occurs due to other mechanisms than those highlighted in the present study in other settings. Another open question is whether farmers with a stronger demand for commitment savings select into informal contracts that defer payments.

These findings have implications for the design of informal contracts between farmers and aggregators in agricultural value chains such as cooperatives, producer groups and contract farming arrangements. Farmers may value deferred payments from trustworthy institutions. In such contexts, aggregators should abstain from making more frequent payments the default, irrespective of whether discount rates elicited using experimenter money would suggest otherwise. We do, however, observe a strong demand for advance payments along with the low demand for early and more frequent payments. Instead of paying early, aggregators may want to provide more flexibility in the form of advance payments, which can be accessed if farmers need the money *ex post*, without having to commit to these payments *ex ante*.

Our results suggest that the optimal informal contract in such a setting needs to strike a delicate balance between providing sufficient liquidity to farmers in case of need, without depriving farmers of the ability to commit their income to saving for bulky expenditures. This is consistent with recent empirical work, which finds greater impacts of soft commitment savings devices with flexible rules compared to impacts of more binding alternatives (Dupas and Robinson, 2013; Karlan and Linden, 2017). Aligning the conditions of informal contracts with farmers' preference for when to be paid could help improve farmers' loyalty to such contracts. This, in turn, could allow aggregators to operate more effectively and realize economies of scale, an important consideration for increasing agricultural incomes and productivity (Ashraf, Giné, and Karlan, 2009; Bellemare, 2012; Verhofstadt and Maertens, 2014; Ma and Abdulai, 2016).

These results, however, also raise the question of how increased financial inclusion will affect

farmers' loyalty toward their aggregators. Macchiavello and Morjaria (2015), studying competition in Rwanda's coffee sector, find that an increase in competition between coffee mills is weakening relational contracts with smallholder producers. In a similar fashion, if producers adherence to informal contracts with aggregators hinges on aggregator trustworthiness to defer payments (and act as savings institutions), then increased access to sound savings instruments outside the agricultural value chain introduces an alternative source of competition for these aggregators. This could potentially weaken the relational contracts between dairy farmers and their cooperatives. An important topic for future research is whether there is indeed such an undesirable side effect of increased financial inclusion.

References

Andersen, S., G. Harrison, M. Lau, and E. Rutstrőm. 2013. "Discounting Behaviour and the Magnitude Effect: Evidence from a Field Experiment in Denmark." *Economica* 80:670–697.

Ashraf, N., X. Giné, and D. Karlan. 2009. "Finding Missing Markets (And a Disturbing Epilogue): Evidence from an Export Crop Adoption and Marketing Intervention in Kenya." *American Journal of Agricultural Economics* 91:973–990.

Ashraf, N., D. Karlan, and W. Yin. 2006. "Tying Odysseus to the Mast: Evidence from a Commitment Savings Product in the Philippines." *Quarterly Journal of Economics* 121:635–672.

Baker, M., S. Nagel, and J. Wurgler. 2007. "The Effect of Dividends on Consumption." *Brookings Papers on Economic Activity* 2007:231–276.

Bellemare, M.F. 2012. "As You Sow, So Shall You Reap: The Welfare Impacts of Contract Farming." *World Development* 40:1418–1434.

Bryan, G., D. Karlan, and S. Nelson. 2010. "Commitment Devices." *Annual Review of Economics* 2:671–698.

Camerer, C., J. Cohen, E. Fehr, P. Glimcher, and D. Laibson. 2015. "Intertemporal Choice and Self-Regulation." In J. Kagel and A. Roth, eds. *The Handbook of Experimental Economics, Vol. 2*. Princeton: Princeton University Press, chap. 3, pp. 177–183.

Casaburi, L., and R. Macchiavello. 2016. "Firm and Market Response to Saving Constraints: Evidence from the Kenyan Dairy Industry." Working paper, CEPR Discussion Paper No. DP10952.

Chabris, C., D. Laibson, and J. Schuldt. 2010. "Intertemporal Choice." In D. S.N. and L. Blume, eds. *Behavioural and Experimental Economics*. London: Palgrave Macmillan, pp. 168–177.

Chuang, Y., and L. Schechter. 2015. "Stability of Experimental and Survey Measures of Risk, Time, and Social Preferences: A Review and some new Results." *Journal of Development Economics* 117:151 – 170.

Cohen, J., K. Ericson, D. Laibson, and J. White. 2016. "Measuring Time Preferences." Working paper, NBER Working Paper No. 22455.

Dean, M., and A. Sautmann. 2016. "Credit Constraints and the Measurement of Time Preferences." Working paper, Unpublished, Department of Economics, Brown University.

Duflo, E., and C. Udry. 2004. "Intrahousehold Resource Allocation in Cote dIvoire: Social Norms, Separate Accounts and Consumption Choices." Working paper, NBER Working Paper No. 10498.

Dupas, P., and J. Robinson. 2013. "Why don't the Poor Save More? Evidence from Health Savings Experiments." *The American Economic Review* 103:1138–1171.

Dupas, P., J. Robinson, and S. Saavedra. 2016. "The Daily Grind: Cash Needs, Labor Supply and Self-Control." Working paper, Unpublished, Stanford University.

Frederick, S., G. Loewenstein, and T. O'Donoghue. 2002. "Time Discounting and Time Preference: A Critical Review." *Journal of Economic Literature* 40:351–401.

Geng, X., B. Kramer, and W. Janssens. 2017. "Liquid Milk: Cash Constraints and Day-to-Day Intertemporal Choice in Financial Diaries." Working paper, IFPRI Discussion Paper 01602.

Halevy, Y. 2015. "Time Consistency: Stationarity and Time Invariance." *Econometrica* 83:335–352.

Hvide, H.K., and J.H. Lee. 2016. "Windfall Gains and Investment Choices." Working paper, Unpublished, University of Bergen.

Janssens, W., B. Kramer, and L. Swart. 2017. "Be Patient when Measuring Hyperbolic Discounting: Stationarity, Time Consistency and Time Invariance in a Field Experiment." *Journal of Development Economics* 126:77–90.

Kahneman, D., J. Knetsch, and R. Thaler. 1991. "Anomalies: The Endowment Effect, Loss Aversion, and Status Quo Bias." *Journal of Economic Perspectives* 5(1):193–206.

Karlan, D., and L. Linden. 2017. "Loose Knots: Strong versus Weak Commitments to Save for Education in Uganda." Working paper, Unpublished, Yale University.

Kooreman, P. 2000. "The Labeling Effect of a Child Benefit System." *American Economic Review* 90:571–583.

Kőszegi, B., and M. Rabin. 2009. "Reference-Dependent Consumption Plans." *The American Economic Review* 99:909–936.

Kramer, B. 2016. "When Expectations Become Aspirations: Reference-Dependent Preferences and Liquidity Constraints." *Economic Theory* 61:685–721.

Ma, W., and A. Abdulai. 2016. "Does Cooperative Membership Improve Household Welfare? Evidence from Apple Farmers in China." *Food Policy* 58:94–102.

Macchiavello, R., and A. Morjaria. 2015. "Competition and Relational Contracts: Evidence from Rwandas Coffee Mills." Working paper, Unpublished, Warwick University.

Meier, S., and C. Sprenger. 2015. "Temporal Stability of Time Preferences." *The Review of Economics and Statistics* 97:273–286.

Minot, N., and B. Sawyer. 2016. "Contract Farming in Developing Countries: Theory, Practice, and Policy Implications." In A. Devaux, M. Torero, J. Donovan, and D. Horton, eds. *Innovation for Inclusive Value-Chain Development: Successes and Challenges*. Washington, D.C.: International Food Policy Research Institute (IFPRI), chap. 4, pp. 127–158.

Muriuki, H. 2011. "Dairy Development in Kenya." Working paper, Food and Agriculutural Organization, Rome.

Reardon, T., C. Barrett, J. Berdegué, and J. Swinnen. 2009. "Agrifood Industry Transformation and Small Farmers in Developing Countries." *World Development* 37:1717–1727.

Souleles, N.S. 1999. "The Response of Household Consumption to Income Tax Refunds." *The American Economic Review* 89:947–958.

Thaler, R. 1990. "Anomalies: Saving, Fungibility, and Mental Accounts." *Journal of Economic Perspectives* 4(1):193–205.

—. 1999. "Mental Accounting Matters." *Journal of Behavioral Decision Making* 12:183–206.

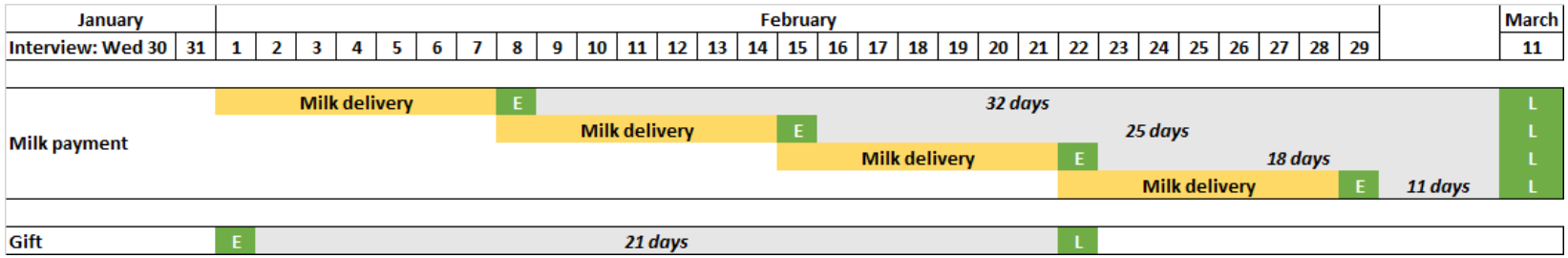
Ubfal, D. 2016. "How General are Time Preferences? Eliciting Good-Specific Discount Rates." *Journal of Development Economics* 118:150–170.

Vargas Hill, R., E. Maruyama, M. Olapade, and M. Frőlich. 2015. "Strengthening Producer Organizations to Increase Market Access of Smallholder Farmers in Uganda." Working paper, Unpublished, International Food Policy Research Institute (IFPRI).

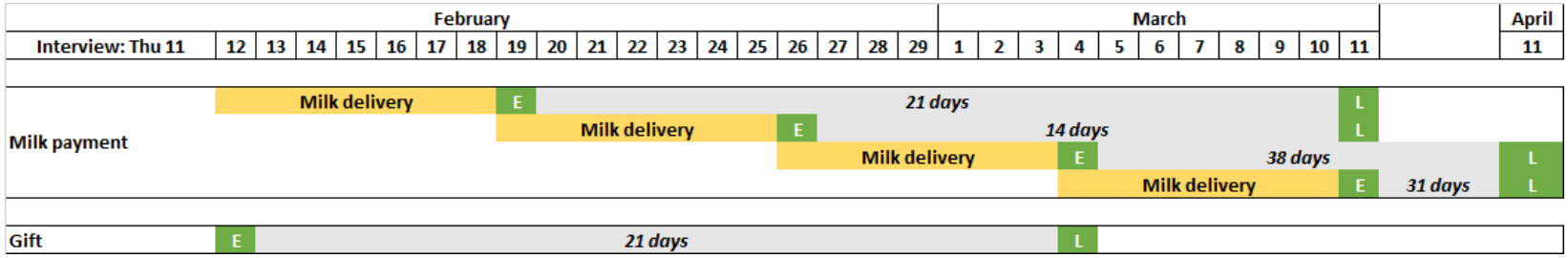
Verhofstadt, E., and M. Maertens. 2014. "Can Agricultural Cooperatives Reduce Poverty? Heterogeneous Impact of Cooperative Membership on Farmers' Welfare in Rwanda." *Applied Economic Perspectives and Policy* 37:86–106.

Villa, K., C. Barrett, and D. Just. 2011. "Differential Nutritional Responses across Various Income Sources Among East African Pastoralists: Intrahousehold Effects, Missing Markets and Mental Accounting." *Journal of African Economies* 20:341–375.

Figure 1: Timeline for experimental tasks



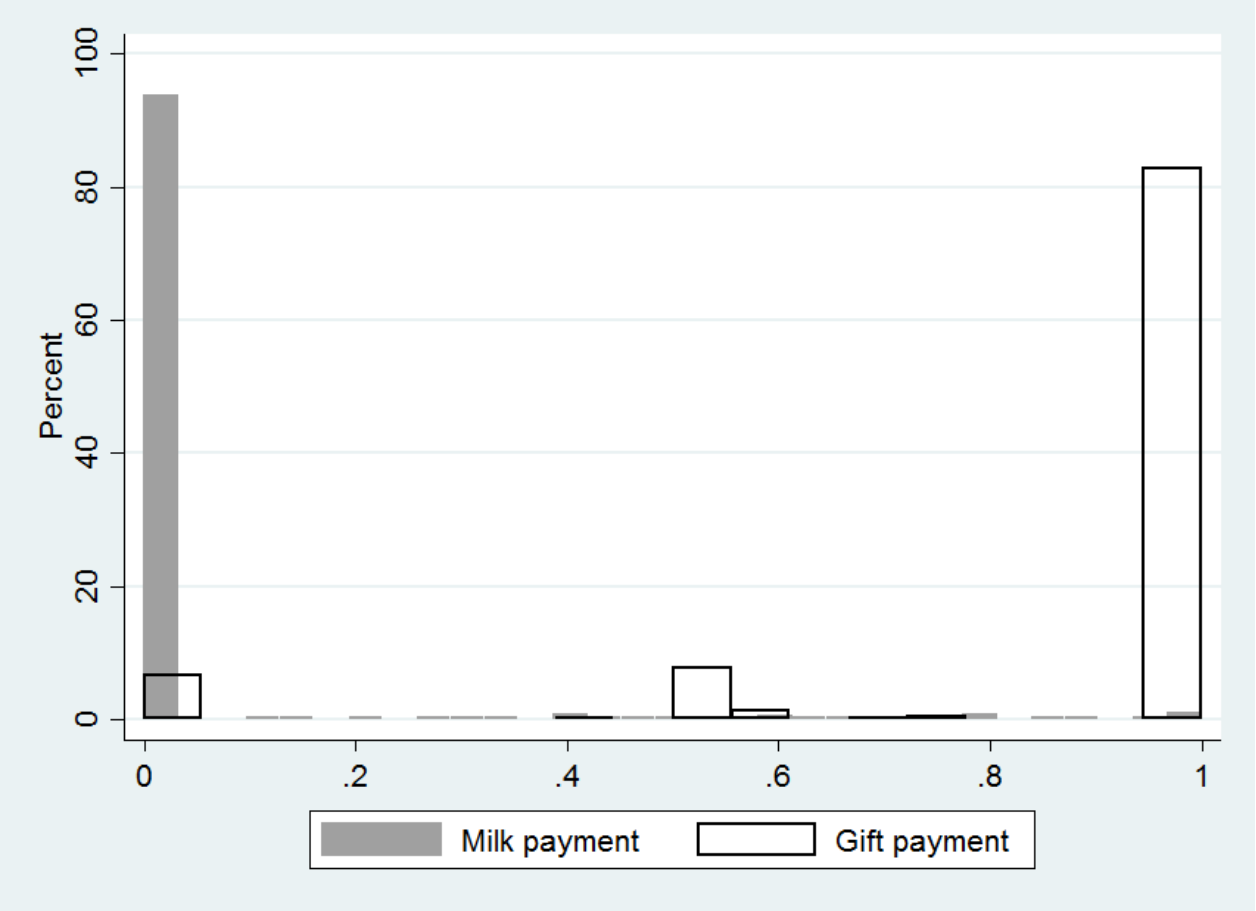
(a) Example for an interview on Wednesday January 30



(b) Example for an interview on Thursday February 11

Notes: On the interview day, the participant allocates payments between an early ('E') and late ('L') payment date. Text in italics indicates the number of days between the early and late payment date. Participants make allocations for in total four milk delivery periods (indicated in yellow) and a gift. Regarding milk payments, the median delay between the two dates is 21 days, with front-end delays (number of days between the interview and the early payment) ranging between 7 and 35 days. Regarding the gift, the delay between the two dates is always 21 days, with a front-end delay between 1 and 7 days. When calculating days between early and late milk payments, we assign weeks according to the majority of days. However, in practice, the later payment date for a given day is the eleventh of the next month, even if the remainder of the week falls in the next month so that the effective deferred payment date is one month later.

Figure 2: Share of payment allocated to the early date



Notes: Histogram of second-round income allocations between an early payment date and a late payment date, treating every choice as one observation ($N = 1,770$). The maximum amount of milk income that a respondent could allocate to the early date in a given week is calculated as 50% of the respondent's expected milk production for that week, unless the respondent is among the few who delivered afternoon milk only to Metkei, in which case we calculate the budget for milk income allocations as 100% of the respondent's expected milk production for that week.

Table 1: Respondent characteristics

	All respondents		**Present both rounds**		**Δ (1)-(3)**
	mean	*s.d.*	*mean*	*s.d.*	*p-value*
	(1)	(2)	(3)	(4)	(5)
Panel A: Demographics					
Age	45.18	13.57	45.78	13.52	0.42
Years of experience in dairy farming	13.82	11.75	14.02	11.80	0.76
Female (%)	46.21		41.59		0.09†
Primary schooling completed (%)	79.34		79.20		0.95
Secondary schooling completed (%)	40.82		40.06		0.78
Dairy farming main income source (%)	81.38		83.49		0.31
Panel B: First round					
Delivers PM milk to Metkei	17.66		16.51		0.58
Number of currently lactating cows	2.52	1.82	2.53	1.81	0.94
Kg milk produced yesterday (survey)	12.77	9.80	13.02	9.64	0.64
- Sold to someone else (%)	4.68	10.18	5.00	10.59	0.59
- Consumed (%)	47.64	24.28	45.67	23.19	0.13
- Survey: Delivered to co-op (%)	45.76	24.54	47.55	23.76	0.18
- Admin. data: Delivered to co-op (%)	36.27	30.51	37.57	30.55	0.44
Net milk price cooperative (KSh)	33.72	2.46	33.64	2.47	0.60
Net milk price other buyer (KSh)	31.97	5.27	31.60	4.45	0.40
Panel C: Second round					
Delivers PM milk to Metkei	13.24		9.79		0.04*
Number of currently lactating cows	2.66	1.79	2.60	1.79	0.53
Kg milk produced yesterday (survey)	13.10	10.16	13.16	10.17	0.90
- Sold to someone else (%)	5.39	11.64	4.35	9.57	0.05*
- Consumed (%)	38.88	20.13	38.85	19.53	0.98
- Survey: Delivered to co-op (%)	53.66	21.00	55.02	19.13	0.20
- Admin. data: Delivered to co-op (%)	42.61	28.92	43.77	28.55	0.46
Net milk price cooperative (KSh)	28.17	2.07	28.18	2.09	0.91
Net milk price other buyer (KSh)	31.37	4.15	31.52	4.34	0.74
Number of first-round respondents	368		327		
Number of second-round respondents	355		327		

Note: KSh = Kenyan shilling. Reported milk prices are averages among those respondents who sold either AM or PM milk to the cooperative or another buyer on the day prior to the interview, net of transport costs. Time-invariant characteristics other than gender are missing for four second round respondents due to a form error. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$.

Table 2: Allocations of milk payments and gifts during the second round

	Percentage (1)
Panel A. Allocations of milk budget between early and late payment date	
Allocates none (zero percent) to early date	92.96
Allocates some but not all to early date	6.48
- *Average percentage allocated to early date*	50.54
Allocates all (one hundred percent) to early date	0.56
Panel B. Allocations of the gift between early and late payment date	
Allocates none (zero percent) to early date	6.76
Allocates some but not all to early date	10.42
- *Average percentage allocated to early date*	53.78
Allocates all (one hundred percent) to early date	82.82
Correlation average share of milk budget and share of gift allocated to early date (ρ)	-0.05
Number of observations	355

Note: Overview of second-round income allocations between an early payment date and a late payment date, treating every respondent as one observation. There are four milk budget allocations and one gift budget allocation per respondent. The maximum amount of milk income that a respondent could allocate to the early date in a given week is calculated as 50% of the respondent's expected milk production for that week, unless the respondent is among the few who delivered afternoon milk only to Metkei, in which case we calculate the budget for milk income allocations as 100% of the respondent's expected milk production for that week.

Table 3: Robustness: Controlling for potential confounds and testing alternative designs

	Dependent variable: Share of budget that participant allocates to the early payment date					
	Round 2 only				*Round 1 and 2*	
	(1)	(2)	(3)	(4)	(5)	(6)
Milk payment	-0.847**	-0.847**	-0.852**	-0.859**	-0.861**	-0.852**
	(0.017)	(0.017)	(0.021)	(0.023)	(0.020)	(0.019)
Budget size (100 kg)			0.024	0.052	0.040	0.014
			(0.026)	(0.056)	(0.036)	(0.025)
Days to early payment/10			-0.003	-0.003	0.002	0.001
			(0.004)	(0.002)	(0.002)	(0.001)
Days between payments/10			-0.010*	-0.010*	-0.002	-0.005*
			(0.004)	(0.004)	(0.004)	(0.002)
Share of milk consumed			0.093	0.084	0.003	-0.030
			(0.064)	(0.093)	(0.026)	(0.026)
Milk payment × First round					0.027†	0.027†
					(0.015)	(0.014)
... × higher price					0.004*	0.004*
					(0.002)	(0.002)
... × lower price					-0.036**	-0.036**
					(0.008)	(0.008)
... × offer for 8 weeks					-0.024	-0.014
					(0.015)	(0.015)
Respondent fixed effects		✓		✓		✓
Observations	1,770	1,770	1,770	1,770	7,185	7,185
Number of respondents	355	355	355	355	396	396
R-squared	0.766	0.862	0.768	0.863	0.530	0.705
Mean share gift allocated to early date	0.884	0.884	0.884	0.884	0.884	0.884

Note: Estimated using ordinary least squares with standard errors (in parentheses) clustered at the participant level. Base for comparison: Share of gift allocated to early payment date. In the specifications with respondent fixed effects, '*R*-squared' indicates the explained variation in allocations *within* respondents. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

Table 4: Reasons for rejecting weekly milk payments in Round 2

	A reason for rejecting early milk payment *Percentage* (1)	**Most important reason for rejecting early milk payment** *Percentage* (2)
Temptation to spend instead of saving	94.85	77.88
Need to share with family or friends	36.67	3.64
Unsure whether enough left for advances	33.94	5.76
Currently no use for the money	21.21	0.91
Amount is too small	21.21	3.33
Bad for cooperative and hence future prices	9.39	0.30
Other	8.18	8.18
Number of observations	330	330

Note: Responses from the 330 second round participants who did not select a weekly payment in any of the four weeks. Most common among the 'other' reasons were references to the use of the regular milk payments in the household budget, with school fees being most frequently mentioned.

Table 5: Heterogeneity in weekly payment choices

	Dependent variable: Share of budget allocated to the early payment date									
	Subgroup: Payment for daily exp. (vs. lump-sum exp.)		Subgroup: p.m. suppliers (vs. a.m. suppliers)		Subgroup: Female suppliers (vs. male suppliers)		Subgroup: Household head (vs. someone else)		Subgroup: Ever sidesold (vs. never sidesold)	
	R2 only (1)	*R1 + R2* (2)	*R2 only* (3)	*R1 + R2* (4)	*R2 only* (5)	*R1 + R2* (6)	*R2 only* (7)	*R1 + R2* (8)	*R2 only* (9)	*R1 + R2* (10)
Milk payment	-0.878**	-0.884**	-0.865**	-0.875**	-0.837**	-0.846**	-0.871**	-0.870**	-0.835**	-0.840**
	(0.022)	(0.021)	(0.021)	(0.021)	(0.028)	(0.026)	(0.039)	(0.041)	(0.026)	(0.024)
Subgroup	-0.071†	-0.072†	-0.037	-0.038	0.023	0.024	-0.037	-0.038	0.058*	0.059*
	(0.038)	(0.039)	(0.038)	(0.038)	(0.030)	(0.030)	(0.038)	(0.038)	(0.027)	(0.027)
... × milk payment	0.099*	0.075†	0.061	0.077†	-0.033	-0.032	0.022	0.011	-0.058+	-0.068*
	(0.045)	(0.042)	(0.044)	(0.043)	(0.034)	(0.033)	(0.042)	(0.044)	(0.034)	(0.030)
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	1,605	6,018	1,770	7,185	1,770	7,185	1,770	7,185	1,770	7,185
Number of resp.	321	357	355	396	355	396	355	396	355	396
R-squared	0.789	0.552	0.769	0.534	0.768	0.531	0.768	0.532	0.769	0.531
Mean gift early	0.884	0.884	0.884	0.884	0.884	0.884	0.884	0.884	0.884	0.884

Note: R1 = Round 1. R2 = Round 2. Estimated using ordinary least squares with standard errors (in parentheses) clustered at the participant level. Controls: Budget size, number of days to the early payment, number of days between early and late payments, and self-reported share of milk consumed yesterday (if *R2 only* and if *R1+R2*); dummy variable indicating first-round allocations and its interactions with price scenario and offer duration (if *R1+R2*). Columns (1) and (2) exclude participants who stated that they had not delivered milk to the cooperative on the day prior to the interview, as well as three second-round participants for whom questions about the use of milk income were skipped due to a form error. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$.

Table 6: Heterogeneity in weekly payment choices (continued)

	Dependent variable: Share of budget allocated to early payment date	
	Subgroup: Expects bulky expenses during week with eleventh of the month (vs. expects no expenses)	Subgroup: Expects a deficit during week with eleventh of the month (vs. expects no deficit)
	R2 only	*R2 only*
	(1)	(2)
Milk payment	-0.845**	-0.856**
	(0.029)	(0.025)
Subgroup	-0.010	-0.022
	(0.030)	(0.032)
... × milk payment	-0.013	0.015
	(0.034)	(0.036)
Controls	✓	✓
Observations	1765	1765
Number of resp.	354	354
R-squared	0.768	0.767
Mean gift early	0.884	0.884

Note: R2 = Round 2. Estimated using ordinary least squares with standard errors (in parentheses) clustered at the participant level. Controls: Budget size, number of days to the early payment, number of days between early and late payments, and self-reported share of milk consumed yesterday. The specifications exclude one participants for whom questions about expected income and expenditures were skipped due to a form error. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$.

A Appendix Tables

Table A1: Overview of all income allocations made by the participants

Round	Weeks with early payment after interview	Median front-end delay [range]	Median days between early and late payment [range]	Income source	Intra-subject variation in return on waiting†	Offer duration (max number of weeks with early payment)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Round 1	1+2	10 [8 to 14]	24 [10 to 34]	Milk	Yes	2 weeks
Round 1	1+2	10 [8 to 14]	24 [10 to 34]	Milk	Yes	8 weeks
Round 1	3+4	24 [22 to 28]	24 [10 to 34]	Milk	Yes	8 weeks
Round 1	5+6	38 [36 to 42]	20 [10 to 35]	Milk	Yes	8 weeks
Round 1	7+8	52 [50 to 56]	27 [13 to 35]	Milk	Yes	8 weeks
Round 2	1	10 [8 to 14]	21 [7 to 31]	Milk	No	4 weeks
Round 2	2	17 [15 to 21]	21 [7 to 31]	Milk	No	4 weeks
Round 2	3	24 [22 to 28]	17 [7 to 31]	Milk	No	4 weeks
Round 2	4	31 [29 to 35]	17 [7 to 31]	Milk	No	4 weeks
Round 2	1	3 [1 to 7]	21 [21 only]	Gift	No	1 week

Note: † Participants indicated what share of milk they preferred to be paid early when the price of milk paid early was 2 KSh higher than, the same as, and 2 KSh lower than the price of milk paid the next month.

Table A2: Timeline

Sampling Oct 2015	**Sensitization, first round** Nov - Dec 2015	**Second (main) round** Feb - Mar 2016
Administrative data handling	Information sessions at Metkei cooking plants	Interviews with the same households
	Distribution of flyers	Milk payment allocations for the next 4 weeks
	Interviews with milk payment allocations for 8 next weeks	Allocation of gift for participating in study

Table A3: Overview of analysis sample construction and attrition

	Round 1			Round 2		
	Total (1)	Self (2)	Transporter (3)	Total (4)	Self (5)	Transporter 6)
Panel A. Sample visited for interviews						
Potential subject pool before interviews*	533	313	220	374	209	165
Round 2 only: Household members added	-	-	-	21	13	8
Total subject pool	533	313	220	395	222	173
- *Interviewed*	363	200	163	359	188	171
- *Household not found*	156	103	53	3	1	2
- *Second Metkei member in household*†	3	1	2	-	-	-
- *Refused or unavailable*	7	6	1	10	8	2
- *No longer supplies milk to Metkei*	4	3	1	3	3	0
- *Cows will be dry the next 8 weeks*	0	-	-	20	12	8
- *Changed to transporter delivery*	0	-	-	10	10	0
Panel B. Sample included in the analyses						
Excluded from analyses	6	5	1	4	2	2
- *Cows dry next 8 weeks*	1	1	0	0	0	0
- *No longer supplies to Metkei*	1	0	1	3	1	2
- *Not authorized to decide about milk payments*	4	4	0	0	0	0
- *Interviewed someone else*	-	-	-	1	1	0
Number of participants in analysis sample	368	204	164	355	186	169
- *Subsample with administrative data*	346	196	150	319	164	155

Note: HH = household. * The potential subject pool in the second round consisted of all respondents interviewed at baseline, plus household members who were not interviewed in the first round but who were responsible for dairy farming. † These are households with two household members registered with Metkei separately. Respondents who could not be matched with the administrative data did not deliver to Metkei in the study period.

Table A4: Advantages of Metkei compared to the main alternative buyer

Compared to the other buyer, Metkei...	True (%)	Main reason for selling to Metkei (%)
	(1)	(2)
...accepts my milk all year whereas the other buyer doesn't	93.20	8.74
...accepts any amount of milk whereas the other buyer doesn't	92.23	3.88
...can be trusted more to save my money for later	90.29	41.75
...offers a higher milk price	67.96	24.27
...is more likely to give me a loan	60.19	3.88
...offers me more extension and training	47.57	0.00
...collects milk from places closer to me	45.63	14.56
...offers me a more stable price	37.86	0.00
...offers me inputs at lower prices	36.89	2.91
Respondents	103	103

Note: Responses from the 103 first-round respondents who stated that they could also regularly sell their milk to a trader, hawker, shop or to neighbors. Note that the large share of respondents who state selling to Metkei because it offers a higher price is consistent with the reported higher average Metkei price in the first round, whereas it dropped below the average outside price in the second round.

Table A5: Use and perception of Metkei services

	Yes (%) (1)
Took in-kind advance for agrovet or AI in last 8 weeks (first round)	43.48
Took out a cash advance in last 8 weeks	19.89
Two most frequent uses of these advances:	
- Pay for schooling	44.29
- Health care or an emergency	15.71
Situation when taking these advances:	
- Needed money urgently and could not get it elsewhere	55.71
- Needed money but could have gotten it elsewhere	22.86
- Needed money but could have waited a week or two	21.43
Perception of advances: "It would be better for me if advances were ..."	
- Available at a lower fee	86.93
- Available already in the first two weeks of the month	48.72
- Available for all milk delivered that month	26.70
- Not available	24.15
- More expensive	10.80
Would side-sell in case of a financial emergency if there were no advances	38.64
Did not select weekly payment, but expected to take advance in next 4 weeks	22.12
- I prefer taking an advance later, only if really needed (don't want to decide already now)	64.38
- Weekly payments can only be made on Fridays	21.92
- Weekly payments are only about milk delivered over one week	13.70
Number of participants	355

Note: Question about use of inkind advances in first row only included in the first round (368 respondents), all other responses from second round. Due to a software error, questions about advances were skipped for 3 respondents.

Table A6: Logit models

	Dependent variable: At least part of budget/entire budget allocated to earlier payment date (dummy variable)					
	Some early			All early		
	(1)	(2)	(3)	(4)	(5)	(6)
Milk payment	-0.868**	-0.885**	-0.876**	-0.820**	-0.715**	-0.719**
	(0.019)	(0.018)	(0.019)	(0.020)	(0.186)	(0.145)
Controls		✓	✓		✓	✓
First round allocations			✓			✓
Observations	1,775	1,775	7,295	1,775	1,775	7,295
Number of respondents	355	355	396	355	355	396

Note: Displayed are marginal effects, estimated using a logit model with standard errors (in parentheses) clustered at the respondent level. Controls are the budget size, the number of days to the early payment, the number of days between early and late payments, and the self-reported share of milk consumed yesterday as control variables. In addition, Columns (3) and (6) also control for dummy variables indicating first-round allocations, and dummy variables interacting this variable with the price scenario and an indicator for the eight-week offer. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$.

Table A7: Expected production vs. actual deliveries

	OLS. Dependent variable: Share of budget allocated to early payment					
	Expected (R1)	Delivered (R1)	Expected (R1)	Delivered (R1)	Expected (R1+R2)	Delivered (R1+R2)
	(1)	(2)	(3)	(4)	(5)	(6)
Milk payment	-0.835**	-0.833**	-0.840**	-0.855**	-0.838**	-0.836**
	(0.019)	(0.019)	(0.022)	(0.022)	(0.022)	(0.022)
Budget size (100 kg)			0.024	0.048	0.003	0.005
			(0.028)	(0.037)	(0.031)	(0.036)
Days to early payment/10			-0.002	0.004	0.001	0.001
			(0.004)	(0.005)	(0.001)	(0.001)
Days between payments/10			-0.010*	-0.011*	-0.005*	-0.007**
			(0.005)	(0.005)	(0.003)	(0.002)
Share of milk consumed			0.130	0.163†	-0.035	0.009
			(0.083)	(0.094)	(0.037)	(0.040)
Additional controls	No	No	No	No	Yes	Yes
Observations	1,534	1,534	1,534	1,534	6,391	6,391
Number of respondents	319	319	319	319	369	369
R-squared	0.751	0.735	0.754	0.740	0.766	0.799
Mean gift early	0.874	0.874	0.874	0.874	0.874	0.874

Note: R1 = Round 1. R2 = Round 2. OLS = ordinary least squares. Standard errors in parentheses, clustered at the respondent level. The analyses include all allocations that could be matched to administrative delivery data. Columns (5) and (6) control for a first-round dummy interacted with the price scenarios and an eight week-offer dummy. † $p < 0.1$, * $p < 0.05$, ** $p < 0.01$

Table A8: Allocations of the gift versus milk payments by milk delivery mode

	Dependent variable: Share of budget allocated to the early payment date	
	Round 2 only (1)	Rounds 1 and 2 (2)
Milk payment	-0.852**	-0.868**
	(0.026)	(0.025)
Self-deliverers milk to the collection center	0.025	0.023
	(0.029)	(0.030)
... × milk payment	0.001	0.018
	(0.034)	(0.033)
Controls	✓	✓
Observations	1,770	7,185
Number of respondents	355	396
R-squared	0.769	0.536
Mean gift early	0.884	0.884

Note: Estimated using ordinary least squares with standard errors (in parentheses) clustered at the respondent level. Both columns control for budget size, number of days to the early payment, number of days between early and late payments, and self-reported share of milk consumed yesterday. Column (2) also controls for variables that indicate first-round allocations and its interactions with price scenario and offer duration. Participants delivering milk to the collection center themselves could collect the early milk payment from the collection center without incurring additional transaction costs. If transaction costs are the main explanation for the low demand for early milk payments, we would expect the interaction term 'Self-delivers × Milk payment' to be positive and statistically significant. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$.

Table A9: Expected expenditures and regular milk payment weeks

	Spending expected in week t (if expects bulky expenses)			
	All spending categories (1)	Agricultural expenses (2)	Dairy expenses (3)	Schooling expenses (4)
Week includes the eleventh	0.138**	0.240**	0.041	-0.049
	(0.035)	(0.038)	(0.043)	(0.056)
Observations	1392	1308	904	484
Number of respondents	348	327	226	121
R-squared	0.012	0.043	0.001	0.002
Mean dependent variable	0.524	0.290	0.277	0.252

Note: Unit of observation is participant i in week t for the four weeks following the second-round interview. Dependent variable in Column (1) is (conditional on expecting any bulky expenditures in the four weeks following the second-round interview) whether the participant expects bulky expenditure in week t, and in Columns (2), (3) and (4) whether the participant expects bulky expenditures on agriculture, dairy farming or schooling (conditional on expecting these expenditures in the next four weeks), respectively. Estimated using ordinary least squares with standard errors (in parentheses) clustered at the participant level. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

Table A10: Planned uses of milk income

	All respondents				**Same respondents**			
	Coop		Other		Coop		Other	
	AM	PM	AM	PM	AM	PM	AM	PM
Food & daily expend.	26.52	52.17	100	89.77	26.67	46.67	100	80
School fees	62.62	26.09	9.09	6.82	53.33	20.00	20.00	20.00
Dairy & crop expend.	65.18	43.48	18.18	12.50	86.67	53.33	20.00	0
Respondents	313	23	11	88	15	15	5	5

Note: Responses of second round-respondents who stated selling AM or PM milk to the respective buyer on the day before the interview. Other buyers are mostly neighbors and shops/vendors, and we exlude 5 responses of farmers that stated delivering to another cooperative on the day before the interview. Due to a software error, questions about the intended use of milk income were skipped for 3 respondents.