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Time Discounting and Credit Market Access in a Large-Scale Cash Transfer Programme

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Summary

Time discounting is thought to influence decision-making in almost every sphere of life, including personal finances, diet, exercise and sexual behavior. In this article we provide evidence on whether a national poverty alleviation program in Kenya can affect inter-temporal decisions. We administered a preferences module as part of a large-scale impact evaluation of the Kenyan Government's Cash Transfer for Orphans and Vulnerable Children. Four years into the program we find that individuals in the treatment group are only marginally more likely to wait for future money, due in part to the erosion of the value of the transfer by inflation. However among the poorest households for whom the value of transfer is still relatively large we find significant program effects on the propensity to wait. We also find strong program effects among those who have access to credit markets though the program itself does not improve access to credit.

1. Introduction

Time preference, the relative importance individuals give to present versus future consumption, is a topic that has long captured the interest of economists. This interest is sparked by the belief that the time preference parameter is a crucial determinant of decisions in virtually every sphere imaginable, from risky sex to entrepreneurship, human capital investment and even obesity. The study of time preference has a long history in psychology where it is linked to self-control and emotional states (Damasio 1994; Bechara and Damasio 1997). In economics on the other hand the origins of time preference can be traced back to models of savings, growth and development (Rae 1905; Samuelson 1937; Smith 1776). More recently economists have begun to use both laboratory and small scale field experiments to understand whether time preference affects financial decisions and the role of income or wealth in determining inter-temporal choice. This paper contributes to this literature using a large scale field survey in which households were randomly assigned to immediately enter into a national cash transfer program. The size of our sample and the fact that it comes from an actual program which currently reaches 170,000 households in Kenya

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implies a degree of external validity which distinguishes this study from previous work that relates economic circumstances to time discounting.

In the face of perfect capital markets the individual discount rate should converge to the market interest rate. However in developing countries such markets are far from perfect and so differences in individual discount rates may vary for that and other reasons as borne out in the empirical literature (Bradford et al 2014). For example there is evidence that the discount rate is affected by age (Handa et al 2014b), gender (Harrison et al. 2009), education (Perez-Arce, 2011), health (Handa et al 2014a), marital status (Bradford 2010) and even household size (Holden et al. 1998). The economics literature has been particularly interested in the role of income or wealth in determining inter-temporal choice and many analyses show that the poor discount more than the rich in both developed (Hausman, 1979; Lawrence, 1991; Harrison et al, 2002) as well as in developing countries (Pender and Walker, 1990; Yesuf and Bluffstone, 2008; Carvalho, 2010; Tanaka et al (2010); Holden, 2013), though there are some exceptions. For example, Ogaki and Atkeson (1997) argue that wealth and the discount rate are not correlated, Harrison et al. (2005) report that the discount rate decreased for Danish people reporting improvement in their economic conditions and Giné et al. (2013) do not find any relationship between shocks – proxied by a death of family members or an income shocks - and inter temporal choices.

A crucial question is why poverty conditions or negative income shocks shift preferences toward present gratification. According to one strand of the literature, the relationship between economic conditions and time preferences is mediated by neurobiological and psychological factors. In particular, poverty status could limit cognitive functions (Shah et al, 2012; Mani et al 2013) or augment stress leading people toward bad decisions (Chemin et al 2013; Cornelisse et al. 2013).¹ Another explanation is that the poor discount more than the rich just because they cannot afford to do differently (Duflo, 2003). Indeed, since the subjective discount rate should not vary across the population under perfect capital markets, the role of credit constraints is considered to be a key factor determining inter-temporal choice in developing countries, and explaining the higher discount rates of the poor in particular (Holden et al. 1998; Yesuf and Bluffstone, 2008; Carvalho et al. 2014; Dean and Sautmann, 2014). This opens up the policy space for interventions to influence inter-temporal decision-making. Banerjee et al (2013) report evidence in this regard using randomized data from India, showing that women experiencing access to microcredit increase expenditure on durable goods and reduce expenditure on items associated with instantaneous utility. Haushofer and Shapiro (2013) show that people living in rural Kenya receiving a lump sum are more inclined to invest in durable goods while those benefitting from monthly transfers are present biased (i.e. are credit and saving constrained) while Handa et al (2013) find that an unconditional cash transfer program implemented in Zambia increases the propensity to wait for future money.

Building on the literature addressing the link between economic circumstances and inter-temporal choice, we investigate the impact of the Kenya Cash Transfer for Orphans and

¹On the other hand, Handa et al (2013) show that a positive income shock increased subjective wellbeing which lead to a reduction of time discounting.

Vulnerable Children (CT-OVC) on beneficiaries' time discounting using data that was collected for the evaluation of the CT-OVC. A special module on preferences and expectations was administered during the 3rd wave of the evaluation to approximately 1800 respondents, one-third of whom were randomly assigned to a delayed entry control arm. In a companion paper (Handa 2014a), we present evidence on the experience in implementing these hypothetical and probabilistic questions in a large scale field survey in a poor population and show that the responses have rates of inconsistency that are quite low and similar to those found in laboratory experiments in highly literate populations. Building on this work, the aim of this paper is to investigate the interaction between receipt of the transfer and the position of individuals in the credit market. The cash transfer could influence time preference by alleviating credit constraints and thus allowing beneficiaries to save and plan for the future. Alternatively an individual's credit market position may itself be unaffected by the program but may act as a moderator, leading to a heterogeneous treatment effect whereby access to credit plus the additional cash available from the program together lead people to be more patient.

The paper thus contributes to the existing literature in several ways. Firstly, it provides evidence about the role of credit constraints in determining time discounting. Secondly, it is one of the few papers that investigate the impact of a national poverty alleviation program on time discounting and how that impact varies by the beneficiary's credit market position. Finally, it is only one of two studies to investigate these questions within the context of a large scale national cash transfer program, thus contributing directly to the public policy literature on how poverty alleviation programs may affect time preference.

2. The Kenya CT-OVC

The Kenya CT-OVC reached 170,000 households and over 300,000 OVC across the country as of mid-2013 and is still expanding. The objective of the program, which began operating at scale in 2007, is to provide regular cash transfers to families living with orphans and vulnerable children (OVC) to encourage fostering and retention of children and to promote their human capital development. Eligible households, those who are ultra-poor (poorest 20 percent) and contain an OVC, receive a flat monthly transfer of \$25 (U.S.) (KES2000 in 2015). An OVC is defined as a household resident between 0 to 17 years old with at least one deceased parent, or who is chronically ill, or whose main caregiver is chronically ill. Beneficiary households are informed that, in exchange for the cash payment, the care and protection of the resident OVC is their responsibility though there are no punitive sanctions for noncompliance with this responsibility.

Targeting of households for the program is conducted in three stages. In stage one each Location (a Location is the fourth administrative level below province, district and division) forms an OVC Committee (LOC) that prepares a list of all potentially eligible households in the Location that meet the demographic and poverty criteria. In stage two, the list of eligible households is sent to the program's central office (located within the Ministry of Gender, Children and Social Development), which then administers a detailed socioeconomic questionnaire to assess poverty and confirm eligibility in order to rank households. The final number of households that enters the program in each district depends on funding to that

district, but approximately 20 percent of the poorest households in each Location are enrolled in the program. In cases where more households meet the eligibility criteria than funds are available, households are prioritized with child-headed households receiving the first priority (of which there are very few), followed by elderly-headed households.

3. Data and study design

Impact evaluation design

Prior to program expansion of the CT-OVC in 2007, UNICEF designed a social experiment to track the impact of the program on a range of household welfare indicators including food security, child health, and schooling. The evaluation entailed a randomized longitudinal design, with a baseline household survey conducted in 2007 and a 24-month follow-up in 2009. The ethical rationale for the design was that the program could not expand to all eligible Locations at the same time, so Locations whose entry would occur later in the expansion cycle could be used as control sites to measure impact. Within each of seven districts across the country (Kisumu, Homa Bay, Migori, Suba, Nairobi, Garissa, and Kwale), four Locations were identified as eligible, and two were randomized for immediate implementation and two were randomized for deferred expansion, serving as control Locations, for a total of 14 control and 14 intervention Locations. Targeting of households was carried out in all Locations according to standard program operation guidelines, and from the eligibility lists a sample of households was drawn, two-thirds from intervention Locations and the remaining third from control sites. Sample size was based on power calculations for the key impact indicators of school enrollment and household consumption expenditures. Results from the impact evaluation have been reported by the Kenya CT-OVC Evaluation Team (2012a, b).

In 2011, we returned to the households in the original evaluation sample that had been re-interviewed in 2009 and administered the same household survey plus an additional module covering preferences and expectations. The 2011 study was approved by the University of North Carolina IRB and the Kenya Medical Research Institute Ethics Review Committee.

Household attrition²

The initial study period coincided with a time of political turmoil in Kenya resulting from the disputed national elections in December 2007. Over 1000 people died and approximately 400,000 people were internally displaced at this time. Consequently, attrition between baseline and the first follow-up in 2009 was 17 percent and concentrated in Kisumu and Nairobi, the two Locations in the study that experienced the most election-related unrest. Attrition between the 2009 and 2011 rounds was only 5 percent. Table A1 in Appendix 1 shows means of selected demographic and poverty measures for households in each arm across the three waves. Means for these indicators were stable across the three waves despite the relatively high attrition rate between 2007 and 2009, indicating that the representativeness of the sample remained intact.

²This section is based on Handa (2014a).

To further explore the potential for selective or differential attrition we estimated the probability of attriting between 2007 and 2009 using baseline values for the variables reported in Table 1. The only statistically significant variables out of the 26 total variables in this regression were the indicators for Kisumu and Nairobi, the number of residents age 12–17, (log of) household size and unprotected water source. To assess whether there was any *differential* determinant of attrition between the two groups we re-estimated this model interacting each regressor with the indicator for intervention status. In only two cases (out of a possible 26) was there a statistically significant interaction effect (the indicator for residence in Kwale, and the number of residents age 6–11). Based on the stability of characteristics in each arm across the waves, the fact that the two most important determinants of attrition stem from residence in Kisumu and Nairobi, and the minimal differences in the determinants of attrition across arms, the threat of selective attrition appears minimal. The results on the determinants of attrition are reported in Handa et al. (2014a).

Baseline balance

Table A1 in the Appendix compares mean poverty and selected demographic characteristics between treatment and control households at baseline. The set of poverty-related variables are balanced across arms in each wave, but there are differences in the age, sex and schooling levels of household heads across arms. This is due to the prioritization process that occurred at the central Ministry when the number of households selected by the communities for the program exceeded the budget. The prioritization process effectively gave weight to elderly-headed households. Since the final prioritization process was not conducted in control Locations (as they were not scheduled to enter the program immediately), households in the control arm of the study were sampled from the initial, slightly larger eligibility list than those from the intervention arm resulting in the differences in heads' characteristics observed in Table A1. It is important to note however that there is no element of self-selection into the program; household eligibility was completely supply-driven and take-up was universal. Below we explain our method for addressing these differences in demographic characteristics.

4. Empirical strategy and measures

Empirical strategy

To measure the impact of the program on people's time discounting, we estimate the following regression model:

$$y_i = \alpha + \beta_1 T_h + \beta_2 X_i + \beta_3 X_h + \varepsilon_i \quad (1)$$

where y defines individual time discounting, T the treatment status and X a set of control variables measured at both the individual (i) and household (h) level. The preferences module was administered to the main respondent of the household and as described above there are small differences in demographic characteristics across arms. To account for these differences we re-weight the control group sample using the method of inverse probability

weighting (IPW), which entails estimating the probability of being in the treatment group using a set of covariates measured at baseline, deriving the predicted probability and then weighting the control sample by the inverse of this probability. Since the prioritization criterion is known and based on age of the head, we ‘saturate’ this regression using eight 5-year age selection criterion. Results of the estimating equation to derive the probabilities are available upon request; Appendix 2 reports the distribution of predicted probabilities before and after weighting which shows that the two distributions become much more similar after applying the weights. Table 1 reports means of selected characteristics of the respondents to the preferences module by study arm and as can be seen in Column (3), once the weights are applied the characteristics of the individual respondents in the control group move towards those of the treatment group with only the difference in mean age remaining statistically significant. In equation (1) we continue to include a full set of control variables to absorb this and any other difference between the two groups.

Inter temporal choice

In order to measure time discounting, we invited participants to carry out an inter-temporal choice task entailing a decision between an immediate versus a future payment. While the former was fixed at KES 1500, the one month future values were varied as follows: KES 1500, 3000, 4500, 7000 and 9000 (Figure 1). We also included a KES1250 option as a check to see if people understood the question. Based on these responses we build two variables to capture impatience: an ordinal variable ranging from 1 (will wait for KES 1250) to 7 (will never wait for any amount) and a dichotomous variable indicating people who are never willing to wait for money.

Figure 1 reports the percentage of participants willing to wait for each option of payments. As expected, the percentage of participant that is willing to wait rises as the future value of the payment increases. Moreover, a substantial proportion of participants switch their preference from immediate money to future payments at KES 3000. Figure 1 also shows that more than 80 per cent of participants would wait one month for a future value of KES 9000, while about 16 per cent of people “always” prefer immediate money than future payments.

The order of the future value was randomized rather than listed in increasing value as in Holt & Laury (2002) and most laboratory or field experiments. We are thus able to identify inconsistent responses through ‘double-switches’, individuals who said they would wait for a low value and also said they will not wait for a higher value. Only eight per cent of respondents report a ‘double switch’ which is at the lower end of the inconsistency range found in controlled laboratory settings among wealthier, more literate populations (Bradford et al. 2014). About two-thirds of these inconsistent respondents are those who would wait for less money suggesting that they may not have understood this question. We exclude inconsistent respondents from our analysis but include those who would delay for less money; results are not sensitive to the exclusion of this latter group. Finally, the inter-temporal choice task that were administered in the survey was not incentivized--this is simply not feasible in a large multi-topic survey, both for financial reasons and because of time constraints. There is debate in the literature on whether reasonable answers can be elicited when tasks are not incentivized (Camerer and Hogarth, 1999; Harrison et al, 2007;

Delavande et al. 2011; Weisser, 2014), but the empirical evidence on the so-called hypothetical bias is mixed. Real games tend to use lower rewards for practical reasons, which confounds the evidence that hypothetical games lead to lower discount rates (more patience). In fact several studies have shown that hypothetical and real games lead to similar responses (Johnson and Bickel 2002; Holt and Laury 2002) and one study actually reports greater discount rates in a hypothetical game versus a real one (Harrison et al 2002).

Access to credit

In the 2011 survey we included a small set of questions on access to credit, capturing whether the household currently had any outstanding loans, whether they had sought a loan, and if they had not sought a loan, why not. We defined households as credit constrained if they had sought a loan and were rejected, or if they had not sought a loan for a reason that indicated they felt they could not obtain a loan (lack of collateral for example), or because they did not know where to go or how to get one (transaction cost constrained). As a result, about 3 out of 4 individuals in our sample are defined as credit constrained.

Figure 2 shows that the relationship between credit constrained and wealth (measured through a local linear regressions - lowess) is surprisingly flat except for very low levels of consumption (below KES 1000) and treated households appear slightly more credit constrained than control households. Note that credit constraints are measured 4 years after program implementation so these results suggest there was no program impact on credit constraints of households. The relatively flat relationship may be simply a function of the unique sample of households, all of whom are potentially eligible for the program and so are quite poor (mean consumption in the sample is 60 US cents per person per day).

To investigate the determinants of access to credit we estimate regressions using a set of individual and household level covariates and also include treatment status—results are shown in Table 2 using OLS and probit specifications, both of which are weighted using the IPW. Having a partner in the household or being literate seem to be important determinants of credit access. In contrast, those living in larger households appear to be more credit constrained while individuals with a chronic illness are less so.

If credit constraints are an important determinant of time preference we might expect to see a relationship between our measure of credit access and the inter-temporal choice task we administered. Table 3 confirms that people without credit constraints appear more inclined to wait for future money. At every value of future money except for KES1250 (which is lower than the instantaneous option of KES1500) those with access to credit appear significantly more likely to wait (IES).

Mean comparisons between treated and control group

Beyond controlling for access to credit, the aim of this paper is to investigate the impact of the program on time discounting. Thus – as a first step – we compare the responses between participants in the program (treated group) and the others (control group) across the different payment options. As can be seen in Table 4, people in these two groups seem to respond in a similar way. The share of people willing to wait rises as the future value of the payment increases in both groups. A future value of KES 3000 represents a switch point in time

preferences for people in the treated as well as for those in the control group. Overall, the mean differences between these two groups are smaller than five points and statistically significant only for future values KES 9000, 4500 (at 10 per cent) and 7000 (at 5 per cent).

As before, we estimate local linear regressions to trace the relationship between propensity to wait and household wealth using (baseline) per adult equivalent household consumption. Figure 3 shows some evidence that even in this very poor sample, higher wealth is somewhat related to an increased propensity to wait for future money, and this pattern is stable across the two study arms. The proportion of households designated with access to credit is 22.5 percent in each arm.

We next check participant responses between treated and control group controlling for access to credit. As shown in Table 5, the mean differences are small and not statistically significant between treatment and control groups without access to credit. However differences are slightly larger between study arms among those having access to credit. Indeed, the mean differences are statistically significant for KES3000, KES 7000 (at 10 percent) and for the ordinal indicator of impatience.

5. Results

Full sample

Table 6 presents multiple regression estimates of the determinants of each of our 5 inter-temporal choice tasks. We also include estimates in the last 2 columns of the ordinal and dichotomous indicators for impatience described earlier. The first row of Table 6 indicates that beyond the threshold value of KES3000 individuals in the program display a 3–5 point higher likelihood of waiting for future money but this is statistically significant only for KES7000 and only at the 10 percent confidence level. Access to credit generally leads to a greater likelihood of waiting for future money, and less likelihood of never waiting no matter what the amount. Other results portray an interesting story about the determinants of inter-temporal decision-making. Literacy is strongly associated with delaying payment (by 8–9 points) while having a disability has an even stronger effect in the opposite direction, both intuitive results. In the Appendix we show results for the full sample, including the 8 percent of individuals who had inconsistent responses.

Results by baseline consumption levels

The weak relationship between the CT-OVC and time-discounting may in part be due to the relatively low value of the transfer at the third round when the preferences module was fielded. At baseline the value of the transfer as a share of beneficiary consumption was 23 percent. With inflation its value eroded to 18 percent in 2009 down to 11 percent by 2011. Consistent with the drop in the real value of the transfer, the significant impacts of the program on consumption (Kenya CT-OVC Evaluation Team 2012a) had dissipated by 2011 (Romeo, Dewbre et al 2014). It could be then that the weak effects of the program reflect in part the erosion in the ‘intensity of the treatment’, the fact that the transfer does not represent a large enough increase in income to alleviate liquidity constraints and induce an impact on the propensity to wait for future money.

We test this hypothesis by estimating program impacts on the poorest 50 percent of our sample, among whom median daily consumption is 34 US cents per person per day and the transfer share is 22 percent of baseline consumption. Results in the top panel of Table 7 show that in fact the program impact is about twice as high on this set of individuals than it is in the full sample and several of the point estimates are now statistically significant. For example the program increases the likelihood of waiting for KES 4500 or 7000 by 8 percentage points and reduces the ordinal impatience score by 0.392 (Table 7). The association between credit access and waiting for future money is also twice as high among this sample and also now statistically significant in several instances.

The bottom panel of Table 7 shows results for individuals in households with baseline adult equivalent consumption above the median for the sample. In contrast to the top panel of Table 8 here the program does not have any impact in delaying payment though access to credit does generally support individuals to delay payment, particularly for KES 7000 and 9000 and credit access significantly reduces the likelihood of never choosing to delay at any payment level.

Heterogeneous treatment effects by credit access

If liquidity constraints in the face of imperfect capital markets affect inter-temporal choice and the cash transfer itself is not big enough to eliminate liquidity constraints, then the cash transfer combined with credit access may together be large enough to overcome liquidity constraints and lead to impact on the choice task. We test this hypothesis by interacting the treatment dummy with the credit access variable. Initial estimates showed no differential impact by credit access among the control group so we drop the dummy variable for credit access (which measures the difference among the control group) and estimate the following model:

$$y_i = \alpha + \beta_1 T_h + \beta_2 T_h * (Credit\ Access) + \beta_3 X_i + \beta_4 X_h + \varepsilon_i \quad (2)$$

In this framework β_2 measures the differential treatment effect by credit access among the treated group only while the coefficient of the treatment dummy (β_1) measures the difference between the treated group without credit access and the entire control group. The constant term in this model shows the mean value of the dependent variable among the control group as a whole. Table 8 shows a significant heterogeneous treatment effect of the CT-OVC by credit access on the order of 6 percentage points with slightly larger effect sizes for larger values of future money. Moreover the difference between the treated group without credit access and the control group, given by the coefficient of the treatment dummy, is not significantly different. The two bottom panels of Table 8 show results by baseline adult equivalent consumption. These reveal that in fact for both groups, there is a positive treatment effect on the propensity to wait for future money in the presence of credit access with effect sizes of roughly equal magnitude. It seems then that the combination of the increased cash from the CT-OVC program and increased access to liquidity through the credit market work together to affect inter-temporal choice leading individuals to be more willing to wait for future money.

Using the model based on propensity to wait for KES7000 we show the predicted probabilities of waiting for those with and without credit access among the treated group by baseline consumption. The program effect is about 6 points larger on average among those with credit access, but increases to almost 10 points at the top of the consumption distribution, presumably where liquidity constraints are least binding.

6. Discussion and Conclusions

Liquidity constraints due in part to lack of access to credit are a major barrier to consumption smoothing and investment in developing countries (Bardhan and Udry, 1999; Ghosh et al 2000; Rosenzweig and Wolpin 1993). Median consumption among households eligible for the Kenyan government's largest poverty alleviation program is 60 cents per day and 77 percent are credit constrained. Program participation had an important initial impact on consumption, but this impact dissipated by the fourth year as the value of the transfer eroded with inflation. Our analysis shows that the program has only a weak positive impact on the propensity to wait for future money after four years. However this impact doubles in magnitude among the very poorest for whom the transfer still represents a relatively large portion of total consumption, suggesting that the transfer helps alleviate liquidity constraints and allows individuals to place more weight on the future. And when we focus on individuals that are not credit constrained, we find large and statistically significant impacts of the program compared to households that are credit constrained. Among those with credit access the program increases the propensity to wait for KES3000 or more by 6 percentage points, and reduces the likelihood of never waiting for any sum of money by the same magnitude. Our interpretation of this effect is that the combination of the transfer and credit access is enough to relax the liquidity constraint for individuals and allows them to place more weight on the future.

Our results support the existing evidence that economic conditions or wealth affect inter-temporal choice though our study differs from the previous literature in that it is based on a large field study rather than a small laboratory or field experiment. The results reported here are exciting from a policy perspective, taken as they are from a rigorous impact evaluation of the Kenyan government's largest poverty alleviation program. They imply that rather than any deficit in cognitive functioning, the way poor people perceive and discount their future is influenced by their environment and it is possible to promote forward looking decision-making by modifying these conditions through public policy. The results further show that a successful development intervention can achieve both equity and efficiency goals. In this example, an unconditional poverty targeted cash transfer program implemented on a large scale appears to be a win-win policy intervention: assuring social and economic protection on the one hand and promoting forward-looking decision-making on the other.

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Appendix 1

Table A1

Household characteristics by wave and intervention status in the CT-OVC Evaluation Sample

Sample:	<u>2007</u>		<u>2009</u>		<u>2011</u>	
	T	C	T	C	T	C
<u>Demographics</u>						
Household size	5.48	5.79	5.54	5.81	5.53	5.82
Female head	0.65	0.57	0.65	0.59	0.65	0.59
Age of head in years	62.34	56.06	62.21	56.20	62.55	56.55
Head not completed primary	0.53	0.38	0.53	0.38	0.53	0.38
<u>Poverty</u>						
Per adult equiv. monthly exp. (Ks)	1533.30	1501.25	1541.77	1459.94	1550.14	1441.99
Walls of mud/dung/grass/sticks	0.75	0.84	0.75	0.86	0.74	0.87
Roof of mud/dung/grass/sticks	0.23	0.22	0.23	0.23	0.22	0.22
Floor of mud/dung	0.66	0.74	0.65	0.77	0.66	0.79
No toilet	0.55	0.56	0.55	0.56	0.54	0.56
Unprotected water source	0.62	0.68	0.61	0.70	0.61	0.70
<u>Region</u>						
Garissa	0.10	0.06	0.11	0.06	0.09	0.05
Homa Bay	0.12	0.13	0.12	0.13	0.12	0.14
Kisumu	0.18	0.23	0.18	0.22	0.18	0.22
Kwale	0.08	0.09	0.08	0.10	0.08	0.11
Migori	0.23	0.23	0.22	0.25	0.22	0.26
Nairobi	0.13	0.10	0.13	0.07	0.13	0.06
Suba	0.15	0.16	0.16	0.16	0.17	0.17
N	1540	754	1325	583	1266	545

Statistically significant (at 10%) differences of t-test between Treatment (T) and Control (C) within each wave shown in bold. Thirty-three new households at follow-up not included in table.

Appendix 2

Figure A2.
Distribution of probability scores

Figure 1. Percent who will wait one month by future value

Note: the specific question was: "Suppose that you suddenly win money in the Lotto. If you could choose between these payment options which do you choose?"

Figure 2. Relationship between household wealth and the probability of being credit constrained, by study arm

Figure 3.
Relationship between time preference and household wealth, by study arm

Figure 4.
Probabilities of waiting for those with and without credit access among the treated group by baseline consumption

Table 1

Mean characteristics of respondents of behavioral module

	T (1)	C (unweighted) (2)	C (weighted) (3)	p-value difference (1) vs. (3) (4)
Age in years	57.3	49.2	59.1	0.03
Female	79.3	72.2	77.3	0.57
Partner in household	34.5	40.4	33.5	0.68
Can read	29.9	44.0	29.9	0.91
Chronically ill (baseline) [/]	14.9	14.1	17.8	0.14
Disabled (baseline) [/]	6.3	4.0	6.3	0.98
N	1280	525	525	

[/] Self-reported. Estimates in column (3) weighted by inverse probability weight.

Table 2

Determinants of the access to the credit

	<u>OLS</u>	<u>Probit</u>
	(1)	(2)
T	−0.00315 (−0.16)	−0.0339 (−0.50)
Age 25–59 years	−0.0386 (−0.68)	−0.133 (−0.74)
Age 60+ years	−0.0813 (−1.41)	−0.298 (−1.61)
Female	0.0421 (1.52)	0.135 (1.40)
Has partner	0.0667 (2.72)	0.250 (3.04)
Can read	0.0635 (2.53)	0.187 (2.31)
Has chronic illness	0.0534 (1.99)	0.173 (1.97)
Disabled	−0.00452 (−0.11)	−0.0101 (−0.07)
Log consumption	0.0170 (0.89)	0.0701 (1.07)
Cattle	−0.00383 (−1.21)	−0.0203 (−1.36)
Goats	−0.00103 (−0.76)	−0.0100 (−1.04)
Sheep	0.00216 (0.60)	0.0236 (1.24)
Poultry	0.00227 (1.54)	0.00803 (1.63)
log household size	−0.0635 (−2.58)	−0.202 (−2.44)
Rural	−0.0326 (−0.70)	−0.152 (−0.84)
Observations	1,804	1,804
R-squared	0.043	

Notes: Coefficients or probit marginal effects reported with t-statistics in parentheses. Also included in model but not reported are indicators for district. Coefficients in bold are statistically significant at 10 percent.

Table 3

Mean differences in per cent willing to wait by study arm and amount

Is willing to wait one month for KES:	no access to credit	access to credit	p-value difference in means
1250	18.30	19.01	0.742
1500	25.25	30.28	0.046
3000	77.07	84.50	0.000
4500	79.75	86.38	0.001
7000	81.28	88.97	0.000
9000	81.35	89.44	0.000
Impatient: Ordinal	3.27	2.94	0.001
Impatient: Dichotomous	17.58	9.86	0.000
N	1378	426	1804

Table 4

Mean differences in per cent willing to wait by study arm and amount

Is willing to wait one month for KES:	T	C	p-value difference in means
1250	19.1	19.5	0.84
1500	26.4	26.3	0.96
3000	78.4	75.0	0.13
4500	81.1	77.5	0.09
7000	83.1	78.7	0.03
9000	83.1	79.6	0.09
Impatient: Ordinal	3.2	3.3	0.14
Impatient: Dichotomous	16.0	19.2	0.11
N	1280	525	

Control group mean weighted using the Inverse Probability Weight

Table 5

Mean differences in per cent willing to wait by study arm and amount

	Not having access to credit				Access to credit			
	Is willing to wait one month for KES:		p-value difference in means		p-value difference in means		p-value difference in means	
	C	T	C	T	C	T	C	T
1250	21.98	19.07	0.237		11.16	19.1		0.026
1500	25.77	25.60	0.95		28.36	29.17		0.863
3000	74.99	76.71	0.505		74.80	84.03		0.032
4500	76.71	79.74	0.227		80.15	85.76		0.159
7000	77.51	81.35	0.119		82.79	89.24		0.083
9000	77.95	81.35	0.165		85.17	89.24		0.252
Impatient: Ordinal	3.34	3.25	0.471		3.34	2.97		0.046
Impatient: Dichotomous	20.64	17.64	0.21		14.34	10.42		0.262
N	386	992	1378		138	238		426

Control group mean weighted using the Inverse Probability Weight

Table 6

Determinants of Propensity to Wait for Future Money

	Is willing to wait one month for KES:						Impatience	
	9000	7000	4500	3000	1500	Ordinal ¹	Dichotomous ²	
	(1)	(2)	(3)	(4)	(5)	(7)	(9)	
T	0.0320 (1.17)	0.0459 (1.65)	0.0434 (1.52)	0.0471 (1.60)	-0.00257 (-0.09)	-0.176 (-1.31)	-0.0320 (-1.17)	
Access to credit	0.0603 (1.88)	0.0484 (1.44)	0.0357 (1.02)	0.0196 (0.52)	0.0272 (0.71)	-0.157 (-0.99)	-0.0603 (-1.88)	
Age 25–59 years	0.0522 (0.89)	0.0483 (0.82)	0.0960 (1.51)	0.0656 (1.03)	0.0608 (0.96)	-0.414 (-1.53)	-0.0522 (-0.89)	
Age 60+ years	0.0161 (0.27)	0.00997 (0.16)	0.0670 (1.02)	0.0461 (0.70)	0.0643 (0.96)	-0.311 (-1.09)	-0.0161 (-0.27)	
Female	0.0351 (0.80)	0.0294 (0.68)	0.0236 (0.53)	0.0339 (0.77)	-0.0581 (-1.40)	-0.00586 (-0.03)	-0.0351 (-0.80)	
Has partner	-0.0174 (-0.53)	-0.0208 (-0.61)	-0.0307 (-0.85)	-0.0273 (-0.75)	-0.0923 (-2.43)	0.228 (1.40)	0.0174 (0.53)	
Can read	0.0834 (2.49)	0.0887 (2.64)	0.0874 (2.56)	0.0944 (2.67)	0.0493 (1.27)	-0.445 (-2.67)	-0.0834 (-2.49)	
Has chronic illness	-0.00789 (-0.18)	-0.000595 (-0.01)	0.0123 (0.28)	0.0300 (0.67)	0.00887 (0.19)	-0.0335 (-0.16)	0.00789 (0.18)	
Disabled	-0.163 (-1.85)	-0.155 (-1.77)	-0.150 (-1.70)	-0.145 (-1.62)	-0.0932 (-1.57)	0.766 (1.89)	0.163 (1.85)	
Rural	0.0603 (0.89)	0.0557 (0.83)	0.0721 (1.08)	0.0890 (1.37)	0.0784 (1.41)	-0.396 (-1.22)	-0.0603 (-0.89)	
Log consumption	-0.00786 (-0.32)	-0.00219 (-0.09)	0.00510 (0.20)	0.00735 (0.28)	0.0280 (0.91)	-0.0268 (-0.22)	0.00786 (0.32)	
Observations	1,664	1,664	1,664	1,664	1,664	1,664	1,664	
R-squared	0.084	0.081	0.077	0.087	0.065	0.084	0.084	

Notes: OLS regressions with robust standard errors and inverse probability weights; inconsistent responses excluded. Also included in model but not reported are indicators for district, log household size, number of residents in each of six age categories, quality of roof, floor, walls, toilet facility, type of cooking fuel used, electricity, and crowding index. Coefficients in bold are statistically significant at 10 percent.

¹ Higher values indicate that individual needs increasingly higher amount of money to wait.

² Will never wait for any amount offered.

Table 7

Determinants of Propensity to Wait for Future Money by Baseline Consumption

	Is willing to wait one month for KES:					Impatience	
	9000	7000	4500	3000	1500	Ordinal ¹	Dichotomous ²
	(1)	(2)	(3)	(4)	(5)	(7)	(9)
Below median consumption							
T	0.0601 (1.51)	0.0772 (1.88)	0.075 (1.79)	0.0746 (1.74)	0.0534 (1.43)	-0.392 (-2.10)	-0.0601 (-1.51)
Access to credit	0.0851 (1.93)	0.0697 (1.45)	0.0688 (1.42)	0.0436 (0.84)	0.121 (2.57)	-0.43 (-2.02)	-0.0851 (-1.93)
Observations	824	824	824	824	824	824	824
R-squared	0.123	0.117	0.109	0.120	0.076	0.112	0.123
Above median consumption							
T	-0.00556 (-0.22)	0.00709 (0.27)	0.00696 (0.26)	0.0128 (0.45)	-0.0582 (-1.81)	0.0691 (0.53)	0.00556 (0.22)
Access to credit	0.0586 (1.97)	0.0489 (1.62)	0.0249 (0.80)	0.0196 (0.60)	-0.0173 (-0.46)	-0.0703 (-0.47)	-0.0586 (-1.97)
Observations	841	841	841	841	841	841	841
R-squared	0.131	0.129	0.125	0.131	0.115	0.133	0.131

Notes: OLS regressions with robust standard errors and inverse probability weights; inconsistent responses excluded. Also included in model but not reported are indicators for Age 25–59 years, Age 60+ years, Female, Has partner, Can read, Has chronic illness, Disabled, Rural, Log consumption as well as indicators for district, log household size, number of residents in each of six age categories, quality of roof, floor, walls, toilet facility, type of cooking fuel used, electricity, and crowding index. Coefficients in bold are statistically significant at 10 percent.

¹ Higher values indicate that individual needs increasingly higher amount of money to wait.

² Will never wait for any amount offered.

Table 8

Interaction of treatment status and credit access on propensity to wait for future money

	Is willing to wait one month for KES:					Impatience	
	9000	7000	4500	3000	1500	Ordinal ¹	Dichotomous ²
	(1)	(2)	(3)	(4)	(5)	(6)	(8)
T	0.0180 (0.63)	0.0324 (1.11)	0.0325 (1.10)	0.0352 (1.15)	-0.0112 (-0.36)	-0.116 (-0.83)	-0.0180 (-0.63)
T*access to credit	0.0594 (2.50)	0.0578 (2.43)	0.0463 (1.79)	0.0513 (1.87)	0.0368 (1.10)	-0.259 (-2.09)	-0.0594 (-2.50)
Constant	0.548 (2.54)	0.506 (2.26)	0.292 (1.25)	0.231 (0.96)	-0.131 (-0.51)	5.394 (5.11)	0.452 (2.09)
Observations	1,664	1,664	1,664	1,664	1,664	1,664	1,664
R-squared	0.082	0.081	0.077	0.088	0.064	0.084	0.082
<u>Below median consumption</u>							
T	0.0438 (1.05)	0.0621 (1.45)	0.0634 (1.45)	0.0620 (1.39)	0.0288 (0.73)	-0.294 (-1.50)	-0.0438 (-1.05)
T*access to credit	0.0663 (1.83)	0.0625 (1.72)	0.0469 (1.21)	0.0541 (1.32)	0.101 (2.05)	-0.405 (-2.19)	-0.0663 (-1.83)
Constant	0.969 (2.38)	0.901 (2.12)	0.67 (1.55)	0.846 (1.86)	0.0226 (0.05)	3.22 (1.64)	0.0314 (0.08)
Observations	824	824	824	824	824	824	824
R-squared	0.118	0.114	0.105	0.119	0.068	0.108	0.118
<u>Above median consumption</u>							
T	-0.0204 (-0.59)	-0.00776 (-0.22)	-0.00618 (-0.17)	-0.00113 (-0.03)	-0.0558 (-1.26)	0.115 (0.64)	0.0204 (0.59)
T*access to credit	0.0641 (1.87)	0.0636 (1.85)	0.0556 (1.52)	0.0585 (1.50)	-0.0106 (-0.23)	-0.195 (-1.13)	-0.0641 (-1.87)
Constant	0.359 (0.87)	0.276 (0.65)	-0.0692 (-0.15)	-0.377 (-0.78)	1.021 (1.67)	5.102 (2.33)	0.641 (1.55)
Observations	841	841	841	841	841	841	841
R-squared	0.129	0.129	0.126	0.133	0.114	0.134	0.129

Notes: OLS regressions with robust standard errors and inverse probability weights; inconsistent responses excluded. Also included in model but not reported are indicators for Age 25–59 years, Age 60+ years, Female, Has partner, Can read, Has chronic illness, Disabled, Rural, Log consumption as well as indicators for district, log household size, number of residents in each of six age categories, quality of roof, floor, walls, toilet facility, type of cooking fuel used, electricity, and crowding index. Coefficients in bold are statistically significant at 10 percent.

¹Higher values indicate that individual needs increasingly higher amount of money to wait.

²Will never wait for any amount offered.

Table A2
Determinants of Time Discounting – full sample including inconsistent observations

	Is willing to wait one month for KES:						Impatience	
	9000	7000	4500	3000	1500	Ordinal ¹	Dichotomous ²	
	(1)	(2)	(3)	(4)	(5)	(7)	(9)	
T	0.0351 (1.34)	0.0436 (1.64)	0.0394 (1.45)	0.0373 (1.33)	0.00555 (0.19)	-0.165 (-1.26)	-0.0312 (-1.21)	
Access to credit	0.0564 (1.84)	0.0445 (1.39)	0.0278 (0.84)	0.0195 (0.54)	0.0306 (0.81)	-0.0614 (-0.41)	-0.0489 (-1.62)	
Age 25–59 years	0.0185 (0.33)	0.0121 (0.22)	0.114 (1.82)	0.0221 (0.36)	0.0597 (1.06)	-0.273 (-0.96)	-0.0254 (-0.46)	
Age 60+ years	-0.0236 (-0.41)	-0.0268 (-0.46)	0.0747 (1.14)	0.00589 (0.09)	0.0606 (1.01)	-0.164 (-0.53)	0.0114 (0.20)	
Female	0.0408 (0.98)	0.0282 (0.69)	0.0229 (0.54)	0.0378 (0.90)	-0.0618 (-1.56)	-0.112 (-0.54)	-0.0402 (-0.98)	
Has partner	-0.0253 (-0.82)	-0.0115 (-0.36)	-0.0263 (-0.79)	-0.0159 (-0.47)	-0.0839 (-2.29)	0.136 (0.87)	0.0106 (0.35)	
Can read	0.0828 (2.68)	0.0803 (2.62)	0.0769 (2.44)	0.0910 (2.80)	0.0305 (0.80)	-0.442 (-2.73)	-0.0765 (-2.51)	
Has chronic illness	0.00170 (0.04)	0.00799 (0.19)	0.0249 (0.59)	0.0383 (0.89)	0.0149 (0.34)	-0.101 (-0.48)	0.00270 (0.06)	
Disabled	-0.152 (-1.78)	-0.157 (-1.84)	-0.148 (-1.74)	-0.143 (-1.65)	-0.0888 (-1.55)	0.813 (2.10)	0.164 (1.93)	
Rural	0.0647 (1.02)	0.0616 (0.97)	0.0928 (1.48)	0.0940 (1.52)	0.0572 (1.09)	-0.510 (-1.63)	-0.0646 (-1.01)	
Log consumption	-0.00894 (-0.40)	-0.000786 (-0.03)	-0.00531 (-0.22)	0.00307 (0.12)	0.0307 (1.08)	-0.00582 (-0.05)	0.00981 (0.44)	
Observations	1,804	1,804	1,804	1,804	1,804	1,804	1,804	
R-squared	0.078	0.077	0.075	0.080	0.059	0.077	0.079	

Notes: OLS regressions with robust standard errors and inverse probability weights. Also included in model but not reported are indicators for district, log household size, number of residents in each of six age categories, quality of roof, floor, walls, toilet facility, type of cooking fuel used, electricity, and crowding index. Coefficients in bold are statistically significant at 10 percent.

¹Higher values indicate need increasingly higher amount of money to wait.

²Will never wait for any amount offered.