



Changes in discount rates over time Evidence from Ethiopia

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Numerous experimental studies have lent credence to the hyperbolic discounting model, which posits that individuals are impatient about immediate or near-term consumption decisions, but are relatively more patient over future consumption. Experiments documenting this behaviour found that subjects often preferred, for instance, to receive \$1 today, rather than \$2 a month from now, but they also preferred \$2 in 13 months over \$1 in 12 months. Few studies have examined inconsistent time preferences in developing countries, where discount rates are more likely to diverge from market interest rates due to pervasive capital market imperfections. Levitt and List (2007) highlighted the importance of complementing lab studies with evidence from field experiments.

Individual rates of time preference have important policy implications in developing countries, from savings to investment to conservation decisions. Hyperbolic time discounting can exacerbate poverty by hindering wealth accumulation and hastening natural resource degradation. However, policy interventions, such as commitment devices for savings accounts (Ashraf, Karlan, and Yin 2006) and fertilizer purchases (Duflo, Kremer, and Robinson 2006), can lead to better outcomes for “sophisticated” hyperbolic discounters, who plan on taking future action, but recognize that they may not follow through when the time comes.

Method

This study tests the hyperbolic discounting hypothesis using real-payoff experiments in Ethiopia. We offered real payments of a substantial sum to motivate responses with real consequences. We varied payments between cash, tradable consumption goods, and final consumption goods to discern whether the subjects’ responses systematically differed between tradable and non-tradable rewards. We introduced a front-end delay treatment to compare whether revealed discount rates changed when the near-term payment was delivered with a short delay (one week in our experiment) versus immediate delivery of payment, to control for any uncertainty or transaction costs associated with collecting a delayed reward. We controlled for the subjects’ expected changes in seasonal consumption flows by setting the future time frame one year from the near-term.

Key Points

- Individual rates of time preference have important policy implications in developing countries, from savings to investment to conservation decisions.
- Discount rates elicited in artefactual field experiments can predict real-world behaviours with important implications for development policy for savings and natural resource use.
- We find that participants made consistent choices over time and that responses did not vary across payment type.
- We found that animal wealth per capita was indeed strongly correlated with patience.

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By opting for a simple two-question design, we avoided the misunderstandings and background risk that may arise from questionnaires that ask a series of questions with different time frames and determine the reward by randomly choosing one of the responses. While our design can only identify the upper or lower bound of respondents' discount rates, allowing us to classify respondents as "patient" or "impatient," our measure of patience was not biased by background risk or anomalies caused from misunderstandings of the survey.

Discount rates elicited in artefactual¹ field experiments can predict real-world behaviours with important implications for development policy for savings and natural resource use.

Data and Design

The data for this study came from two surveys, conducted in parallel, of a random selection of 445 households in the eastern Gojjam zone of the north western Ethiopian highlands. The surveys were conducted in March–April 2006.

In the discounting experiment, each respondent was confronted by a choice of two options: a more immediate, smaller payment (which we defined as the "impatient" option) or a larger payment one month later (the "patient" option). We used a simple two-question design similar to Ashraf, Karlan, and Yin (2006).

Results

We found no direct evidence for time preference reversals in any of the treatment groups. All but one of the 445 participants preferred either the patient or the impatient option in both near- and far-term time horizons (table 1)². This result was surprising, given the substantial proportion of participants selecting time-inconsistent choices in similar studies.

Table 1 Responses to All Treatments Combined

	Impatient near term	Patient near term	Total
Impatient far term	150 (33.7%)	1 (0.2%)	151 (33.9%)
Patient far term	0 (0%)	294 (66.1%)	294 (66.1%)
Total	150 (33.7%)	295 (66.3%)	445 (100%)

¹ Artefactual experiments use stylized questions adapted from lab experiments with non-standard subject pools (Harrison and List 2004).

² The one subject with inconsistent time preferences was not a hyperbolic discounter; rather the subject was patient in the near term and impatient in the future time frame.

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We found no systematic difference in time preferences across the form of payment—cash, a tradable consumption good, wheat; and a non-tradable consumption good, salt. While rates of time preference were, on average, highest in the cash treatment and lowest in the salt treatment, these differences were not statistically significant.

We included several socioeconomic characteristics as possible determinants of patience. Sex, age, marital status, and literacy are included as demographic indicators. We also included household size, distance to the nearest road, land area per capita, and livestock value per capita in the regressions.

We found that animal wealth per capita was indeed strongly correlated with patience. Regarding the treatment variables, patience did not differ with salt or wheat payments relative to cash, but did increase with the time delay. The effect of a one-week delay was not statistically significant once all the covariates were included, although the one-year time frame did have a highly significant positive effect on patience.

Conclusion

We compared time discounting over cash and consumption goods using real-payoff experiments. The experiment was conducted in Ethiopia, a low-income country with limited credit markets, where discount rates are expected to exceed market interest rates. We found no difference in elicited time preferences between cash and consumption goods, whether tradable or final. This finding could result from the limited intertemporal arbitrage opportunities available in rural Ethiopia due to missing markets. We also saw some evidence in our survey of time-inconsistent preferences, inferred from the finding that participants asked about their near-term preferences first expressed significantly more impatience than those who were asked first about future choices. However, a strong anchoring effect precluded clear interpretation of the effect on nearterm time preferences of offering payment with a short delay rather than immediately.

ABOUT THIS BRIEF

This brief is based on results from Klemick, H., and Yesuf, M., 2008 “Do Discount Rates Change over Time? Experimental Evidence from Ethiopia” Discussion Paper Series, EFD DP 08-06, Environment for Development (EFD), Gothenburg, Sweden.

REFERENCES

- 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: 635–72. (Also available from the authors)
- Besharov, G., and B. Coffey. 2003. “Reconsidering the Experimental Evidence for Quasi-Hyperbolic Discounting.” Photocopy, Duke University, Durham, N.C.
- Duflo, E., M. Kremer, and J. Robinson. 2005. “Understanding Technology Adoption: Fertilizers in Western Kenya.” Photocopy. Massachusetts Institute of Technology, Cambridge, MA.
- Frederick, S., G. Loewenstein, and T. O'Donoghue. 2002. “Time Discounting and Time Preference: A Critical Review.” *Journal of Economic Literature* 40: 351–401.
- Godoy, R., K. Kirby, and D. Wilkie. 2001. “Tenure Security, Private Time Preferences, and Use of Natural Resources among Lowland Bolivian Amerindians.” *Ecological Economics* 38: 105–118.
- Godoy, R., M. Jacobson, J. De Castro, Vianca Aliaga, Julio Romero, and Allison Davis. 1998. “The Role of Tenure Security and Private Time Preference in Neotropical Deforestation.” *Land Economics* 74 (2): 162–70.

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Green, D., K.E. Jacowitz, D. Kahneman, and D. McFadden. 1998. "Referendum Contingent Valuation, Anchoring, and Willingness to Pay for Public Goods." *Resource and Energy Economics* 20: 85–116.

Harrison, G., and J. List. 2004. "Field Experiments." *Journal of Economic Literature* 42 (4): 1013–59.

Harrison, G., J. List, and C. Towe. 2007. "Naturally Occurring Preferences and Exogenous Laboratory Experiments: A Case Study of Risk Aversion." *Econometrica* 75 (2): 433–58.

Holden, S.T., B. Shiferaw, and M. Wik. 1998. "Poverty, Market Imperfections, and Time Preferences: Of Relevance for Environmental Policy?" *Environment and Development Economics* 3: 105–130.

Levitt, S.D., and J.A. List. 2007. "What Do Laboratory Experiments Measuring Social Preferences Tell Us about the Real World?" *Journal of Economic Perspectives* 21 (2): 153-174.

Mulligan, C. 1996. "A Logical Economist's Argument against Hyperbolic Discounting." Photocopy. University of Chicago, IL.

Pender, J.L. 1996. "Discount Rates and Credit Markets: Theory and Evidence from Rural India." *Journal of Development Economics* 50: 257–96.

Shiferaw, B., and S. Holden. 1996. "Resource Degradation and Adoption of Land Conservation Technologies by Smallholders in the Ethiopian Highlands: A Study in Andit Tid, North Shewa." Discussion Paper D-31, Agricultural University of Norway, Ås. <http://www.umb.no/ios/Publikasjoner/DP'S-H~1/D-31HTML.HTM>. Accessed December 4, 2007.

Yesuf, M. 2003a. "Market Imperfections and Farm Technology Adoption Decisions: An Empirical Analysis." Photocopy. University of Gothenburg, Sweden.

———. 2003b. "Time Preferences of Farm Households in Ethiopia." Photocopy. University of Gothenburg, Sweden.

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