University of Cambridge

Part IIB, Paper 8: Development Economics I

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Supervision 3

Exercise 1: Hyperbolic Discounting and Savings

An individual with lifetime wealth W lives three periods. His utility in the first period is log $C_1 + \eta(logC_2 + logC_3)$, his utility in the second period is $logC_2 + \eta logC_3$ and his utility in the last period is $logC_3$, where C_i denotes consumption in period i, for $i = 1, 2, 3$, and $\eta < 1$ captures the dynamic inconsistency of optimal plans (an inconsistency the individual is aware of). The individual can borrow/save at zero interest rate.

1. What is the optimal consumption path, $\{C_1, C_2, C_3\}$?

2. Assume now that the individual has access to a committed account. That is, he can set aside some wealth that is inaccessible to self 2 but is available to self 3.

   (a) How much wealth will the individual decide to set aside?

   (b) What is the new consumption path, $\left\{\tilde{C}_1, \tilde{C}_2, \tilde{C}_3\right\}$?

   (c) As seen from period $t = 0$, is the introduction of the committed account welfare improving?

3. Assume now that the individual does not have access to a committed account but can buy an asset at time t = 0 that pays negative return ρ if sold in period 2 and zero return if sold in period 3[1]. This asset is referred to as an illiquid asset. Also, the individual cannot borrow in period 2 against income that he may have in period 3 (including that from the illiquid asset).

   (a) Suppose that the individual at time $t = 0$ invests in the illiquid asset the same amount he would set aside in a committed account. Can he achieve the same consumption path of the committed account scenario? Does your answer depend on the value of ρ? [An intuitive argument will suffice, no formal derivation needed].

[1] That is, if he buys x in period 1, in period 2 he chooses between receiving $(1-\rho)x$ in period 2 and x in period 3.

4. Suppose we added uncertainty to this model by assuming that the individual faces the possibility of a (positive or negative) shock to wealth in future periods.

   (a) Would this change the amounts set aside in a committed account or invested in an illiquid asset, if those were available? Why? [An intuitive argument will suffice, no formal derivation needed].

   (b) What does this tell you about the potential demand for savings accounts with "hard" commitment features? How about savings accounts with "soft" commitment features such as labeling the account (e.g. "Education only") or setting a goal amount?

Exercise 2: Commitment Devices and Savings

We review the evidence from a randomized experiment that tested whether individuals would open a savings account with a commitment feature that restricted access to their funds, and whether such individuals would save more as a result of opening the account. The authors partnered with a rural bank, randomly chose half of its clients and offered them a new commitment savings product that restricted access to deposits until a certain time or goal was reached. The other half was assigned to either a control group that received no further contact or a marketing group that received a special visit to encourage savings using existing savings products. The table below presents estimates of the impact of the savings product on financial savings held at the bank (both in the commitment account and in other accounts). Based on the information provided in the table, answer the following questions.

1. According to column 1, what is the impact of the savings product? What is the impact of the marketing treatment?

2. Why are the authors reporting the impact on total balance rather than the impact on balance in the commitment account? Would the interpretation differ? Why? Which other outcome variables would you want to look at, if any, in order to assess the impact on how much an individual saves?

3. Why is the impact analysis performed at both six and twelve months? What is the impact on total balance at 12 months?

4. Why do you think the authors set up a marketing treatment?

5. What is the information we obtain from column 2, and how does it differ from column 1? What do you conclude from column 2 on the effectiveness of the commitment savings product?

6. Focus now your attention on columns 5 to 8. They report estimates of the impact on the probability of increasing savings, and the probability of increasing savings by at least 20 percent.

   Interpret the results in each column 5 to 8 and, based on them, comment on what we can conclude on the effectiveness of the commitment savings product in increasing savings.

7. In all regressions, the independent variables are indicators for having been assigned to commitment-treatment and marketing-treatment. Why are the authors using those variables instead of indicators for having opened an account?

TABLE VI

IMPACT ON CHANGE IN SAVINGS HELD AT BANK

OLS, PROBIT

INTENT TO TREAT EFFECT	OLS				Probit			
Length	6 months		12 months		12 months			
Dependent variable:	Change in total balance	Change in total balance	Change in total balance	Change in total balance	Binary outcome = 1 if change in balance > 0%	Binary outcome = 1 if change in balance > 0%	Binary outcome = 1 if change in balance > 20%	Binary outcome = 1 if change in balance > 20%
Sample	All (1)	Commitment & marketing only (2)	All (3)	Commitment & marketing only (4)	All (5)	Commitment & marketing only (6)	All (7)	Commitment & marketing only (8)
Commitment treatment	234.678*	49.828	411.466*	287.575	0.102***	0.056**	0.101***	0.064***
	(101.748)	(156.027)	(244.021)	(228.523)	(3.82)	(0.026)	(0.022)	(0.021)
Marketing treatment	184.851		123.891		0.048		0.041	
	(146.982)		(153.440)		(1.56)		(0.027)	
Constant	40.626	225.476*	65.183	189.074**				
	(61.676)	(133.405)	(124.215)	(90.072)				
Observations	1777	1308	1777	1308	1777	1308	1777	1308
R^2	0.00	0.00	0.00	0.00				

Robust standard errors are in parentheses. * significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent. The dependent variable in the first two columns is the change in total savings held at the Green Bank after six months. Column (1) regresses change in total savings balances on indicators for assignment in the commitment- and marketing-treatment groups. The omitted group indicator in this regression corresponds to the control group. Column (2) shows the regression restricting the sample to commitment- and marketing-treatment groups. Columns (3) and (4) repeat this regression, using change in savings balances after twelve months as a dependent variable. The dependent variable in columns (5)–(8) is a binary variable equal to 1 if balances increased by x percent. One hundred and fifty-four clients had a preintervention savings balance equal to zero. Twenty-four of them had positive savings after twelve months. These individuals were coded as "one," and those that remain at zero were coded as zero for the outcome variables for columns (5) through (8). Exchange rate is 50 pesos for U.S. $1.

Exercise 3: Self-Control at Work

Read the article: Supreet Kaur, Michael Kremer and Sendhil Mullainathan, "Self-Control at Work", Journal of Political Economy, 2015, vol. 123, no. 6. Answer the following questions:

1. Payday Effect
   (a) What do the authors mean by payday effect?
   (b) How do they test for it?
   (c) What do they find?
2. Dominated Contract Effect
   (a) What do the authors mean by dominated contract effect?
   (b) How do they test for it?
   (c) What do they find?
   (d) Do we expect the dominated contract effect to change over the pay cycle? Why? What do the data say?
3. The authors examine whether there is heterogeneity in payday and contract effects.
   (a) Why is this relevant?
   (b) What do they find?
4. How is the choice of dominated labor contracts in this paper similar to the take-up of zero-interest savings account with positive withdrawal fees that we saw in other papers?
5. The authors argue that "Self-control problems change the logic of agency theory by partly aligning the interests of the firm and worker". What do they mean?
6. A large fraction of individuals in low-income countries are employed in agriculture. Are there features of the agricultural production process that create self-control problems? If so, what does this paper imply about productivity in agriculture?
7. The transition from agriculture to industrial production brings with it a shift in the organization of production. Can this paper speak to the increase in labor productivity that the Industrial Revolution caused? How?
8. Many people in the developing world do not have employment contracts and are instead self-employed. What does this paper imply for the effort and productivity of self-employed workers?

Exercise 4: Technology Adoption and Learning

Many agricultural technologies with demonstrated productivity gains have not been widely adopted in developing countries, and in Sub-Saharan Africa in particular. Existing literature has examined the role of (lack of) information about new technologies and documented the importance of social learning from peers in overcoming such information failures. While the existence of social learning has been well established in the literature, a natural next question is whether policies to promote new technologies can be improved by leveraging the power of social influence.

We review here one paper that explored such strategies. The paper used a randomized controlled trial to vary the dissemination method for two new agricultural technologies (pit planting and Chinese composting) across 168 villages in Malawi[2]. The experiment incorporated social learning in a standard agricultural extension policy where government hires external agents to communicate with farmers about agricultural practices.

The authors randomly assigned the role of main communicator about the new technologies to (a) government-employed extension workers (AEDOs), or (b) "lead farmers" (LFs) who are educated, are identified by the village as "leaders" and have more resources at their disposal to sustain experimentation costs, or (c) "peer farmers" (PFs) who are more representative of the general population in the village. In a control group of 48 villages, they did not disseminate any information about the new technologies.

Random subsets of the communicators were then offered performance-based incentives. The ministry expected recipient farmers to hear about the new technologies by the end of the first year, and make actual adoption decisions by the end of the second year. Therefore, communicators in the incentive treatment were told they would receive an in-kind reward if the average knowledge score among sampled respondents in their targeted villages rose by 20 percentage points.

1. What do you think is the rationale for each of the three communicator types? What can we learn by comparing their effectiveness?

2. What motivates the introduction of performance-based incentives? Are they addressing any market failure?

3. How do incentives affect the effort that different communicators exert and the results they obtain? Answer the question using specific results in Table 6 below. [Interpret the sign, magnitude and statistical significance of estimated coefficients and comment on whether results across communicator/incentive treatments are statistically different or not.]

[2]Pit planting involves planting seeds in a shallow pit in the ground, in order to retain greater moisture for the plant in an arid environment, while minimizing soil disturbance. Chinese composting is a post-harvest activity that involves using crop residues as composting material.

4. Consider now the effects on adoption. Answer the questions below using results in Table 7. Focus on whether the household reports that pit planting was used on at least one household plot (Columns 1 and 2). [Make specific reference to sign, magnitude and statistical significance of estimated coefficients to answer the questions.]

   (a) When communicators are not incentivized, do communication services help?

   (b) When communicators are incentivizes, do communication services help? Do "lead farmers" perform better than standard extension workers? Do "peer farmers" perform better than standard extension workers? How about the relative performance of "peer" and "lead" farmers?

   (c) Do incentives matter for standard extension workers? Do they matter for "peer" and "lead" farmers?

5. List some of the reasons why "peer farmers" may be particularly effective. Which data/strategies would you use to examine the relative importance of these reasons?

6. Let's now consider the theoretical framework that underpins this paper. Explain how you could extend the standard target input model we saw in class to capture:

   (a) The fact that a "communicator farmer" decides whether to transmit information about technology;

   (b) The role of incentives;

   (c) The difference between "peer"and "lead" farmers.

Table 6: Knowledge after one season among target farmers

	Dependent variable: Knowledge scores in household survey			
	Unincentivized communicators		Incentivized communicators	
AEDO treatment	0.195***	0.183***	0.0595***	0.0605***
	(0.0574)	(0.0477)	(0.0264)	(0.0248)
LF treatment	0.0850***	0.0685***	0.0757***	0.0780***
	(0.0315)	(0.0263)	(0.0256)	(0.0263)
PF treatment	0.0273	0.0302	0.127***	0.121***
	(0.0269)	(0.0238)	(0.0358)	(0.0337)
Pit planting district	0.190***		0.220***	
	(0.0254)		(0.0213)	
District FE	N	Y	N	Y
Additional baseline controls	N	Y	N	Y
Observations	2,699	2,323	2,696	2,370
R-squared	0.191	0.269	0.222	0.258
p-values for				
AEDO = LF	0.073	0.026	0.557	0.550
AEDO = PF	0.007	0.006	0.069	0.084
LF = PF	0.092	0.172	0.163	0.217
Mean of Dep. Var. for Control Villages	0.092	0.092	0.092	0.092
Mean of Dep. Var. for AEDO Villages	0.287	0.298	0.134	0.138
p-value for incentive = non-incentive				
AEDO			0.064	0.026
LF			0.914	0.725
PF			0.025	0.023

*** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered by village in parentheses. Excluded group is control villages. Additional baseline controls in columns 2 and 4 include household head gender, education and age, household wall and roof construction materials and primary source of water in dry and wet seasons, staple food consumed by household, number of animals and assets owned by household, primary sources of farming income (own farm, others' farm, own business), and whether anyone in the household had taken a loan in the preceding 12 months. Dependent variable includes zero scores for respondents who answered that they were not aware of the technology.

Table 7: Adoption after two seasons

Technology	Pit Planting						Composting	
Dependent variable	Used on at least one household plot in 2010/11		Directly observed usage on at least one plot in 2010/11		Plan to use next year		Household produced at least compost heap	
Communicator incentives	Non-incentive	Incentive	Non-incentive	Incentive	Non-incentive	Incentive	Non-incentive	Incentive
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
AEDO treatment	0.022***	0.055***	0.089***	-0.022	0.084***	0.036	-0.035	0.190***
	(0.010)	(0.019)	(0.014)	(0.053)	(0.036)	(0.032)	(0.073)	(0.099)
LF treatment	0.002	0.063***	0.0340	0.062***	0.021	0.115***	-0.049	0.144***
	(0.010)	(0.026)	(0.024)	(0.035)	(0.038)	(0.048)	(0.060)	(0.065)
PF treatment	0.017	0.102***	0.082	0.136***	0.082***	0.176***	-0.073	0.261***
	(0.013)	(0.019)	(0.073)	(0.037)	(0.040)	(0.041)	(0.057)	(0.061)
District FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	1,716	1,569	261	469	1,716	1,666	1,373	1,209
p-values for								
AEDO = LF p-value	0.067	0.722	0.006	0.229	0.095	0.071	0.871	0.622
AEDO = PF p-value	0.725	0.009	0.926	0.016	0.975	0.000	0.653	0.478
LF = PF p-value	0.246	0.045	0.498	0.088	0.143	0.179	0.667	0.076
Mean of Dep. Var. for Control Villages	0.009	0.010	0.009	0.010	0.087	0.087	0.246	0.246
Mean of Dep. Var. for AEDO Villages	0.052	0.033	0.0769	0.000	0.213	0.123	0.173	0.444
p-value for incentive = non-incentive								
AEDO		0.805		0.738		0.052		0.061
LF		0.024		0.329		0.080		0.051
PF		0.024		0.289		0.059		0.000

*** p<0.01, ** p<0.05, * p<0.1. Estimates in columns (3) and (4) are OLS coefficients; all other columns report average marginal effects from probit regression. Standard errors clustered by village in parentheses. Excluded group is control villages. Columns 3 and 4 use the random subsamples of households in PP villages for which direct observation was conducted (sample sizes are limited because it was expensive to do the direct observation. We allocated a larger sample size to incentive villages in order to validate the self-report data on the basis of which incentives were awarded).