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Reversal and magnitude effects in long-term time preferences: Results from a field experiment☆

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HIGHLIGHTS

- We use a MPL approach to elicit the long-term time preferences of French farmers.
- Contrary to the previous literature, we find a reasonable discount rate of 13.6%.
- Discount rates vary with the time delay, which supports a preference reversal effect.
- Discount rates increase with rewards, which contradicts the magnitude effect.

ARTICLE INFO

ABSTRACT

We use a multiple price list approach with real payments to elicit long-term time preferences on a sample of French farmers. Elicited individual discount rates vary with the time delay, which supports the existence of a reversal effect in long-term time preferences, and increase with rewards, which contradicts the usual magnitude effect finding.

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1. Introduction

Intertemporal choices defined as decisions involving tradeoffs between costs and benefits occurring at different times have constituted a central part of the economic analysis over the last decades. Understanding intertemporal choices is obviously of great importance to economists and policy makers because they drive many of households economic decisions such as saving, investing in education or health. Those choices are intrinsically linked to individual time preferences of which "discounting" is one attribute.

For a long time the literature on time preferences has been dominated by the exponential discounted utility model despite the various anomalies which have been documented. "Preference reversals" are the most important ones. They occur, for example, when a subject prefers receiving $100 immediately to receiving $120 in a year, but reverses preferences when both rewards are delayed by a common number of periods. Preference reversals reveal a time-inconsistent behavior, which conflicts which the

Table 1
Experimental design.

Task	Option A		Option B	
	Reward (in euros)	Delay (in years)	Reward (in euros)	Delay (in years)
1	400	1	400, 408, 416, 424, 432 440, 456, 472, 488, 504	2
2	400, 392, 384, 376, 368 360, 344, 328, 312, 296	0	400	1
3	400	1	400, 416, 433, 449, 467 484, 520, 557, 595, 635	3
4	400, 384, 368, 352, 336 320, 288, 256, 224, 192	0	400	2
5	200	1	200, 204, 208, 212, 216 220, 228, 236, 244, 252	2
6	200, 196, 192, 188, 184 180, 172, 164, 156, 148	0	200	1
7	800	1	800, 832, 865, 899, 933 968, 1040, 1114, 1191, 1270	3
8	800, 768, 736, 704, 672 640, 576, 512, 448, 384	0	800	1

exponential model. Another widely observed phenomenon is the "magnitude effect" which corresponds to a discount rate declining with the amount at stake (i.e., greater patience toward larger rewards).

Whereas important intertemporal choices are typically taken over long horizons (e.g., firms' investment decisions, households' education decisions), it is surprising to see that most empirical studies on time preferences (especially those using experimental approaches with monetary incentives) have considered short horizons only. Frederick and Loewenstein (2002) report that among 17 studies having used real payments for eliciting individual time preferences, only 3 feature payments delayed by 2 years or more (Pender, 1996; Warner and Pleeter, 2001; Harrison, 2002). More recent studies such as Benhabib et al. (2010) on U.S. graduate students, Tanaka et al. (2010) on Vietnamese households and Duquette et al. (2012) on U.S. farmers have even considered shorter horizons (respectively 6, 3 and 9 months).

In our paper, we elicit time preferences from a sample of French farmers using an experimental protocol with long-term payments (up to three years). The objective is twofold: provide a better estimate of time preferences in long-term decision making, and assess the existence of preference reversals and magnitude effects in that context.

2. The experiment

2.1. Experimental design and protocol

Our experimental design is similar to the one used by Tanaka et al. (2010) in their time experiment. However, rewards and delays were adapted. Our experiment consists of 8 tasks of the multiple price list (MPL) format. In each task, subjects are asked to make 10 choices between a small reward delivered today or in 1 year (option A) and a larger reward delivered later in the future (option B). Rewards vary between 148 and 1270 euros and the time delay varies between zero (immediate payment) and 3 years (Table 1). The implied exponential discount rates vary from 0% to more than 100% (in task 8). Monotonic preferences are enforced by asking subjects to provide a unique switching point in each task, i.e., the reward for which their preference switches from option A to option B.

The experiment was carried out from February to June 2010. It took place after a 2 h face-to-face interview aiming, *inter alia*, at

collecting farmer and farm data. The experiment lasted around half an hour and included a risk, an ambiguity and a time experiment. In this paper, we only analyze the results from the time experiment. A comprehensive introduction of methods and goals, as well as examples, were given to respondents prior to the experiment to ensure a good understanding. Subjects were provided with an initial endowment of 15 euros for their participation. After the subject had completed all three experiments, one choice item was randomly selected for real payment. However, respondents only received a predetermined percentage of the rewards (2%). They were advised of the procedure at the beginning of the experiment, but the extent of the reduction was not disclosed.[2]

We also explained how delayed payments would be implemented: "*If the experiment results in a future payment (up to 3 years), we will hand you a contract pre-signed by the funding organization (ADEPRINA). Without any action on your part, you will receive by mail a check on the due date (1, 2 or 3 years from now). The researchers involved in this experiment will ensure that payment dates will be respected. Payment is guaranteed by the duration of the research project (8 years as of 2009).*". This procedure is particularly adapted to long-term payments. First, it reduces the transaction costs for respondents. Second, it makes payments credible, and minimizes the role of risk aversion in discounting the future. It should also be noted that the project was lead by INRA, a well recognized French research institute, and known by most farmers.

2.2. Sample

We used a stratified random sample of farmers from 64 rural towns in *Bourgogne*, in the east of France. Farmers are socio-economically more diversified than students, which enhances the likelihood of detecting heterogeneity in behavior compared to standard laboratory experiments. In the same line, we chose an area where agriculture was diversified. We contacted 232 farmers by mail first, and followed up with a phone call a few days later. Among them, 85 subjects were excluded because of wrong activity

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[2] This approach was used by other authors dealing with large rewards in the laboratory, e.g., Abdellaoui et al. (2008). Another approach is to select randomly one respondent to be paid the full monetary reward. This is the approach followed by Harrison (2002).