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Subjective discount rates in the general population and their predictive power for energy saving behavior

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HIGHLIGHTS

- Results of a large panel study in Switzerland.
- Mean subjective discount rates in population are well above market interest rates.
- Subjective discount rates are moderately stable over four years.
- Theory suggests impact of subjective discount rates on energy saving behavior.
- However, subjective discount rates do not contribute to explanation of energy saving behavior.

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ABSTRACT

Why do people sometimes refrain from saving energy even if it would pay off in monetary terms? Subjective discount rates present one possible explanation for this lack of foresight, but little is known about their level and reliability in the general population. With regard to behavior, persons with lower discount rates are expected to accept additional costs upfront more readily than those with higher discount rates. Based on a representative nation-wide study, the Swiss Environmental Survey 2007, and a follow-up survey, our analyses reveal that on average subjective discount rates are well above market interest rates and moderately stable over a time interval of four years. Income and education are negatively correlated with discount rates. Contrary to expectations, we did not find convincing support for an impact of discount rates on energy saving behavior.

1. Introduction

Many decisions relevant to environmental conservation involve a trade-off between short- and long-term benefits. For example, when buying a washing machine, less expensive but less energy-efficient devices have to be compared to options with higher purchase prices and lower operating costs. In some of these situations, investments in energy efficiency would result in lower life-cycle costs. But even in such cases, the corresponding option is not always chosen. Hence, more money than necessary is spent on certain goods and services, and on the aggregate level a large potential for energy saving is lost. This lack of investments corresponds to the so-called "energy efficiency gap" (Howarth, 2004).

This paper focuses on one possible explanation for such a lack of foresight: subjective discount rates.[1] They capture the extent to which a person is present- or future-oriented. Daly and Farley (2011, p. 190) describe discounting as follows: "When evaluating present and future values, intertemporal discounting is the process of systematically weighting future costs and benefits as less valuable than present ones. […] The farther off in time that a cost or benefit occurs, the more we discount its present value." A high discount rate implies that someone is devaluing future rewards rapidly and thus is present-oriented. In contrast, a low discount rate signifies a higher valuation of future utility and therefore a higher degree of future orientation.

Environmentally responsible behavior that pays off financially often only does so in the long run. It therefore requires

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[1] An overview of alternative explanations is found in Howarth (2004). These include structural aspects (for example, a user/investor dilemma), hidden costs, uncertainty and computational limitations (see also DEFRA, 2010; Hassett and Metcalf, 1993; Jakob, 2006; Ott et al., 2005).

behaving in a future-oriented manner by delaying utility. For example, the purchase of a fuel-efficient car may initially be more expensive than a less energy-efficient vehicle, but it is profitable in the long term and at the same time causes a lower environmental burden. In such situations, persons with lower discount rates should more readily accept additional costs up front than those with higher discount rates since they put greater value on future utility.

While these theoretical considerations might be compelling, little is known about the level of subjective discount rates and their reliability (and hence temporal stability) in the general population. Most previous studies have been conducted with relatively small (student) samples and report average discount rates that are considerably higher than market interest rates (see Frederick et al., 2002). Furthermore, there are only a few studies analyzing subjective discount rates as predictors of actual behavior. So far the results have been heterogeneous.

The aim of this paper is fourfold: First, it reports subjective discount rates for a representative population sample in Switzerland. Second, a brief analysis of the reliability of discount rates is conducted. This is noteworthy not only because of the sample properties but also since the measurements were conducted four years apart. Third, the effects of different sociodemographic variables on subjective discount rates are analyzed by means of multivariate methods. Fourth, discount rates are used to predict self-reported behavior. This paper thus presents one of the rare examples that analyzes a representative general population sample and links discount rates to energy saving behavior.

1.1. Estimation of subjective discount rates in the general population

So far, only a few studies have reported discount rates for representative population samples. For example, Harrison et al. (2002) have reported a mean of 28% for a Danish sample and Epper et al. (2011) a median of 47% based on an online survey in the German-speaking area of Switzerland.

For student samples, a broad range of average discount rates has been reported. For example, in their classic study Benzion et al. (1989) report mean discount rates of 11–46% (average 21%) depending on framing, amounts and delays involved. There is no clear expectation as to whether the average discount rate of a student or a population sample should be higher. On the one hand, students are more educated than the average population and therefore presumably more adept in handling compound interest computations. On the other hand, they might also be more impulsive and hence more tempted to choose earlier payments rather than more delayed ones (see the next section for a discussion of the effects of education and age on discount rates).

When interpreting subjective discount rates reported by such studies, it should be kept in mind that the way in which discount rates are typically measured already implies there should be positive discounting and hence may bias discount rates upwards (Frederick et al., 2002): Most studies – including the ones cited above – use choice tasks to capture subjective discount rates (Frederick et al., 2002). Usually, respondents are given a choice between a smaller sooner reward (SSR) and a larger later reward (LLR) – for example, a payment of $100 in one year versus a payment of $125 in two years. In the above example, someone preferring the earlier payment is said to have an annual discount rate of at least 25%. As such a measurement simply yields a lower or upper bound on the discount rate, many studies use series of choice tasks varying the delay as well as the amounts of the reward involved. By doing so, the possible range of each person's discount rate can be narrowed down (for example, Kirby et al., 1999). The absolute level of discount rates found in such experiments depends on several factors (for comprehensive reviews see Frederick et al., 2002; Manzini and Mariotti, 2007). For example, lower discount rates are reported when higher amounts of a reward are involved (see Kirby, 1997; Percoco and Nijkamp, 2009). This “magnitude effect” is plausible if the respondents do not only consider the relative but also the absolute height of the amounts involved and behave accordingly (Loewenstein and Prelec, 1991).

A related phenomenon is increasing patience with delay (hyperbolic discounting). For example, a decision between a cookie tomorrow and two cookies the day after tomorrow is perceived differently from a decision between a cookie in 60 days and two cookies in 61 days. In both situations, the same additional waiting period (one day) is required to receive a larger instead of a smaller reward. However, the situations differ with regard to when this additional waiting period begins (in one or in 60 days). Hyperbolic discounting conveys that respondents are more likely to wait for LLRs in the second type of decision. The closer to the present the additional waiting period starts, the higher the discount rates are (Benzion et al., 1989; Thaler, 1981).

So far there is no conclusive evidence on whether discount rates are affected by whether hypothetical rewards, real rewards or rewards depending on a lottery are used (Coller and Williams, 1999; Frederick et al., 2002). It could either be argued that the possibility of actually receiving a reward increases its salience (see for example research on psychological distance; Trope and Liberman, 2010) and hence may lead to more impulsive choices, or it could be assumed that incentivized choices should yield lower discount rates as respondents might be more thoughtful when facing real rewards (see Camerer and Hogarth, 1999).

Apart from the methodological factors discussed so far, there are other possible confounding factors such as transaction costs, risk preferences and trust in the paying institution. To reduce these, studies with incentivized choices often use delayed rewards only (see Frederick et al., 2002; Harrison et al., 2005).

In our surveys, the subjective discount rate was measured twice in each wave. All measures are based on choice tasks, some of which were incentivized while some also included a front-end delay. This allows comparing them and testing for possible influences of the magnitude of the rewards, the delays involved and the presence of a lottery. However, one of the main goals of this paper is to estimate the average discount rate for a general population sample, in this case the Swiss population.

1.2. Reliability of subjective discount rates

Only a few studies have investigated the reliability or stability of discount rates. Typically, two measurements were conducted with a brief period between them, such as one week or three months, and the findings are based on non-representative and rather small (student) samples. Table 1 gives an overview of correlations between discount rates over time reported by previous studies. Most of them report moderate to high correlations, although the results vary both between and within the studies.

Unfortunately, none of these correlation studies is based on a representative population sample. The present paper will, however, report the test–retest reliability of discount rates over a