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Time discounting, present biases, and health-related behaviors: Evidence from Japan

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ABSTRACT

Human health is considered the outcome of intertemporal choices under tradeoffs between a small immediate reward and a larger delayed reward. Health-related behaviors are thus affected by personal time preferences. Based on an Internet-based survey conducted on Japanese adults, we contribute to the literature by incorporating the multifaceted nature of time discounting in an analysis of the associations between time preference and health-related behaviors. We find that, first, less patient respondents tend to exhibit worse health-related attributes. Second, present bias, which is measured by the degree of declining impatience, is positively associated with unhealthy behaviors for naïve respondents, who are unaware of their self-control problem. Third, such associations cannot be found in sophisticates, who are aware of that. As a policy implication, direct intervention policies, including "nudging," are more effective than a commitment device provision in correcting the unhealthy behaviors due to present bias. Fourth, the sign effect, wherein future losses are discounted at a lower rate than future gains, is negatively associated with unhealthy outcomes, although at weak statistical significance levels.

1. Introduction

Human health is considered the outcome of intertemporal choices under tradeoffs between a small immediate reward (e.g., eating high-calorie meals) and a larger delayed reward (e.g., enjoying future good health) or between an immediate payment (e.g., exercise or routine medical checkups) and a larger delayed payment (e.g., suffering from lifestyle-related diseases such as obesity or diabetes). Health-related behaviors are thus affected by personal time preferences (Grossman, 1972). This study conducts a nationwide Internet survey on Japanese adults to empirically examine how health-related behaviors are associated with time-discounting properties.

We aim to contribute to the literature in two ways. First, we incorporate the multifaceted nature of time discounting in an analysis of the associations between time preference and health-related behaviors. The personal discount rate level represents the decision maker's degree of impatience. As behavioral economics has found, personal time discounting can also be characterized by two other behavioral properties: (i) hyperbolic discounting, where a person applies a higher discount rate to immediate future choices than to distant ones, and (ii) the sign effect, where a person discounts positive payoffs more intensely than negative ones (Thaler, 1981; Benzion et al., 1989; Chapman, 1996). Previous studies have suggested that hyperbolic discounters sacrifice their future health outcomes for small immediate rewards (Ainslie, 1992; Gruber and Kőszegi, 2001; Chabris et al., 2008) and that

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people who display the sign effect are reluctant to bear the future cost of a lower health status in return for immediate gratification (Odum et al., 2002). However, studies have focused on only one of the time-discounting properties (i.e., either impatience, hyperbolic discounting, or the sign effect).[2] To examine how a health-related outcome is associated with time preference, the three time-discounting properties should be jointly incorporated because they are not mutually exclusive: hyperbolic discounters can be less patient in terms of the overall discount rate and may or may not show gain–loss asymmetry in discounting.[3] By jointly incorporating the three variables as regressors, we estimate the partial associations between each time-discounting property and health-related behaviors, enabling us to obtain unbiased estimates for the associations between time preference and health outcomes.[4]

Second, and more importantly, we examine how the associations between hyperbolic discounting and health-related behaviors depend on whether the hyperbolic discounters are naïfs, who misperceive their self-control problem, or sophisticates, who incorporate the effect of the problem into their decision-making process. Theoretically, naïve hyperbolic discounters are predicted to have greater inclinations toward ill health than both sophisticated hyperbolic and exponential discounters.[5] We empirically test this prediction by sorting hyperbolic discounters into naïfs and sophisticates according to the self-reported gap between planning for and actual behaviors during an onerous assignment.

The empirical question is particularly important when considering policies for unhealthy people because effective policies depend on how the associations between suboptimal health-related behaviors and hyperbolic discounting involve people's awareness of their own self-control problem. When suboptimal health-related behaviors under hyperbolic discounting occur in sophisticates as well as naïfs, providing commitment devices is an effective policy; when the behaviors occur only among naïfs, however, an intervention more direct than commitment device provision, including "nudging," would be necessary.

This study elicits the above-described measures of time-discounting properties (i.e., impatience, declining impatience, and the sign effect) from four hypothetical questions about intertemporal choices. Our discount factor is specified in the form of a "generalized hyperbolic discount function" (Loewenstein and Prelec, 1992), characterized by two parameters: the degree of hyperbolic deviation from exponential discounting (α) and the determinant of the intercept (γ). We assign these two parameters to each sampled individual based on his or her responses to hypothetical questions regarding immediate and distant future choices. Each individual's α thus measures his or her degree of declining impatience, which we find to be associated with health-related behaviors in the manner predicted. In addition, we construct each individual's degree of impatience by combining the inferred individual values of parameter γ with the other discount rates. The incidence of the sign effect is discerned via two discount rates for future receipts and future payments.

Our main findings show that, first, less patient respondents tend to exhibit worse health-related attributes. Second, steeply declining impatience or a present-biased preference are associated with unhealthy behavior and ill health for naïve respondents, whereas such associations cannot be found in sophisticates, implying that direct intervention policies, including "nudging," are more effective than a commitment device provision in correcting the unhealthy behaviors of hyperbolic discounters. Third, the sign effect is associated with health-related attributes, consistent with our prediction, although at weak statistical significance levels.

Following Fuchs (1980), the first to empirically relate the degree of individual impatience to health-related measures, many studies have suggested associations between time-discounting properties and health outcomes. Among health domains, the smoking decision is most frequently examined in relation to time-discounting properties. The literature finds that cigarette consumption is more salient for impatient people (Bickel et al., 1999; Mitchell, 1999; Baker et al., 2003; Reynolds et al., 2004; Ohmura et al., 2005; Ida and Goto, 2009) and hyperbolic discounters (Ainslie, 2001; Odum et al., 2002; Grignon, 2009; Ida, 2010). Recently, Kang and Ikeda (2014) have estimated the significant partial associations among three sorts of time-discounting properties—degree of impatience, the presence of present biases, and the incidence of the sign effect. They also find that naïve hyperbolic discounters smoke more than others, consistent with the theoretical prediction in Gruber and Kőszegi (2001, 2004) about the excess smoking behavior of naïve hyperbolic discounters. The evidence in this study supports their findings in the parameterized manner of the generalized hyperbolic discount function.

Previous studies reveal systematic differences in body habitus among different types of time-discounting properties. Since Komlos et al. (2004) suggested possible relationships between obesity and time discounting, the literature has shown significant associations of BMI with impatience (Smith et al., 2005; Borghans and Golsteyn, 2006; Ikeda et al., 2010; Dodd, 2014; Courtemanche et al., 2014; Rieger, 2015), hyperbolic discounting (Shapiro, 2005; Chabris et al., 2008; Scharff, 2009; Ikeda et al.,

[2] Grignon's (2009) study is a typical example: to compare smoking decisions among these types of time-discounting behaviors, Grignon classifies respondents into impatient, patient, *and* present-biased agents. Similarly, Chabris et al. (2008) focus on the association between the degree of declining impatience and health behavior without distinguishing the other time-discounting properties.

[3] In our dataset, 28.3% of respondents ($N = 543$) display below-average discount rates while showing both the hyperbolic property and the incidence of the sign effect.

[4] On the basis of a similar motivation, we also find partial associations among the three time-discounting properties with BMI, debt-holding behavior, and cigarette consumption. See Ikeda et al. (2010), Ikeda and Kang (2015), and Kang and Ikeda (2014) for further details.

[5] Indeed, for the smoking decision, Gruber and Kőszegi (2004) demonstrate theoretically that naïve hyperbolic discounters have a higher smoking propensity than sophisticated hyperbolic and exponential discounters, whereas the difference in smoking propensity between sophisticated hyperbolic and exponential discounters is relatively small.