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Age-Dependent Discounting and the Role of Imagination

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ABSTRACT: Discounting is a hallmark in economic theory and practice. Discounting future value of options determines human behavior and market pricing. Behavioral economics adds information about human discounting peculiarities, such as the present bias and hyperbolic discounting. An ample account of discounting research finds people focus on the present more than on the past and the future. Hyperbolic discounting describes the discounting function as hyperbola around the present moment. This tendency to overvalue the current now has been found to hold for human beings with applications to many domains. For looking back at previous times, the present bias helps cope with loss and sorrow. For planning the future, the present bias and hyperbolic discounting though are often found to lead to suboptimal choices over time. This paper presents evidence that human discounting varies by age. Data is presented about time perception of time use over time, which shows a varying pattern for different age groups. The paper then brings forward the need for further research on age-dependent discounting and discusses the role of imagination and changing one's time perspective throughout life. Elder people are assumed to live more in the past and thinking about future generations, hence a lower present bias is speculated to be present in elders.

KEYWORDS: behavioral economics, discounting, elder, future generations, hyperbolic discounting, present bias, time discounting, younger

Introduction

Economics and finance use discounting theory and applied models in order to determine the value of options over time. Throughout life, human discount future perspectives, which guides their behavior and choice. Neoclassical discounting models assumed a linear function of value estimation. The behavioral economics revolution shed light on hyperbolic discounting behavior of human beings. We tend to focus on the present and value estimations over time fade as the overall risk increases and uncertainty rises with distant time. This so-called present bias is well-established in behavioral sciences. Very many different applications of the present bias have been found in an ample account of laboratory and field experiments (e.g., Ainslie & Haslam 1992; Becker & Murphy 1988; Doyle 2013; Estle et al. 2007; Frederick, Loewenstein & O'Donoghue 2002; Green, Fry & Myerson 1994; Green & Myerson 2004; Kirby 1997; Kirby & Marakovic 1995; Laibson 1997; Loewenstein & Prelec 1993; Mazur 1987; Meyer 2013; Myerson & Green 1995; Rachlin, Raineri & Cross 1991; Sterner 1994).

A recent empirical investigation conducted using Amazon Mechanical Turk (MTurk) online that tested 565 subjects from around the world and found that different age groups make a difference when it comes to time allocation perceptions in the social sphere and the environmental domain (Puaschunder 2022). The findings are also the first introduction of a diversified discounting theory based on age (Puaschunder 2022).

This paper takes the finding of present bias and age-dependent discounting further by arguing that there may be systemic patterns of present bias throughout different lifetimes. Elder people may be more prone to evade the present moment and travel to their past selves mentally or be concerned about future generations. Future research could clarify if the present bias fades with age and elder are more likely to be less susceptible to a now focus. These findings could have powerful implications for societal planning strategies and intergenerational transfers.

This paper is structured as follows: First, the present bias will be described by empirical evidence. Second, the idea of age-dependent present biases will be presented. Third, research avenues will be prospected on age-dependent discounting. Fourth, the implications of potential elders' lower present bias will be discussed.

Present bias and hyperbolic discounting

The present bias is a behavioral insight that captures that human beings are more focused on the now than on their past or their future. Humans tend to live in the present, rather than being too concerned about their past or their future. This bias has been studied in the economic and finance discounting. So-called hyperbolic discounting describes the tendency that the focus is on the current moment and therefore the discounting function is in the shape of a hyperbola. Hyperbolic discounting leads to dynamically inconsistent preferences reverse as people are patient when deciding for the future and impatient when choosing for now (Hornsby 2007; Laibson 1997; McClure, Ericson, Laibson, Loewenstein & Cohen 2007; Meyer 2013; Reed & Martens 2011; Thaler 1981). Field and laboratory experiments provide widespread empirical evidence for hyperbolic discounting and self-control failures (e.g., Frederick et al. 2002; Hoch & Loewenstein 1991; Sen 1971, 2002a) – ranging from money management (Alberini & Chiabai 2007; Chabris, Laibson & Schuldt 2008; Coller & Williams 1999; Harrison, Lau & Williams 2002; Keller & Strazzera 2002; Kirby & Marakovic 1995; Laibson 1997; Laibson, Repetto & Tobacman 2003; Salanié & Treich 2005; Slonim, Carlson & Bettinger 2007; Thaler & Shefrin 1981; Warner & Pleeter 2007), financial benefits (Cairns & van der Pol 2008), credit card debt (Meier & Sprenger 2010; Shui & Ausubel 2004), medical adherence (Trope & Fishbach 2000), public health (Bosworth, Cameron & DeShazo 2006; Cameron & Gerdes 2003; Chapman 1996a; Duflo, Banerjee, Glennerster & Kothari 2010; Horowitz & Carson 1990; van der Pol & Cairns 2001), addiction (Badger, Bickel, Giordano, Jacobs, Loewenstein & Marsch 2007; Becker & Murphy 1988; Heyman 1996; Laux & Peck 2007; Madden, Bickel & Jacobs 1999; Petry & Casarella 1999), social security (Mastrobuoni & Weinberg 2009), fiscal policies (Keeler & Cretin 1983), commitment (Duflo, Kremer & Robinson 2008; Sen 1977, 2002b), health exercise (DellaVigna & Malmendier 2004, 2006), employment (DellaVigna & Paserman 2005), procrastination (Reuben, Sapienza & Zingales 2010), diet (Read & van Leeuwen 1998), subscription discipline (Oster & Scott-Morton 2005), animal care (Green & Myerson 1994; Mazur 1987), consumption (Read et al. 1999; Wertenbroch 1998), environmentalism (Puaschunder 2017) and social concerns (Puaschunder 2015).

Failures to disciplinedly stick to plans for giving in to immediate desires (Ainslie & Haslam 1992; Read, Frederick & Airoldi 2012; Strotz 1956) are explained by people caring less about future outcomes in the eye of future uncertainty (Luce & Raiffa 1957; Shackle 1955), perceived risk (Mas-Colell, Whinston & Green 1995), and transaction costs (Chung & Herrnstein 1967; Epper, Fehr-Duda & Bruhin 2011; Frederick et al. 2002; Kirby & Herrnstein 1995; Mazur 1987; Read 2001). Presenting temporal snapshots for now and later concurrently helps overcome myopia (Puaschunder & Schwarz 2012).

Empirical evidence for age-dependent discounting

An exploratory study gave quantitative indications of the time use in specific domains (Puaschunder 2022). Studies were conducted over the Internet using the website Amazon Mechanical Turk (MTurk), an online labor market to conduct surveys (Puaschunder 2022). General time-use questions were presented to subjects on Amazon Mechanical Turk in a Qualtrics questionnaire (Puaschunder 2022). After consenting to a standard informed consent form, all subjects were asked to report how much time they spend on (1) Social time defined as time spent with other people and engaging in social interaction, communication or activities with others; (2) Economic time defined as time spent using one's labor power and productive capacity, likely to

earn money and be or prospectively be a productive part of the labor force; (3) Environmental time defined as time spent outdoors in the open environment (Puaschunder 2022). The time use categories were scrambled (Puaschunder 2022). All subjects had questions about all time horizons of a day, week, month, year and a decade (Puaschunder 2022). Time frames and time use categories' display was scrambled between subjects (Puaschunder 2022). This behavioral survey thereby quantitatively depicted the percentage of time use estimates between categories and could differentiate age-related answers (Puaschunder 2022). Different mental temporal discounting tendencies could be estimated per day, week, month, year and over a decade (Puaschunder 2022).

The total sample comprised of 110 individuals (female=32 [29.09 percent], male=77 [70 percent], M_{age}=31, SD_{age}=8.55, Range=[18,64]) from around the world participated in the study online (Puaschunder 2022). As for the findings, when it comes to social time use, age groups appear to have a declining trend (Puaschunder 2022). The older individuals get, the less social time use they report (Puaschunder 2022). Economic time use appears to be declining by age groups as well, however the eldest age group from 58 years to 67 years reports more economic time use (Puaschunder 2022). The sample group of the eldest age group was yet small with an n=2 (Puaschunder 2022). As for environmental time, age groups have a somewhat declining trend, yet the group from 48 years to 57 years reports a higher environmental time use than the cohorts before – ranging from 38 years to 47 years – and after – ranging from 58 years to 67 years (Puaschunder 2022). The sample group of the second eldest age group ranging from 48 years to 57 years was yet small with an n=7 (Puaschunder 2022).

Overall, the results indicate age-variant discounting prospects given different time perception and time use varying by age. While the study was a first attempt to investigate the idea of age-dependent discounting, the research results only point at discounting variances between the ages. The sampling is rather small in some age groups and the focus of the study was not as targeted to derive concrete stringent hypotheses. Future studies on the role of age for discounting with particular attention to the present bias are warranted for.

Age-dependent discounting

Given the preliminary finding of age variant time use and time prospects, one can imagine that people differ in discounting based on age. During early childhood a present bias may be most accentuated for more impulsive thinking than during later stages in life. Youth and early adulthood may still be phases where the now is more important than a far distant future, the present bias may still be prevalent. As humans grow older, a more reflective thinking may set in and a broader time horizon may guide judgement and decision making. In the late phases of human life, the present bias may fade for a more rational and long-term perspective. Elder may spend less time in the social sphere, as the presented results indicated (Puaschunder 2022). They may therefore travel in time and remember their past more often than those who are living in the now with many external focus points and immediate social contacts. When approaching one's end, future considerations may become active, triggering thoughts about legacy, future generations and one's own place in a larger universe.

Finding age-dependent discounting could have many wide-ranging implications for many domains, such as intergenerational equity, retirement planning, health and well-being as well as marketing purposes. Age-variant outlooks on discounting would also be most valuable information for banking to optimize wealth-management throughout life. Family planning based on strategic foresight about needs and wants over the lifetime could be improved. If finding that elder do not suffer from a present bias, this would also open up specific training possibilities, in which elder are leading on choices over time. In the family compound, elders making less biases decisions would predestine them to be foresighted leaders of the household. Lastly, in the environmental domain, elder being particularly concerned about future generations makes them susceptible to ideas of sustainability and leaving a positive legacy for the future.

Discussion

The first preliminary results indicating age-variant discounting propensities warrant for future research on the topic. If finding that there are systemic differences in discounting over all age categories, this would hold invaluable insights on incentives to nudge individuals into benevolent time use and use external cues to motivate positive change. Age-sensitive societal benefits and communication strategies to enhance well-being over time could be derived from clear understanding of the different discounting preferences among various age groups.

The age-sensitive discounting preferences could be investigated by qualitative and quantitative research. Qualitative research could first be built on focus groups that discuss time prospects and be prompted to report on their daily time allocations. A diary technique study could help gain further insights into different time prospects of variant age groups. In particular, free association techniques could gain invaluable qualitative data that can reveal if different ages predestine to mentally live in the past or in the future.

Quantitative research could measure age-variant discounting propensities by complementing standard assessments of how different age groups value future rewards compared to immediate ones. Different methods could used to gain insights into age-dependent discounting propensities:

As a starting ground, meta-analyses and statistical modeling over multiple results obtained in the past would help to quantify the rate at which individuals discount future rewards. For instance, hyperbolic discounting models can help assess how the discount rate changes with the time delay. Further meta-analyses could reveal age-related propensities to live in the past or in the future by analyzing the amalgamated knowledge over previous studies that could hold an indication of age-variant time prospects.

Behavioral experiments could be conducted where participants make choices between smaller immediate rewards and larger delayed rewards and time prospects measured with a temporal discounting questionnaire, in which individuals indicate time preferences throughout the experiment. In the delay discounting tasks, participants choose between receiving a smaller amount now or a larger amount later. Here also, self-report measures, in which individuals indicate their preferences over time could be employed.

Surveys and questionnaires could be used to understand individual preferences regarding future rewards. Surveys can also assess various factors that influence discounting propensities, such as impulsiveness and future orientation. Thereby, cross-cultural studies should be employed to validate time preferences across cultures. Evidence exists that some cultures are more future-oriented than others. Investigating discounting preferences across different cultures and age demographics can reveal how societal factors influence age-variant discounting.

As one of the hallmarks in behavioral economics, economic games (e.g., the Ultimatum Game or Trust Game) can compare how individuals of different ages make decisions related to delayed rewards. Coupled with tracking people's thought process during the decision making over the rewards, economic games could reveal invaluable insights into how different ages make choices given their time prospect.

Longitudinal studies are the most thorough account one could take over the lifetime of a human being. Longitudinal investigations could track the discounting behavior of individuals over time to see how it changes as they age. This approach can provide insight into age-related trends in discounting in a very sophisticated way, allowing also for clarifying if life-changing events, such as marriage or parenthood, change the time prospect in a particular way.

Most novel ways to measure human behavior are neuroimaging techniques. For instance, fMRI or EEG study the brain activity associated with decision-making in relation to time. These methods could be used to track and monitor rewards in different age groups and thereby can help identify neural correlates of discounting behavior. Coupled with survey or interview techniques, one could derive foundational inferences of human nature throughout the ages.

When designing studies or assessments, it is important to consider factors such as socioeconomic status, cognitive development, and individual differences, as these can all influence discounting behavior across different ages.

Overall, elucidating how age, contexts and experiencing critical life stages influence temporal activity allocation choices holds manifold implications to improve decisions on education, health, asset management, career paths and common goods preservation throughout life. If systemic differences to decide based on different time prospects are found, this would have impact on temporal discounting research but also practical application to maximize utility not only on monetary allocations, but also social, economic and environment aspects of life.

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