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The Influencing of Aging on Time Preference in Indonesia*

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Abstract

Purpose: The influence of age on time preference is not identified in the usual cross-sectional analysis. This study aims to test whether age affects time preference after controlling for the effects of individual heterogeneity including cohort effects. **Research design, data and methodology:** Drawing on a nationally representative panel dataset of Indonesians, we estimate the effects of age on time preference after controlling for unobserved individual heterogeneity as well as potential cohort effects. We measure time preference exploiting information on two sets of multiple price lists: one for a one-year delay, and the other for a five-year delay. **Results:** When we controlled for time-invariant individual characteristics, including birth cohort effects in a fixed effects model, the older men and women were more patient in a linear fashion, particularly when the delay was longer. To highlight the importance of controlling for individual fixed effects, we repeated the specification without controlling for individual fixed effects in OLS or censored maximum likelihood regression; we found no relation between age and impatience in men or women and for a one or five-year delay. **Conclusions:** The older men and women are more patient, and time preferences are correlated with unobserved individual heterogeneity.

Keywords : Impatience, Time Preference, Discounting, Age, Indonesia

JEL Classification Code: C83, D12, D81, D91

1. Introduction

Intertemporal choices are important and ubiquitous in life. One often has to decide between smaller, immediate rewards and greater, later rewards (Keidel, Rramani, Weber, Murawski, & Ettinger 2021), which ultimately depends on individual time preference. The time preference can be pivotal as the decisions to delay gratifications such as educational investment, health investment, and retirement savings can affect welfare over the lifespan (van der Pol 2012; Finke & Huston 2013). Indeed, a micro study suggests that adolescent time preference predicts lifetime outcomes such as education, academic achievement, health, and lifetime income (Golsteyn, Grönqvist, & Lndahl, 2014).

Although time preference in economics is typically assumed to be time-invariant, and theories are built on the assumption, empirical evidence is mixed at best. Despite the early small-sample study showing stability of time preference across ages (Harrison, Lau, & Williams 2002), several larger-sample studies report changing impatience across ages (Reimers, Maylor, Stwewart, & Chater 2009; Tanaka, Camerer, & Nguyen 2010). One important limitation that is common in the empirical literature, however, is that the results were mostly derived from cross-sectional data where age effects cannot be separated from cohort effects.

In this paper, we formally test whether age affects time preference regardless of unobserved individual heterogeneity, and also investigate how time preference changes over the lifespan. Specifically, we construct a

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measure of impatience based on panel surveys from Indonesia. At the outset, we note that researchers from different disciplines have adopted different measures to describe time discounting, but we use impatience because it is intuitive and plain. A high level of impatience means a high level of impulsiveness, myopia, inability to delay gratification, and discount rate. For simplicity, we do not allow in the analysis for time inconsistency, which in principle may interact with impatience when it does exist (Yoon 2020).

When we controlled for time-invariant individual characteristics in a fixed effects model, the older men and women were found to be more patient in a linear fashion, particularly when the delay was longer. To highlight the importance of controlling for individual fixed effects, we repeated the specification without controlling for individual fixed effects in OLS or censored maximum likelihood regression; we found no relation between age and impatience in men or women and for a one or five-year delay.

This study is structured as follows: we briefly review the literature in Section 2, and describe the data and methodology in Section 3. Section 4 provides results, and Section 5 concludes.

2. Literature Review

In economics, impatience is typically assumed to be time-invariant, and theories are built on the assumption. In an early experimental study, Harrison et al. (2002) regressed discount rates elicited from 268 Danes on a set of covariates and found that the coefficients on age group dummies were statistically insignificant. A growing empirical evidence, however, casts doubt on this assumption.

Reimers et al. (2009) related a one-shot delay discounting measure to age for 42,863 UK residents aged 21–65 in a chart, which displayed an unambiguous negative relation between age and impatience. Tanaka et al. (2010) is of particular interest because they collected cross-sectional information on time preferences in Vietnam, which shared a similar level of income and a close geographical location with Indonesia. Although their focus was not on the relation between age and impatience, the older were less impatient in their results. There does not exist much research on children's time preference, but a recent study examined time discounting by children and adults in Slovakia, finding that actually fewer children were impatient than adults (Želinský 2021).

The relation between age and impatience may be curvilinear as in theories proposed by Rogers (1994) and Sozou and Seymour (2003). Read and Read (2004) performed an experiment on 123 peopled aged 19–89 in the UK. Their main result was that the middle-aged were most patient, followed by the young and the old, thereby supporting the theory of Sozou and Seymour (2003). Similarly, Richter and Mata (2018) analyzed survey data on 1,548 people aged 18-96 in Germany, finding that middle-aged adults were more patient that younger or older adults.

Green, Myerson, Lichtman, Rosen, and Fry (1996) suggested another shape of the relation, an L-shape. They combined their current results with those in their previous study (Green, Fry, & Myerson, 1994) and identified a pattern in which the discount rate precipitously dropped between age 20 to age 30 but then remained the same for age 70.

Jimura et al. (2011) reported that age differences in impatience depended on the domain. Therefore, in their results, old people (ages 60–84) were less impatient than younger people (undergraduate or graduate students) when the two groups discounted monetary rewards, but the age difference disappeared when they discounted the amount of juice.

Overall, no consensus has emerged on the relation between age and impatience. The mixed findings may reflect differences in the origin of the sample or methods to measure time preferences or to estimate the relation between age and impatience. An important limitation that these studies are commonly subject to is that the results were mostly derived from cross-sectional data even when age effects cannot be identified based on the cross-sectional data at the presence of time-invariant unobserved heterogeneity, including birth cohort effects. One notable exception is Bishai (2004), which analyzed longitudinal data and used risk preferences as a proxy for time preferences, but risk preferences are distinct from time preferences (Andreoni & Sprenger, 2012).

Moreover, relatively little attention has been paid to developing countries although the dramatically different social and economic environment may not permit generalization of results derived from developed countries. Becker and Mulligan (1997) argued that wealth, mortality, and other correlates including income, education, and religion may endogenously affect the degree of time preference. Indeed, Lawrence (1991) finds evidence that poor households are less patient than richer households, and the estimates are sensitive to the inclusion of demographic factors such as race and education. Also, Benjamin, Choi, and Fisher (2016) suggest that the association between preferences and economic behaviors in general may be mediated by religious identity.

In particular, heterogeneity in time preference within countries has often been reported, as was in van der Pol, Walsh, and McCartney (2015) who find evidence for

geographic heterogeneity in time preference across UK cities. The factors that explain differences across countries and regions may include political regime, climate, and historical origins. Friehe and Pannenberg (2020) found that residents of East Germany were much more patient than those of West Germany, suggesting that political regime may affects time preference.

Examining heterogeneity in time preference in Sri Lanka, Callen (2015) found evidence that workers who were exposed to tsunami in the past tend to be more patient, indicating that experiences may matter in shaping time preference. Galor and Ö zak (2016) found that regions where pre-industrial return to agricultural investment was higher were more patient, suggesting that time preference may transmit across generations through culture.

In this paper, we fill the gap in the literature by estimating the effects of age on the measure of impatience after controlling for the effects of individual heterogeneity (and hence cohort effects), as well as by employing a nationally representative longitudinal data for Indonesia, where the characteristics of the population have little in common with those of the most studied countries in terms of ethnicity, mortality, income level, education, religiosity, and so on.

3. Method

3.1. Data

We used the Indonesian Family Life Survey (IFLS), which is an ongoing, widely-used longitudinal survey. The IFLS began to collect information on more than 22,000 individuals in 7,224 households from 13 provinces in 1993 (IFLS1); the population of these provinces was representative of 83% of the Indonesian population in 1993. The IFLS sampling scheme stratified by provinces and then randomly selected 321 enumeration areas in the provinces and then households within each of the enumeration areas. A representative member of each of the households provided household-level demographic and economic information, and interviewers randomly selected household members and obtained detailed individual information. Five follow-ups ensued in 1997 (IFLS2), 1998 (IFLS2+), 2000 (IFLS3), 2007–8 (IFLS4), and 2014–5 (IFLS5), but information on impatience was available only in IFLS4 and IFLS5. Therefore, we analyzed these two follow-ups. Additionally, as mortality and impatience are related (Olsen, 1993), we analyzed only individuals aged 15–55 in IFLS4 to reduce survival bias. After excluding observations with missing values, we were left with 16,052 male observations and 19,656 female observations.

3.2. Variables

The interviewer elicited the respondent's impatience by asking two series of questions; Figures A-1 and A-2 in the appendix present the flow of the questions. For each question, the respondent chose a small, immediate (hypothetical) monetary reward or a later, larger reward. One series concerned a one-year delay, and the other a five-year delay. In both series, the small, immediate reward was Rp. one million, which is large given that the mean monthly expenditure per capita in urban areas in Indonesia was about Rp. 0.2 million in 2007 and Rp. 0.44 million in 2014. Answers to the questions generated five levels of impatience, and Table A-1 in the appendix lists the intervals of discount rates by using an exponential and a hyperbolic discount functions. Impatience is an ordinal variable, but three of the five intervals were open-ended. We thus treated impatience as a cardinal variable. Although this treatment is not ideal, it is second-best given the data limitation.

The respondent self-reported his or her age, and we initially used a continuous variable of age. However, Rogers (1994) and Sozou and Seymour (2003) predicted a nonlinear relation between age and impatience, so we later used a series of five-year age intervals. To alleviate omitted variable bias, we controlled for an array of variables: married (vs. unmarried), nonsmoker (vs. current smoker), BMI, hypertensive (vs. normotensive), three levels of self-reported health status, the natural log of earnings in the past month, no (vs. positive) earnings, risk preferences, and urban (vs. rural) residence. By controlling for risk preferences, we attempted to distinguish time preferences from risk preferences. Questions eliciting risk preferences were similar to those for time preferences; Sohn (2014, 2016, 2017) explained this variable in detail.

3.3. Empirical Model

We estimated the following specification:

$$impatience_{it} = \beta_1 age_{it} + X_{it}\beta_2 + u_i + \varepsilon_{it} \quad (1)$$

where $impatience_{it}$ refers to the level of impatience of individual i at time t, age to a continuous variable of age (subsequently, a series of age group dummies), X to a set of covariates, u to individual fixed effects, ε to the error term, and β_1 and β_2 are a coefficient and a coefficient vector to be estimated. β_1 is the independent variable of interest. It is uncertain whether β_1 is the same for both men and women, so we analyzed the specification by sex.

To highlight the importance of controlling for u, we re-estimated specification (1) by applying OLS to IFLS4. In

this case, we controlled for two important time-invariant individual characteristics: education and ethnicity. Although the results were similar whether these two were included or excluded, we presented the results after including them.

4. Results

The use of equation (1) is based on the premise that impatience is time-varying. We strengthened this argument by calculating the difference in impatience levels between IFLS4 and IFLS5. Figure 1 shows that a large proportion of respondents chose the same impatience level between the two survey years regardless of sex and length of delay. However, the proportion does not appear to be overwhelmingly large enough to assert that impatience is time-invariant; more than 90% of no change cases were generated by respondents who always chose small, immediate rewards in IFLS4 and IFLS5. The correlation coefficients of impatience levels between IFLS4 and IFLS5 tell the same story (Table A-2 in the appendix): for both delay series, the coefficient was at most 0.10. Given the evidence of changes in impatience, we proceeded with analysis, taking impatience as a time-varying variable.

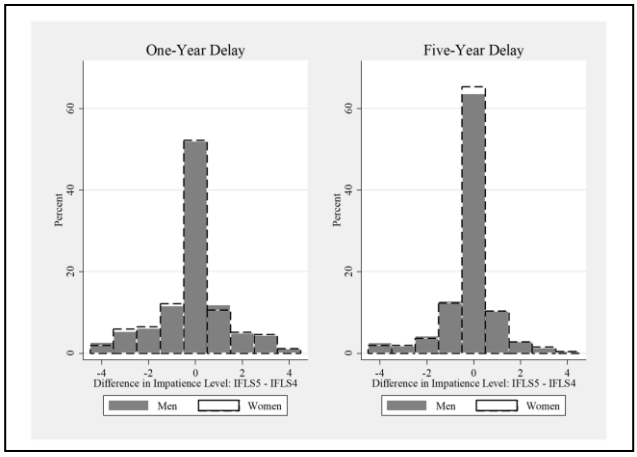
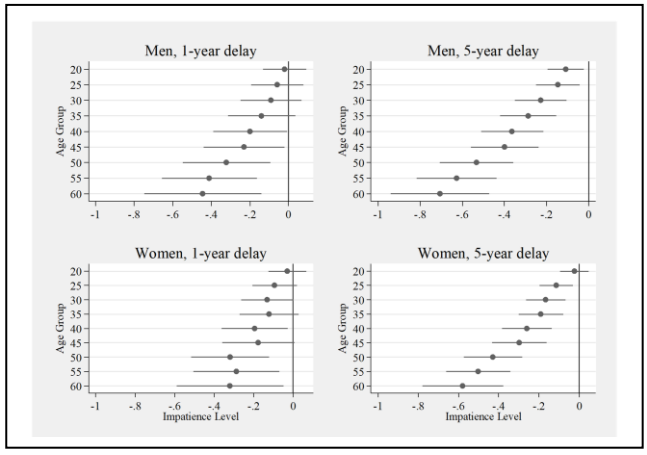


Figure 1: Changes in Impatience Levels Between IFLS4 and IFLS5

4.1. Main Results

We listed descriptive statistics in Table 1 and, to save space, only mentioned that most respondents were impatient and slightly more so for a five-year delay. More importantly, between the two survey years (i.e., as respondents aged), respondents became less impatient for both delays—this fact anticipates our formal results. Each of Tables A-3 – A-6 in the appendix presents four columns of results: with only age, only age group dummies, age plus X, and age group dummies plus X. Tables A-3 and A-4 concern men while Tables A-5 and A-6 concern women. Table A-3 and Table A-5 concern a one-year delay, and Tables A-4 and A-6 concern a five-year delay. For both sexes, controlling for X made β_1 smaller in absolute value to some extent for a one-year delay, but only slightly for a five-year delay. For example, among men, β_1 changed from -0.016 to -0.012 for a one-year delay and from -0.020 to -0.018 for a five-year delay; the corresponding figures for women were -0.016 and -0.008 for a one-year delay and -0.015 and -0.014 for a five-year delay (all statistically significant). Table A-3 lists β_2, and only the coefficients on risk preferences were statistically significant. Since this was generally true for the remaining cases, we did not list β_2 in the remaining tables.

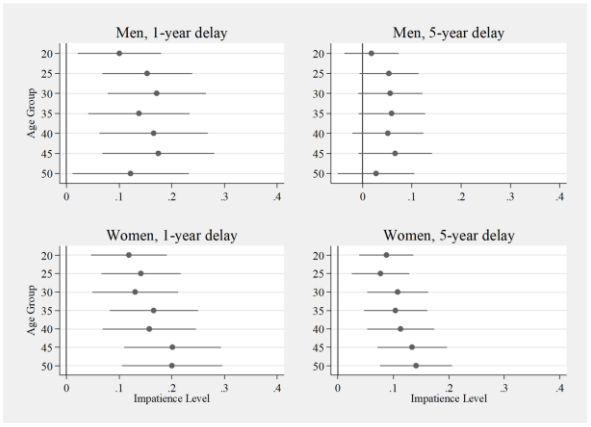


Note: We merged IFLS4 and IFLS5 and then analyzed the panel data. We controlled for all covariates listed in Column 4 of Table. Dots indicate coefficients, and spikes indicate the 95% confidence intervals.

Figure 2: Relationship Between Age and Impatience: Fixed Effects Model

Figure 2 summarizes the four cases when we adopted the age group dummies and controlled for X. Dots indicate the coefficients on the dummies and spikes indicate the 95% confidence intervals. Older men exhibited less impatience for both lengths of delay, but the relation was stronger for a five-year delay. Also noteworthy is that the relation was almost linear. Therefore, compared to men aged under 20, men aged 60 or older were 0.71 level less impatient. To provide a rough sense of this magnitude, we did the following calculation. Impatience levels 2 and 3 had closed intervals of discount rates, and the middle values of the intervals were 0.4 and 1.2, respectively. Therefore, a one level decrease in impatience is associated with a reduction of 80% points in discount rate; therefore, a 0.71 level is translated to 57% points.

The relation between age and impatience is weaker for women, but the pattern was similar to men's. Hence, for a one-year delay, four of the nine coefficients were statistically significant, and older women were less impatient, but the relation was not unambiguously linear. For a five-year delay, however, all of the nine coefficients were statistically significant, and the relation between age and impatience was negative and almost linear. Compared to women aged under 20, women aged 60 or older were 0.58 level less impatient.



Note: We analyzed IFLS4 and controlled for all covariates listed in Column 4 of Table plus education (no schooling/elementary school, junior high school, senior high school, or college or above) and ethnicity (Javanese vs. the rest). Excluding education and ethnicity did not change the main results. Dots indicate coefficients, and spikes indicate the 95% confidence intervals.

Figure 3: Relationship Between Age and Impatience: OLS

Figure 3 presents the corresponding results when we analyzed IFLS4 by OLS. The relation between age and impatience exhibited no clear pattern for men and a weak positive relation for women. However, the confidence intervals indicate that when the reference age group (ages<20) is excluded, age was not associated with impatience. We repeated the analysis by using the intervals of discount rates in Table A-1 and applying censored maximum likelihood regressions. The main results remained the same (not shown).

4.2. Issue of Attrition

In a large longitudinal survey like the IFLS, attrition is practically unavoidable. When we excluded observations with missing values and merged IFLS4 and IFLS5, 24.2% of respondents in IFLS4 were lost in IFLS5. We regressed the attrition status on an extensive set of covariates and found that middle-aged, female, Javanese, married, healthy, working people were more likely to be followed and college-educated, higher-earners were more likely to be lost (Table A-7 in the appendix). Therefore, our sample was a selected group, and care should be taken when relating our results to other environments. However, impatience was not related to attrition whether we used the one- or five-year delay questions. Furthermore, if attrition was not random but driven by time-invariant individual characteristics, our fixed effects model should address selection bias.

5. Conclusion and Implication

We applied fixed effects models to a panel dataset of Indonesians and related age to impatience. We found that older men and women were less impatient in a linear fashion and the relation was stronger for a longer delay. We also demonstrated the importance of controlling for time-invariant unobserved individual characteristics. Recall that our OLS results exhibited no discernible relation between age and impatience among respondents aged 20+, which is similar to some previous results.

Despite the findings above, now much is known about the mechanism for the relation between age and impatience. Some researchers, however, have offered helpful guidance to interpret our results. Löckenhoff et al. (2011) explained their negative relation between age and impatience by pointing out that older people can better regulate emotions and consequently tame the "hot" system. We conjectured another mechanism by judiciously interweaving other theories which were conceived to explain a curvilinear relation between age and impatience. Sozou and Seymour (2003) proposed a useful theory to understand the initial decline in impatience; that is, as individuals age, they become more secure in survival and discount the future less. Alternatively, Becker and Mulligan (1997) argued that children become more patient over time because they learn to imagine the future. However, their theories cannot explain the continuous decline because Sozou and Seymour (2003) and Becker and Mulligan (1997) argued that as mortality looms larger and fertility declines, people start heavily discounting the future. Trostel and Taylor (2001) agreed to this but relied on a decline in the ability to enjoy consumption. Rogers (1994) provided a complementary theory by stressing Darwinian fitness as the main driving force of time preference. It seems that impatience in older adulthood is little affected by an increase in mortality, a decline in fertility, or a deterioration in the ability to enjoy consumption. Instead, the motivation to bequeath (and therefore to increase reproductive fitness) appears to become strong enough to resist and eventually reverse an increase in impatience.

Policymakers can also use the insights and prevent time

inconsistency in policymaking particularly when the proportion and number of old people are growing in the world. Given that older people are more patient and will constitute more of the population in the future, stronger future-oriented policies now (e.g., ensuring sustainable health insurance and pension) will be supported later, albeit not necessarily now.

Our major limitation is a lack of a systematic theory to parsimoniously explain our and previous results. Also, provided that hypothetical rewards were used, these results may differ from those derived from real rewards. Some suggest that the two types of rewards produce similar results (Frederick et al., 2002; Johnson & Bickel, 2002; Madden, Begotka, Raiff, & Kastern, 2003) whereas others note that people were more impatient when facing hypothetical rewards (Coller & Williams, 1999; Epper, Fehr-Duda, & Schubert, 2011). As long as the difference was limited to a level effect as uncovered by Epper et al. (2011), our fixed effects models addressed this concern. Finally, although we controlled for time-invariant individual characteristics, time-varying omitted variable bias may remain. Adjusting for X hardly changed β_1 for a five-year delay, and most elements of β_2 were statistically nonsignificant. Therefore, omitted variable bias appears to be small at least for a five-year delay. We await replication studies to determine whether our results are specific to Indonesia or general to developing countries or even the world.

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