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Time preferences and community-based conservation: Insights from elephant patrolling efforts in Aras Napal, Indonesia

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Abstract

This study took place in an Indonesian village in Aras Napal, North Sumatra, which previously has been involved in an elephant patrolling conservation program to mitigate human-elephant conflicts and protect the neighboring Leuser National Park. The study examines the villager's individual and social time preferences, particularly comparing those who were actively involved in the elephant patrolling unit and those who were not. Quantitative data from a sample of 50 villagers was collected. The survey used comparable index measures for individual and social patience, consisting of subjectively self-assessed time preferences and revealed time preferences through staircase choice experiments. The results suggest that the villagers tend to be less patient for individual benefits than for social benefits. The finding was especially significant among those who had not been actively involved in the elephant patrolling unit. The study also showed that there is a discrepancy between the measures of self-assessed time preferences and revealed time preferences, indicating that the villagers act in discordance with their intentions for intertemporal choices. I argue that these findings are relevant for sustainable development policy and research as more people will be expected to face environmental poverty and degradation in the future. Studying time preferences in relation to conservation efforts will help us understand the difficulties in uniting farsighted environmental patience with the urgency for environmental services to satisfy immediate needs.

Key words: *Indonesia, individual time preferences, social time preferences, patience, community-based conservation.*

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List of Abbreviations

CBA	Cost-Benefit Analysis
DU	Discounted Utility
EPU	Elephant Patrolling Unit
IDR	Individual Discount Rate
LIF	Leuser International Foundation
LNP	Leuser National Park
PRTP	Pure Rate of Time Preferences
SDR	Social Discount Rate
SOC	Social Opportunity Cost
SRTP	Social Rate of Time Preferences

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1. Introduction

1.1. What are Time Preferences?

People in general prefer to receive benefits today rather than tomorrow. When faced with a choice between a smaller benefit today, or a slightly larger benefit at some point in the future, most people will choose the smaller benefit today. In other words – people tend to be impatient. How much so may depend on a number of personal circumstances: personal characteristics (such as short-sightedness, risk attitudes, tendency to follow habits or possess self-control), social preferences (for e.g. altruism, trust, equity, reciprocity, or fairness), socio-demographic factors (such as age, gender, income, or education level) or cultural influences, perception of time and one's self, and the conditions surrounding the intertemporal choice and the type of benefits accruing from it. By encompassing these factors, the rate of time preferences describes to what degree people prefer to receive immediate benefits rather than delayed.

Intertemporal decisions are not only made by individuals but frequently so by society as well. Many social policies require an intertemporal trade-off between something that is beneficial for society today and its present generations, and something that is beneficial for society in the long-run and for future generations. A commonly used example of this dilemma is policies on climate change, e.g. what is the optimal level of greenhouse gas emissions that will maximize social utility for present generations without sacrificing social utility for future generations. The benefits in this case are benefits gained by society as a whole, and if applying the same logic as for individual time preferences, these societal intertemporal decisions should reflect some underlying concept of social time preferences.

Are social time preferences different from individual time preferences? Is society as patient or impatient as individuals? And if so, should it be? Depending on how social time preferences are regarded by policy-makers, which often requires a normative standpoint, the consequences for their policy-making can be powerful. For the purpose of this study, the issue will be scaled down to focus on the individual and social time preferences of people rather than society. That is, do people have the same time preferences for their own individual benefits, as for social benefits received by everyone in their society? Moreover, how do we attempt to understand and measure people's true time preferences? These are the questions of departure for this thesis.

1.2. Research Questions and Objectives

An overarching purpose of this study is to be relevant for research and policy on development issues, by conducting empirical research on a specific case in a development context, more specifically the Elephant Patrolling Unit in Aras Napal, Indonesia. The study is designed to incorporate two key elements of global development, namely environmental conservation issues and community-based development. As a minor field study, it will additionally serve as an impact analysis of the community-based conservation effort that has taken place in Aras Napal, and thus contribute with research that is policy-oriented and with relevance for the targeted community.

The main research objectives of this thesis are twofold. First, it aims to investigate the differences between people's individual time preferences and social time preferences, and whether people value individual benefits differently from social benefits in their intertemporal decision-making. By focusing on the participation in a specific community-based conservation program, the intention is to better understand the connection between social preferences for community-based cooperative efforts, and time preferences. Second, this study aims to examine the differences between two separate measures of time preferences. Self-assessed time preferences and revealed time preferences will be studied jointly and in isolation, with the hopes of gaining a more holistic understanding of the concept of time preferences. Consequently, the research questions are as follows:

1. Is there a difference between social time preferences and individual time preferences for people who have been actively involved in a community-based conservation effort, compared to people who have not?
2. Is there a discrepancy between measures of self-assessed social and individual time preferences and measures of revealed social and individual time preferences?

2. Theoretical Framework

2.1. The Irrational Individual

Many economic models are based on rational choice theory, which assumes that humans are rational beings that in any given situation will make the most beneficial choice for her to maximize her own utility. In terms of time preferences, this implies that individuals possess the required amount of patience and farsightedness in order to make intertemporal decisions that will maximize utility today and in the future. However, this theory is often contradicted by situations when individuals behave irrationally in making intertemporal choices.

An intuitive way of thinking about a rational rate of time preferences is that it would be equal to a positive, constant marginal interest rate. Consider a marginal interest rate of 5%, which would make an amount of \$100 invested in the capital market compound to \$105 in one year's time. A rational individual would in this case be indifferent between receiving a monetary benefit of \$100 today or \$105 in one year, since either choice will in the end provide her with the same monetary benefit and there is no incentive for her to choose one option over the other. In reality, there exist a number of anomalies to this case and variations where people's time preferences for different benefits deviate from time preferences that would seem rational. Loewenstein and Thaler (1989) exemplifies with people sunbathing despite the future risk of skin cancer, revealing very high and myopic time preferences as they are giving up the benefit of health in the future for the benefit of sunbathing in the present. Another example but of negative time preferences is when tax authorities every year refund tax payers who have given up the benefit of keeping tax-money today, but instead essentially have granted the government an interest-free loan by waiting a year to be refunded (Loewenstein & Thaler, 1989, p.182).

A natural starting point for discussing irrational time preferences is to explore the psychology behind the irrationality of intertemporal decisions. Zauberman et.al (2009) argue that people's subjective perception of time might not be consistent with objective time, which partly can explain why most people are myopic with present-biased preferences and, depending on how a person perceives the time horizon, preferences that sometimes deviate from being positive and constant (p.545). As put forward by Strotz (1955), people might also behave inconsistently with their optimal plan for the future. After having committed to a decision in the present that

concerns the future, some people are more and others are less prone to act and behave in accordance with that plan as the future approaches (p.177). So, in addition to behaving in a way that might deviate from optimality, people might also perceive and assess their own time preferences differently than the time preferences revealed from their behavior and actions.

2.2. Individual Discount Rates

Individual time preferences are often used interchangeably with the term individual discount rates (IDRs), alluding to the fact that expected future benefits are discounted to their present value at a certain rate depending on individual time preferences. The literature on individual time preferences and IDRs is extensive. One of the early economists to write about time preferences was Irving Fisher, who identified four aspects of an individual's income stream that determines her impatience for income in different time periods: the *size* of expected real income, the expected *distribution in time*, the *composition*, and the *probability* (degree of uncertainty) of the income stream (Fisher, 1930, II.IV.24). For example, a higher probability of e.g. disease, accidents or disasters in the future would indicate that a stronger weight is put on present income rather than future income, implying a higher rate of time preferences and impatience. In addition to these factors, time preferences will vary depending on personal characteristics and attitudes, and can therefore vary between any two individuals even if they were to have the exact same income stream (Fisher, 1930, II.IV.10).

The essence of Fisher's contribution to the time preferences-theory, in line with rational choice theory, is the argument that the rate of time preferences is in equilibrium equal to the marginal interest rate. This is because time preferences will manifest themselves in the market place through the marginal rate of substitution between present and future consumption, which in turn will determine relative prices and the rate of interest (Fisher, 1930, II.V.8).

In 1937, drawing on previous theories on discounting and time preferences, the Discounted Utility-model was formulated by Paul Samuelson. The model states that the discount rate reflects intertemporal choices and preferences based on a utility function that describes a person's relative weights attached to well-being in different time periods (Frederick, Loewenstein & O'Donoghue, 2002, p.355). Many of the assumptions underlying the DU-model have later come to be questioned. One is the assumption of exponential discounting and

constant discount rates, which has been contradicted by both theory and empirical evidence of hyperbolic discounting and declining discount rates. Laibson (1997) argues that individual time preferences are more accurately modelled by applying higher discount rates for shorter time horizons, and lower discount rates for longer time horizons, rather than the same constant discount rate for all time horizons (p.445). In other words, an individual might prefer an income stream of \$100 today over \$120 tomorrow, but at the same time she might prefer \$120 one year and one day from now over \$100 one year from now, i.e. her time preferences vary depending on the time horizon of the intertemporal choice.

Despite the many new models that have been proposed following the DU-model, that in different ways attempt to deal with its weaknesses, the DU-model still provides a powerful tool for understanding the mechanisms behind discounting and intertemporal decision-making based on how people value benefits received at different points in time.

2.3. Social Discount Rates

Assuming that time preferences of individuals concern benefits received solely by the one individual, time preferences of society on the other hand concern benefits received by the entire society. Hence social time preferences and social discount rates should reflect at what rate society is willing to trade present benefits for future benefits. A difficulty when it comes to thinking about social time preferences is whether it should be considered an aggregate of all individual's time preferences for activities that concern the entire society, or time preferences of society as a separate unit represented by governments that can act more rationally than individuals (Feldstein, 1964, p.365).

In any case, social optimization might not be well captured with the individual discount rate since some mechanisms might be more relevant in social decision-making than in individual decision-making. Sen (1967) demonstrates in his Isolation Paradox-model how a socially optimal intertemporal decision can be achieved by enforcement of a collusive solution, which he exemplifies with the following savings problem. Consider an individual who is faced with the choice of increasing her savings or not, and that her decision will be based not only on the weight she puts on her own and her future heir's consumption, but as part of a society it will also be based on weights put on consumption of present and future generations in general. By

increasing her savings for future generations in society, including (but not restricted to) her own heirs, the individual would be better off. However, an individual in isolation would not make that decision unless it was compulsory to enter a social contract where every other member of society was forced to increase their savings as well (Sen, 1967, p.114). Due to this paradox, Sen argues that the market solution, i.e. the market rate of savings and the market rate of discount, cannot be assumed to be the optimal solution for society (Sen, 1967, p.123). This kind of inconsistency shows that certain values complicate and make it important to distinguish social time preferences from individual time preferences, such as collectivism, social trust and reciprocity.

The social discount rate (SDR) is the key factor used in cost-benefit analysis (CBA), when governments or other decision-makers need to evaluate projects with costs and benefits that will be generated for a long period of time. One example could be building a new road – a social project that will yield both future costs (e.g. maintenance of the road) and future benefits (e.g. from shortening travel-time to work) for society for many years to come. Applying a high SDR means that future costs and benefits will be discounted more heavily, making it worthwhile to invest in the present in building the new road. Applying a low SDR on the other hand might result in the road not being worth investing in at all, and the investment will be foregone. Many social projects tend to have public good or common good-characteristics, meaning that consumption and enjoyment of their benefits are non-excludable and either rivalrous or non-rivalrous. An example of a social public good project could be an investment in reforestation, since the benefits of the regrown forest is not exclusive for any particular member of society, and one society member's enjoyment of the forest does not hinder someone else's enjoyment of it. CBA for environmental policies dealing with e.g. climate change, biodiversity loss or nuclear waste will moreover include costs and benefits that typically cover a very long time frame, making the SDR even more critical in the calculations. Evidently, the choice of an SDR in CBA can have great consequences for society, both its present and its future generations. Yet there exists no consensus on what the exact size of the SDR should be, or how it should be determined.

Many governments in developed countries, as well as some other economic policy-makers such as the World Bank, advocate for a lower SDR than the market interest rate (Zhuang et.al, 2007, p.19). One argument for this is that the capital market suffers from imperfections, which makes it improper to use as a benchmark for evaluating public policy decisions. Another is that society

should be more farsighted and patient than individuals, with concern for future generations in addition to present generations. Many economists however have asserted that the idea of SDRs being lower than market rates is not justified. Baumol (1968) early on argued that there is no reason for such intergenerational distribution that makes present generations forego consumption today for the benefit of future generations, since the latter most likely will have a higher average GDP per capita and thus in any case will be more wealthy than present generations (Baumol, 1968, p.800). Instead of subsidizing the future, he advocates for allowing market forces to dominate.

The opponents of this argumentation emphasize the concern for environmental degradation that may result from using SDRs that are too high. The publication of the Stern Review in 2006 brought attention to this topic as the author argued against turning to the market rate when determining the SDR due to its inability to be considerate of climate change issues, and instead he proposed a near-zero SDR. The essence of Stern's argument is that the market is affected by imperfections such as environmental externalities, and therefore it bypasses the ethical considerations (e.g. responsibility towards future generations) that are essential when designing sustainable public policy to deal with climate change and greenhouse gas emissions (Stern, 2008, p.13). Stern has however been criticized for applying a prescriptive and normative approach rather than a descriptive and factual economic analysis. A low SDR may result in economic effects such as a sharp increase in savings and an unfavorable cut in global consumption in the future (Nordhaus, 2006, p.17). Nordhaus (2006) argues that climate change could be more efficiently targeted with direct policies rather than through adapting the social discount rate (p.19). Baumol (1968) did also acknowledge the market externalities from present generation's overuse of natural resources, leading to environmental degradation of an irreversible character. His view, similar to what Nordhaus concludes many years later, is to deal with the issue by using e.g. subsidies targeted straight at these sorts of public goods rather than lowering social discount rates (Baumol, 1968, p.801).

2.3.1. Estimating the SDR

The disagreement on how to treat social discounting is reflected in the two main approaches used by policy-makers to determine the SDR. The first is to use the Social Opportunity Cost (SOC) derived from marginal interest rates on investments in the private sector. This approach

presumes that capital invested in a public project could instead generate returns by being invested elsewhere, such as in a private corporate bond. The expected return on that investment is considered the social opportunity cost and therefore the SDR should be equal to the marginal rate of return to private investment (Zhuang et.al, 2007, p.3). As mentioned previously, an issue with this approach is that social preferences for public projects might not be properly reflected by market interest rates. Furthermore, due to the usually long time horizon of public projects, the market rates might not be able to take into account the aspect of intergenerational equity.

The second approach is to use the Social Rate of Time Preferences (SRTP), which usually results in a lower SDR than market interest rates. It is commonly based on one of two strategies: the rate of return to government bonds or some other low-risk market rate (Zhuang et.al, 2007, p.4), or the Ramsey formula, based on Frank Ramsey's theory of savings in which he introduced the rate of discounted utility as a component of a society's rate of income savings (Ramsey, 1928, p.553). The Ramsey formula is often used by governments, particularly in developed countries, to estimate SDRs in cost-benefit analyses. It is determined by a country's growth rate (g), marginal utility of consumption (η), and pure rate of time preferences (ρ) (Markandya & Pearce, 1991, p.142), and constructed as follows:

$$SRTP = \rho + \eta \cdot g$$

For the purpose of this study, focus will be on the factor (ρ), i.e. society's pure rate of time preferences (PRTP). In the Ramsey formula, it generally includes two parts: level of impatience (similar to individual impatience but instead some societal impatience), and catastrophe risk (e.g. risk of death of the members of society estimated by mortality rate, or risk of human extinction in society) (Zhuang et.al, 2007, p.5). A PRTP equal to zero would be fully considerate of intergenerational equity, with utility of present and future generations treated equally since society would have zero impatience and zero concern for future risks. This is sometimes argued for especially in environmental discounting, where social projects will affect many future generations to come (see for example, Cline, 1999; Cowen & Parfit, 1992; Hellweg, Hofstetter & Hungerbuhler, 2003). There are however alternatives on how to incorporate intergenerational equity into the SDR even if not assuming a PRTP equal to zero, such as adding an intergenerational weight to the estimation. This would make it possible to be explicitly mindful of intergenerational equity no matter what approach is used to determine the SDR (Scarborough, 2011).

2.3.2. The SDR in Developing Countries

For developing countries, the SDR tends to be higher compared to the SDR in developed countries, since most developing countries use the SOC-approach (Zhuang et.al, 2007, p.22). If using the SRTP-approach and the Ramsey formula, the SDR would still presumably be higher since expected economic growth tends to be higher in developing countries (Halsnæs et.al, 2007, p.136). Looking at the PRTP specifically, it may intuitively be higher for poor countries as more weight is put on satisfying immediate needs that are more urgent for society today and might be prioritized over having a long-term perspective. The relationship between poverty and impatience has been frequently studied for individual time preferences, and is often concluded as summed up in a model by Becker and Mulligan (1997): “wealth causes patience” (p.752).

A society basing its intertemporal decision-making on this line of reasoning might however be caught in a vicious cycle. A high SDR might incentivize exploitative use of natural resources in order to satisfy the immediate needs, which would increase the risk of environmental degradation and lack of natural resources in the future. Sustainable use of environmental resources would instead require more of a long-term perspective, for example by applying lower SDRs (Markandya & Pearce, 1991, p.142). Additionally, there is no absolute agreement on a causal link between poverty and higher rates of time preferences. Moseley (2001) puts forward a theory from evidence on African household’s farsighted behaviors in regards to food security and famine warnings, concluding that in some cases there may in fact exist low rates of time preferences among people living in poverty. This might call into question the assumption of poor people and developing countries being more impatient, and the policies that follow from this belief.

3. Previous Studies

3.1. An Overview

Given the extensive amount of empirical research on time preferences and discount rates, this section will only touch on some of the previous studies relevant for the topic of this study. One of the more comprehensive reviews of the empirical research on individual discount rates,

consisting of both experimental elicitations and field studies, is done by Frederick, Loewenstein and O'Donoghue (2002). The compilation of 42 studies reveals a range of discount rates from as low as -6% to as high as infinity (p.377). Another compilation but of social discount rates used by 16 countries' governments or agencies, both using SRTP- and SOC-approaches in their estimations, reveals a range of applied SDRs between 0,5% (as the lowest value in a sensitivity analysis by US Environmental Protection Agency) and 15% (the Philippine government) (Zhuang et.al, 2007 p.17-18). In other words, there is little unity in previous estimations and applications of discount rates.

Individual discount rates tend to vary with personal variables such as age, gender, education or income. Harrison, Lau and Williams (2002) used a nationally representative sample of the Danish population and found e.g. that individual discount rates decline with age, income and education, that retired people have higher discount rates, and that people with employment have higher discount rates than those unemployed (p.1616). Furthermore, there are studies looking at the direct effect of e.g. education on time preferences, for example Meier and Sprenger (2013) finding that people improving their financial literacy by participating in a financial education program were more patient with lower discount rates compared to those who did not participate. There are also studies looking at how cultural aspects affect time preferences. Wang, Rieger and Hens (2016) conducted a survey in 45 countries, studying how time preferences vary between countries depending on cultural factors like subjective cultural belonging, religion, individualism versus collectivism, and mentality about the future. In short, there have been plenty of previous studies on how time preferences vary depending on sociodemographic factors, personal experiences, and cultural or historical circumstances.

Most previous studies on time preferences focus on eliciting revealed time preferences, through either experiments or observing real-life behavior, and there are less previous studies on comparing these with self-assessed or stated time preferences, i.e. attitudes and perceptions of how people make intertemporal choices. Tabi (2013) does attempt to bridge the two types of measures by using survey questions both to reveal individual monetary time preferences, as well as to capture attitudes and self-assessed social time preferences for environmental and health benefits (p.8). However, she emphasizes the inadequacy of existing methodological frameworks in attempting to compare these measures properly. There are also studies done in other research fields, such as marketing research, on comparing revealed preferences and self-stated preferences but without incorporating the aspect of time, for example Brownstone, Bunch

and Train (1999) studying preferences for alternative-fuel vehicles. Other studies attempt to contrast time preferences with measures of e.g. self-control and impulsivity, mainly when looking at health decisions, for example Khwaja, Silverman and Sloan (2007) who found that these were more strongly correlated with smoking decisions than they were with experimentally elicited time preferences.

Since benefits may come in different forms than monetary, a person's individual time preferences may vary for different types of goods and benefits. Chapman and Coups (1999) compared time preferences for monetary benefits and health benefits (from avoiding the flu) with the acceptance of influenza vaccination. They found a slight relationship between vaccine acceptance and monetary future-oriented time preferences, but not with health time preferences. For social goods with environmental benefits, such as improved air quality in a city after building bike lanes, social time preferences may also be different from individual time preferences for e.g. a private good with pure monetary benefits. An empirical study done by Luckert and Adamowicz (1993) showed that social rate of time preferences for forest provision was lower than market interest rates on capital, indicating that a lower SDR better describes social welfare maximization for this environmental good than discount rates determined by the capital market (p.17). Faccioli et.al (2016) found that respondents in their survey were equally concerned about environmental sustainability for present generations as for future generations, when asked about their preferences for a conservation policy that would prevent a decline in a specific bird species in Mallorca, Spain. The authors argue that this result is relevant since sustainability concerns are frequently overlooked by research done on social time preferences, despite it being a matter of importance for many people as well as environmental policy-makers who stress the need for long-term sustainability. Both studies mentioned above concentrate on social time preferences of the individual for environmental benefits, although they do not contrast them with elicitation of individual time preferences for monetary benefits, as will be attempted in this study.

3.2. Studies in Developing Countries

A central topic for empirical research in developing countries is to test the theory of a relationship between poverty and impatience. A review done by Cardenas and Carpenter (2008) collects the results of field studies done in developing countries on time-, risk-, and social

preferences. For time preferences, they conclude that both the methods used and results attained are mixed, and there is no consistent evidence of poverty being associated with higher levels of impatience (p.358). Tanaka, Camerer and Nguyen (2010) on the other hand conducted experiments on risk and time preferences in Vietnam, and found that both household income and mean village income were negatively correlated with individual discount rates (p.567). Kirby et.al (2002) conducted a study on Tsimane' Amerindians in the Bolivian rainforest, and found similarly that discount rates were negatively correlated with recent income, as well as educational level and literacy, and positively correlated with age.

There are some interesting studies done in developing countries testing the relationship between time preferences and negative shocks, mainly environmental shocks. One study done in Thailand looked at how the tsunami in 2004 relates to time preferences, showing that individuals were more impatient after having experienced the natural disaster (Cassar, Healy & von Kessler, 2017). Bchir and Willinger (2013) conducted a study with similar results, finding that people living in poverty that were exposed to mudflows from a volcano in Peru were more impatient and risk-seeking compared to those who were not exposed. Although at the same time, they found that for people with higher income there were no differences in risk and time preferences between the exposed and unexposed. The result can thus be understood as having a lower income is associated with higher sensibility to negative environmental shocks in terms of being more impatient. This research topic will presumably become increasingly important as the negative environmental effects of climate change is predicted to be more damaging in areas already suffering from environmental vulnerability and poverty.

3.3. Contributions of this Study

This study aims to target the gaps in previous empirical research in three ways. First, it will attempt to contrast individual time preferences with social time preferences by using measures of the two that are comparable, rather than studying them in isolation of one another. The lack of this type of study in previous research may partly be due to the difficulties of defining and measuring social time preferences, and in particular in a way that makes it comparable to individual time preferences. For this reason, the social time preferences measured in this study will be derived from the perspective of the individual and how the individual choose between intertemporal social benefits, rather than attempting to estimate some aggregated social time

preference of the entire society. The idea is to combine two research areas that have been thoroughly studied already – social preferences and individual time preferences – to study the concept of social time preferences.

Second, this study will look at the relationship between community cooperation for environmental services and time preferences, by focusing on a specific community-based conservation program in a specific Indonesian village. To the author's knowledge, there is a limited amount of previous empirical research on the relationship between participating in social projects and social time preferences.

Third, this study hopes to add to the research field in the intersection between psychology and economics, by comparing people's self-assessed time preferences with their revealed time preferences. Most previous economic research have opted to use methods that measure revealed time preferences, whereas this study hopes to scrutinize the strengths and weaknesses with both notions of time preferences, and the context in which each measure can be used.

4. Case Study: Aras Napal, Indonesia

The setting for this minor field study is a rural village in Aras Napal, situated in the region of North Sumatra in the western part of Indonesia. The village lies on the border of the Leuser National Park (LNP), with the Leuser Ecosystem identified as one of the top 25 most critical ecosystems in the world. Approximately 4 million people in the regions Aceh and North Sumatra are dependent on its ecosystem services, such as water supply and prevention from floods and draughts. The LNP has an additional national and global value in terms of e.g. carbon sequestration and biodiversity. The Leuser Ecosystem is unique in the sense that it is the only remaining ecosystem where the orangutan, the tiger, the elephant, and the rhinoceros, all share the same habitat (Baabud et.al, 2016, p.17).

Elephant patrolling has been in place in Aras Napal for more than 20 years, but the Elephant Patrolling Unit (EPU) run by the Leuser International Foundation (LIF) was introduced in 2005, initially funded by the World Bank (Leuser Foundation, 2014). The main intention of this community-based conservation project was to patrol the border between the village and the

forest area, with the help of trained elephants and their *mahouts* (elephant riders). Due to lack of financial resources the EPU was forced to stop operating in Aras Napal in the beginning of 2017, and the elephants had to be relocated.

The EPU filled multiple purposes and generated benefits for the community in several ways. First and foremost, it mitigated human-elephant conflicts by securing the border to the LNP. The village in Aras Napal is mainly made up of small-scale farmers, and living right next to the national park means being heavily exposed to attacks from wild elephants on both crops as well as on the villagers themselves and their homes. The presence of the EPU decreased the risk of incidents of this sort. The EPU also decreased illegal activities in the area, mainly illegal logging but also encroachment and poaching of endangered animals, since the patrolling worked as surveillance of the forest. The EPU run by the LIF furthermore involved representatives from the government forestry agency, which put an additional pressure on those who would consider conducting illegal actions in the forest. Finally, the EPU provided the community with economic benefits from local tourism, such as school classes on field trips visiting the elephants. This would create job opportunities for e.g. local tour guides and boatmen for transportation on the river. Additionally, the EPU could provide possibilities for an expansion of ecotourism by connecting Aras Napal to nearby locations like Tangkahan and Bukit Lawang – both already well-established tourist destinations in Sumatra. Elephant patrolling of the forest could be combined with ecotourism activities such as elephant riding from one location to another, and tourist accommodation could take the form of home-stays which would further bring economic benefits to the community.

5. Methodological Framework

5.1. Procedure and Sample

This minor field study was constructed as a quantitative field experiment targeting a specific population that was chosen for its relevance to economic development issues and environmental conservation. The field work was carried out in December 2017 in a village in Aras Napal, inhabited by a total number of 70 households from which a convenience sample of 50 respondents was selected. The data was collected by doing face-to-face interviews with

respondents who agreed to participate when they were approached by the research team in their homes or in the village center. The two interviewers were fluent Bahasa Indonesia speakers, and they used a separate printed questionnaire for each respondent from which they read the questions out loud and checked the boxes that matched the respondent's answers.

Due to the experimental character of the study, the survey targeted one treatment group and one control group. The treatment group consisted of villagers who have been actively involved in the elephant patrolling unit in the village. The control group consisted of villagers who have not been actively involved, although most of them still have some experiences with the EPU since it has been a community-based program with the purpose to be beneficial for the entire community. In order to separate the treatment group from the control group, the respondents themselves were asked to determine in the questionnaire whether they have been actively involved in the EPU or not (due to the difficulties for an outsider to accurately make this distinction). This process generated two roughly equal groups (19 actively involved, 31 not actively involved).

5.2. Survey Instrument

The methodological approach used in this survey is largely based on the following paper: *Falk, A., Becker, A., Dohmen, T. J., Huffman, D., & Sunde, U. (2016). The preference survey module: A validated instrument for measuring risk, time, and social preferences.* The authors have streamlined a survey module in an attempt to standardize a measurement of preferences, in order to create a wider comparability in the research field since there exists a great variety of measures and results today (Falk et.al, 2016, p.2).

For their measure of time preferences, the authors conclude that previous research has shown that both quantitative measures of time preferences (choice experiments designed to reveal actual time preferences, often for monetary benefits) and qualitative measures of time preferences (subjective self-assessment of willingness to choose between benefits at different points in time, in a different context than financial) are useful in trying to capture the mechanisms behind intertemporal decision-making, and the measures work well as complements (Falk et.al, 2016, p.13). For this reason, they have combined the two approaches to create a multi-dimensional measurement of a person's degree of patience. The quantitative

measure aims to elicit time preferences through a staircase procedure originally used in the field of psychophysics. The benefits are expressed in monetary amounts, and the respondent is faced with binary choices of a monetary benefit today or in 12 months, in order to identify her revealed time preferences: “Please consider the following: Would you rather receive amount x today or y in 12 months?” (Falk et.al, 2015, p.7). The qualitative measure consists of a self-assessment question with benefits expressed in a more general, non-financial way, to capture the respondent’s subjective perception of her own degree of patience: “How willing are you to give up something that is beneficial for you today in order to benefit more from that in the future?” (Falk et.al, 2015, p.7). The two measures will together determine a person’s degree of patience, in this paper referred to as Individual Patience.

The original framework has been slightly adjusted and complemented to fit the purposes of this study. The monetary amounts that were used have been brought from the Global Preference Survey conducted in Indonesia in 2012, as one of the total 76 countries in the survey (Falk et.al, 2015). The amounts are determined by the same share of Indonesian median household income expressed in local currency (Indonesian rupiah) as the share of German median household income where the survey module was first developed (Falk et.al, 2016, p.20). In addition to using the staircase procedure and the self-assessment question for individual time preferences, this survey used a second staircase procedure and self-assessment question of identical structure, but phrased to capture the respondent’s social time preferences instead. This second combined measure is referred to in this paper as Social Patience.

The monetary amounts were identical for the individual and social staircase procedure, but in the social staircase they were expressed as benefits received by the entire community through money spent on re-instating the EPU that was previously in place in the village. As for the social self-assessment question, it was phrased in terms of community-based benefits and trade-offs between present and future generations, rather than intertemporal trade-off of individual benefits. The full questionnaire (see appendix A) thus consisted of three parts: (i) background variables, (ii) self-assessment questions relating to individual benefits, social benefits, and willingness to take risks, (iii) staircase-procedures for individual time preferences and social time preferences respectively (see appendix B for an illustration of the staircase procedure).

5.3. Data Preparation

Based on the answers to the self-assessment questions and the staircase procedures, each respondent would get one calculated index-score measuring his or her Individual Patience, and one calculated index-score measuring his or her Social Patience. Z-scores were computed for standardization purposes and weighted to create the indices, using the weights validated in the original survey module that are equal to 1 (Falk et.al, 2015, p.40). The indices were thus calculated according to the following formulas:

$$Patience_{ind} = 0.7115185 \times Z_{Staircase_{ind}} + 0.2884815 \times Z_{Self\ assessment_{ind}}$$

$$Patience_{soc} = 0.7115185 \times Z_{Staircase_{soc}} + 0.2884815 \times Z_{Self\ assessment_{soc}}$$

The z-scores were computed using the observed values ranging from 1 to 8 for the staircase procedures, and 1 to 5 for the self-assessment questions, as follows:

$$z = \frac{(x - \mu)}{\sigma}$$

where x is the raw score for each measure, μ is the sample mean, and σ is the sample standard deviation. After transforming the raw data and computing the indices, the data over individual patience and social patience consists of ordinal-level data where a higher score indicates a higher degree of patience (low rate of time preferences), and a lower score indicates a lower degree of patience (high rate of time preferences). Due to the transformed data being of ordinal scale and not assumed to be normally distributed, only non-parametric statistical test is performed. A 95% level of confidence is used for all tests.

The data had no missing values for the preference-measures, and only two missing values in total, both for the background variable asking for number of children in household. This was dealt with by imputing the median value for that same variable (which was equal to 1).

5.4. Limitations

Due to limitations of time and resources for this study, and also to be considerate of the context in which the research was carried out, certain aspects of the survey have been scaled down in accordance with recommendations from the creators of the survey module that was utilized: “Particularly if time constraints are severe or if respondents have limited cognitive capacity, an even simpler and shorter module seems useful, even though it might come at some costs in terms of lower explanatory power” (Falk et.al, 2016, p.19). For the self-assessment questions, the number of response alternatives was reduced from a scale of 0 to 10 to a scale of 1 to 5, resulting in 5 possible outcomes as opposed to 11 in the original framework. The staircase procedure was simplified from generating 32 possible outcomes in the original framework, to 8 possible outcomes in this survey. The possible loss of explanatory power has been justified by the fact that the study is designed as a small-scale case study, and makes no claims to finding results with a wider generalizability.

Other limitations might have affected the validity of the results. The study had to use hypothetical rewards instead of real rewards, i.e. the benefits chosen by the respondents would not actually be received by them. The measure of revealed time preferences strives to capture how individuals make actual decisions, which it might not have been able to do to its full extent since the respondents were aware of the rewards merely being hypothetical. Furthermore, due to the data-collecting process and setting in which the study was carried out, it proved difficult to isolate the respondents and avoid them chatting in-between each other or with the interviewing team. The data might thus be biased by factors similar to peer pressure or other social effects, i.e. respondents choosing the same alternative as a friend or a partner, or simply choosing an alternative that does not purely reflect her own preferences or opinions without being influenced by others. At the same time, although these may not be of statistical significance, the comments and stories from the respondents gave valuable insights into the villagers reasoning and way of thinking about intertemporal decisions (see discussion section for reflections on these).

In some cases when collecting the data, the self-assessment questions in the questionnaire had to be clarified with examples in order for the respondent to fully understand what was being asked for. For reliability purposes, this was attempted to do in a way that was as consistent as

possible, by using the same clarifications each time it was needed. For question 8 (see appendix A), the example used was related to harvest and the respondent's willingness to give up harvesting their crop today in order to benefit more from a bigger harvest in the future. For question 9 (see appendix A), the example used was related to forest provision and the respondent's willingness to give up the benefit of cutting down trees today so that future generations could benefit from more trees in the future. Seeing as this clarification was not needed for all respondents, there might be some bias in the data depending on who requested a clarification and who did not.

The ethical considerations and dilemmas in conducting this study need to be made aware of, as they may have limited the study and affected the results. When doing field studies in developing countries, especially as a foreigner with little to no previous knowledge or experience with the country, community, or the participants, there is always a risk of the results being biased due to lack of credibility and trust to the research and researcher (Cardenas & Carpenter, 2008, p.356). In order to minimize this risk, the research was carried out in cooperation with the organization Leuser International Foundation. LIF has operated in the area for many years and know it well, and the villagers are familiar with the organization. The interviewing team consisted of the author of this paper, as a foreign researcher and project leader; two interviewers that were new to the area but native Bahasa Indonesia-speakers; as well as one local guide that knew and introduced the rest of the team to the villagers. The results from this research must be read with consciousness of the researcher's position as a white, foreign, female, young student in the cultural context of the community and the country where the research took place.

6. Results

6.1. Descriptive Statistics

The collected sample consisted of 26 male and 24 female respondents, with ages ranging from 17 to 85 years old. The vast majority of the respondents (86%) indicated that they were married, and 86% of the respondents also indicated either elementary or high school education as their highest completed level of education (as opposed to tertiary education or no education at all).

Number of children below the age of 18 living in the household ranged from 0 to 3. 84% of the respondents had a somewhat positive or very positive view on the EPU. 19 respondents indicated that they had been actively involved in the EPU, and 31 indicated that they had not.

6.2. Correlations

A non-parametric Spearman rank correlation was done to test the correlation between independent variables and the two dependent variables (individual patience and social patience). The data satisfies the two assumptions for this test: (i) data of at least ordinal or continuous scale for all variables (dichotomous variables are excluded for this correlation test), and (ii) monotonic relationship between all correlated variables, which has been confirmed by scatter plots.

	PATIEN~C	PATIEN~D	age	educat~n	children	viewEPU	risk
PATIENCE5OC	1.0000						
PATIENCEIND	0.6796*	1.0000					
age	-0.3782*	-0.3511*	1.0000				
education	0.1520	0.0770	-0.3000*	1.0000			
children	0.0650	-0.0608	-0.1619	-0.0609	1.0000		
viewEPU	-0.2335	-0.2221	0.1567	-0.0577	0.2213	1.0000	
risk	0.0730	0.0485	0.0456	-0.2235	0.2851*	0.1386	1.0000

Figure 1: Matrix of correlation coefficients and probability values. *Significant at 5% level.

The correlation matrix (see figure 1) reveals some interesting results. First, both individual patience and social patience are negatively correlated with age ($\rho = -0.3511$ and $\rho = -0.3782$ respectively), both at a statistically significant level. Higher age is thus correlated with lower levels of patience. Second, both individual patience and social patience are slightly negatively correlated with the view of EPU ($\rho = -0.2221$ and $\rho = -0.2335$ respectively), although the correlation is not significant. There might be a tendency for people with a more positive view of the EPU to be less patient. Third, individual patience and social patience

themselves are highly correlated ($\rho = 0.6796$) at a very statistically significant level ($p\text{-value} = 0.0000$). Degrees of patience thus seems to be similar no matter if it concerns individual benefits or social benefits. A scatter plot (see figure 2) of the two variables shows the positive and monotonic relationship.

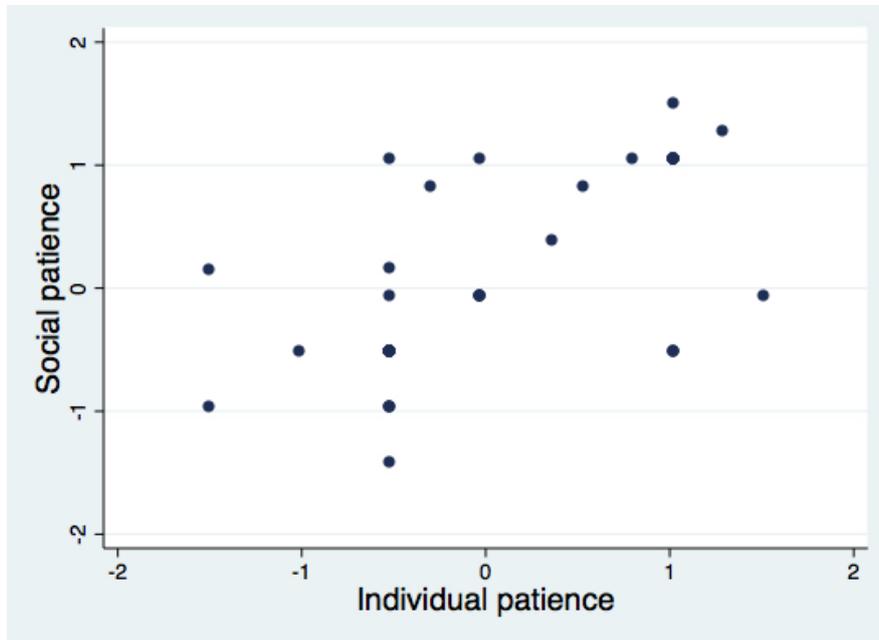


Figure 2: Scatter plot of individual patience and social patience.

6.3. EPU-Involvement and Patience

In order to analyze the relationship between active involvement in the EPU and individual and social time preferences, this will first be done by looking at each measure separately and comparing the preferences of those who have been actively involved and those who have not. The two groups (involved and not involved) will in this case be treated as two independent samples. A two-sample Mann-Whitney U-test is performed, with the null hypothesis being that the distribution for each measure is equal for both groups. For the individual patience measure, the test statistics show that the null hypothesis is rejected with a probability value of 0.0493. There is a statistically significant difference in the underlying distribution of individual patience between people involved in the EPU conservation effort and people not involved in the EPU. When performing the same two-sample Mann-Whitney U-test for social patience, the null hypothesis cannot be rejected at the 5% significance level.

If instead treating the data over individual patience and social patience as paired data for each respondent, the median difference between the two measures can be studied. By furthermore splitting the independent variable of EPU-involvement into two groups (those who have been actively involved in the EPU, and those who have not), they can be studied separately by doing a Wilcoxon signed-rank test for each group. The null hypothesis states that the median difference between individual patience and social patience is zero. The first test is performed only on the group that has been actively involved in the EPU, showing no significant median difference between their individual patience and social patience. The second test is performed only on the group that has not been actively involved in the EPU, which showed a significant median difference between individual patience and social patience at the 1% significance level (p-value = 0.0076) (see figure 3).

```
. signrank PATIENCEIND=PATIENCESOC if involvedEPU==1

Wilcoxon signed-rank test
```

sign	obs	sum ranks	expected
positive	5	113	248
negative	26	383	248
zero	0	0	0
all	31	496	496

```

unadjusted variance      2604.00
adjustment for ties      -47.00
adjustment for zeros      0.00
-----
adjusted variance        2557.00

Ho: PATIENCEIND = PATIENCESOC
      z = -2.670
      Prob > |z| = 0.0076

```

Figure 3: Wilcoxon signed-rank test comparing individual patience and social patience for the group that has not been actively involved in the EPU.

Since the Wilcoxon signed-rank test is a two-sided test, a complementary one-sided sign test is done to study the direction rather than the magnitude of the difference between individual and social patience (see figure 4). The null hypothesis, phrased in the same way as in the signed-rank test, is rejected at the 1% level (p-value = 0.0001), implying a statistically significant lower individual patience compared to social patience for those who have not been actively involved

in the EPU. In other words, not being actively involved in the EPU is associated with more patience for social benefits generated from elephant patrolling than for individual monetary benefits.

```
. signtest PATIENCEIND=PATIENCESOC if involvedEPU==1

Sign test
```

sign	observed	expected
positive	5	15.5
negative	26	15.5
zero	0	0
all	31	31

```
One-sided tests:
Ho: median of PATIENCE~D - PATIENCE~SOC = 0 vs.
Ha: median of PATIENCE~D - PATIENCE~SOC > 0
Pr(#positive >= 5) =
  Binomial(n = 31, x >= 5, p = 0.5) = 1.0000

Ho: median of PATIENCE~D - PATIENCE~SOC = 0 vs.
Ha: median of PATIENCE~D - PATIENCE~SOC < 0
Pr(#negative >= 26) =
  Binomial(n = 31, x >= 26, p = 0.5) = 0.0001
```

Figure 4: Sign-test comparing individual patience and social patience for people not actively involved in the EPU.

If treating the entire sample as one group, and not separating the actively involved in the EPU from the not actively involved, a two-sided Wilcoxon signed-rank test can be done to compare individual patience and social patience overall. The null hypothesis, i.e. that the median difference between individual patience and social patience is zero, cannot be rejected at the 5% level (p-value = 0.124). When instead performing a less powerful sign test, the null hypothesis can be rejected at the 1% level (p-value = 0.0005) indicating that individual patience is significantly lower than social patience (see figure 5).

```

. signtest PATIENCEIND=PATIENCECOC

Sign test

      sign | observed  expected
-----|-----
positive |         13         25
negative |         37         25
zero     |          0          0
-----|-----
all      |         50         50

One-sided tests:
Ho: median of PATIENCE~D - PATIENCECOC = 0 vs.
Ha: median of PATIENCE~D - PATIENCECOC > 0
Pr(#positive >= 13) =
  Binomial(n = 50, x >= 13, p = 0.5) = 0.9998

Ho: median of PATIENCE~D - PATIENCECOC = 0 vs.
Ha: median of PATIENCE~D - PATIENCECOC < 0
Pr(#negative >= 37) =
  Binomial(n = 50, x >= 37, p = 0.5) = 0.0005

```

Figure 5: Sign-test comparing individual patience and social patience for the entire sample.

6.4. Self-assessed and Revealed Time Preferences

In section 5.2, the variables individual patience and social patience was shown to have a strong, positive correlation of 0.6796, which is an indication of the two measures moving in the same direction. In order to closer examine the mechanisms behind this result, the two index measures can be decomposed into their separate qualitative and quantitative components: the self-assessed time preferences, and the revealed time preferences elicited from the staircase procedures. In order to study the relationship between the measures of self-assessed and revealed time preferences, a Spearman correlation is done between their z-scores for individual and social time preferences respectively. The results show that there is essentially no correlation between the self-assessed and the revealed individual time preferences ($\rho = -0.0268$), and also essentially no correlation between the self-assessed and the revealed social time preferences ($\rho = -0.0070$). These results indicate that there exists no clear monotonic relationship between the two measures, which stands in contrast to what would be expected since they aim to measure the same thing, i.e. a person's degree of patience.

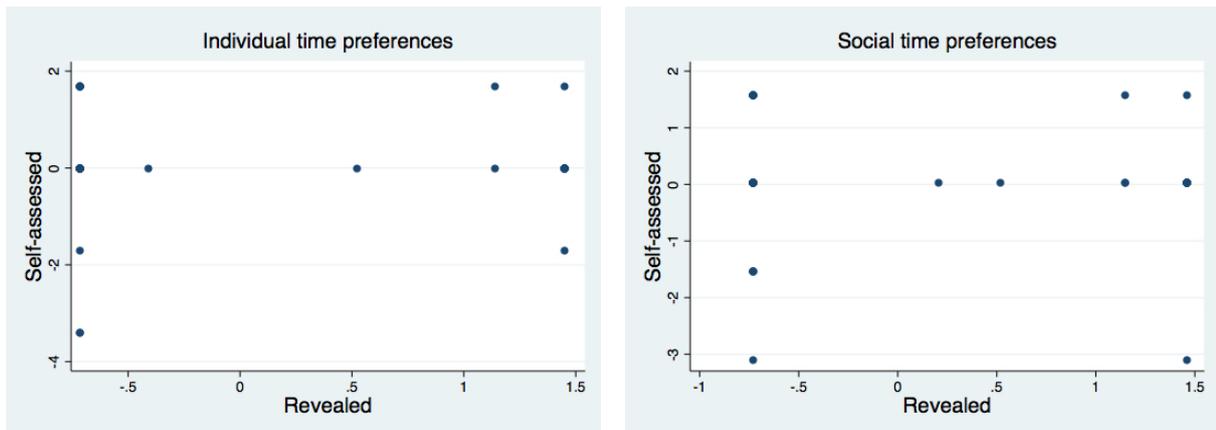


Figure 6a, 6b: Scatter plots showing z-scores of self-assessed and revealed individual time preferences (left side) and self-assessed and revealed social time preferences (right side).

A two-sided Wilcoxon signed-rank test does not reveal any significant median difference between the self-assessed and revealed individual time preferences, or the self-assessed and revealed social time preferences. However, a comparison of the medians does not necessarily give sufficient information about the data. Using visual aids in the form of simple frequency histograms, the distribution of the different measures can be inspected closer (see figure 7).

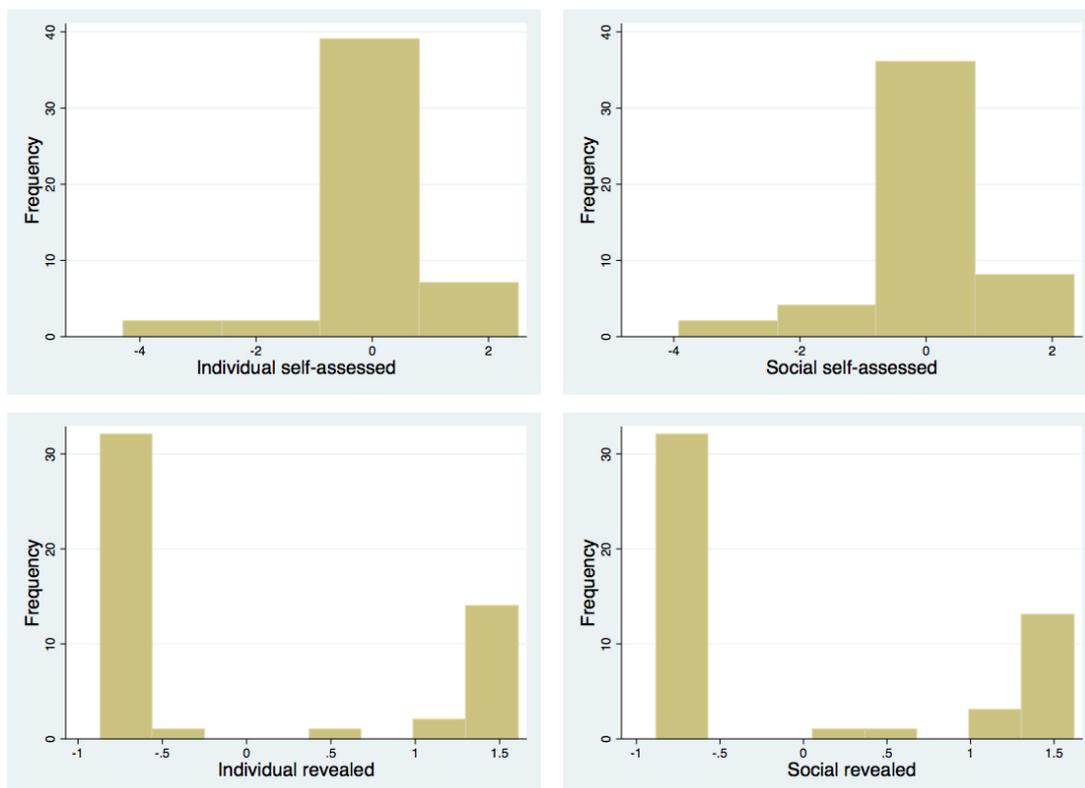


Figure 7a, 7b, 7c, 7d: Frequency histograms of z-scores for individual and social self-assessed time preferences, and for individual and social revealed time preferences.

As seen on the two upper histograms of figure 7, the distributions of self-assessed time preferences are slightly skewed to the right, whereas the distributions of revealed time preferences are more similar to a U-shape with higher frequencies in the margins, as seen on the two lower histograms of figure 7. This points to the fact that the respondents perceive their self-assessed time preferences differently from the time preferences revealed through the staircase experiment. It also indicates that there is more polarization in the revealed time preferences, whereas self-assessed time preferences are more homogenous.

When doing a one-sided sign test to test the difference between self-assessed individual time preferences and revealed individual time preferences, the null hypothesis can be rejected with a p-value of 0.0325 which statistically demonstrates lower self-assessed individual time preferences (higher z-scores) compared to revealed individual time preferences (see figure 8). Performing a one-sided sign test on self-assessed and revealed social time preferences, the null hypothesis cannot be rejected (p-value = 0.1611).

```
. signtest zscorequalind=zscorequantind

Sign test

      sign |      observed      expected
-----|-----
  positive |          32          25
  negative |          18          25
    zero   |           0           0
-----|-----
      all  |          50          50

One-sided tests:
Ho: median of zscorequalind - zscorequantind = 0 vs.
Ha: median of zscorequalind - zscorequantind > 0
Pr(#positive >= 32) =
  Binomial(n = 50, x >= 32, p = 0.5) = 0.0325

Ho: median of zscorequalind - zscorequantind = 0 vs.
Ha: median of zscorequalind - zscorequantind < 0
Pr(#negative >= 18) =
  Binomial(n = 50, x >= 18, p = 0.5) = 0.9836
```

Figure 8: Sign-test comparing self-assessed individual time preferences and revealed individual time preferences.

7. Discussion

In conclusion, the main findings of this study are the following: (i) Overall, individual patience for monetary benefits tends to be lower than social patience for elephant patrolling, although this result is not very robust. (ii) For the group that was not actively involved in the EPU specifically, individual patience is significantly lower than social patience. (iii) Individual and social patience are highly correlated, but the distribution curves for self-assessed time preferences and revealed time preferences are dissimilar. (iv) Self-assessed time preferences are lower than revealed time preferences for individual benefits, but a significant difference cannot be found for social benefits. Each of these findings will be discussed in greater detail below.

The first finding (i) indicates that there is no overwhelming evidence of there being a difference between individual and social patience, although a sign test pointed to the fact that the degree of social patience is higher than the degree of individual patience. This finding is in accordance with theory stating that social time preferences reflect more farsightedness and patience than individual time preferences, as well as with practitioners proposing social discount rates lower than individual discount rates. One possible explanation for why this result was not more evident can be found in the construction of the questionnaire. The staircase procedure for social time preferences might not have properly captured that many social projects generate benefits for a long period of time, since the spending on elephant patrolling in this case can be seen as something that mainly generates immediate benefits for the community. From this perspective, it seems reasonable that impatience for elephant patrolling benefits are similar to impatience for individual monetary benefits, since choosing the immediate reward for each good also means that the benefit will be immediately received (either through money in your pocket today or through a re-instated EPU starting today). If the staircase procedure for social time preferences instead would have targeted a conservation effort that would not generate benefits until 20 or 30 years from now, e.g. a reforestation program, social patience would perhaps be found to be even more significantly higher than individual patience since it would not be as critical whether the reforestation program was implemented today or one year from now.

The second finding (ii) can be interpreted as by not having first-hand experience of working with the EPU, one has more patience for the social benefits from elephant patrolling than for

individual monetary benefits. Perhaps impatience for social benefits of elephant patrolling is something that comes from being more involved and knowledgeable about how the EPU works, and being able to see more directly the immediate need for the program. Impatience for elephant patrolling in general must be understood from the context of living in a village in Aras Napal, and the risks associated with living closely to the Leuser National Park. When speaking to the villagers, many expressed concerns about wild elephants entering the village and disrupting their crops, which has happened several times in the past. A few mentioned that they had experienced attacks from wild elephants in their homes, making them feel threatened and unsafe. Experiences such as these may cause the immediate need for elephant patrolling to be greater than the immediate need for money. In section 5.2, it was shown that there indeed was a slight correlation between having a positive view of the EPU and being more impatient, which might support this line of thinking. Impatience must also be understood from a cultural context. Some respondents expressed for the staircase procedure that they would choose the alternative revealing the lowest degree of patience, despite them being fully aware of the economic disadvantage of choosing this alternative. One respondent phrased it as it is more important to live fully today, since what happens in the future is not up to us. In other words, there might be certain mindsets and beliefs that are stronger determinants in optimizing utility than economic rationality.

As for the third (iii) and fourth (iv) findings from this study, they raise questions about how to measure time preferences, and what measure is more telling of how a person resonates and acts when faced with intertemporal choices. Perceptions of one's own time preferences might be very different from time preferences revealed by one's behavior. The findings from this study show tendencies that respondents are more patient when it comes to how they self-assess their time preferences – sometimes after clarifying with an example about intertemporal farming decisions that are related to the everyday life of a rural farmer in Indonesia. The self-assessed time preferences might thus be based on decision-making that is more closely related to personal intertemporal decisions made on a daily basis, as opposed to the revealed time preferences from choosing between hypothetical monetary rewards which can be seen as more abstract for someone who is not very familiar with economic concepts. It might also be the case that the self-assessment questions in this study, since they were not defined in any exact time-frame, cover a longer time horizon in the perception of the respondent, compared to the staircase procedure of revealed time preferences that was explicitly expressed in terms of choosing a benefit today or one year from now.

In terms of development policy, it is important to look at the idea of impatience from different angles. The irrational human being can be more or less impatient for different types of goods, even if the monetary benefit received from those goods would be the same. The relationship between poverty and impatience needs to be contextualized – someone who lives in poverty might be more patient in intertemporal decisions regarding a harvest than a monetary reward, and this will consequently affect how to best design sustainable development policies. Furthermore, as long as there is a divergence between people’s perceptions of their own time preferences and their behavior, policy-makers are faced with the challenge of how to close this gap. Development policy should in that case strive to make it easier for people to act patiently, in line with their perceived time preferences.

A paradox that will need to be explored further is the fact that although social projects perhaps should be characterized by more patience and farsightedness, some social goods (elephant patrolling, in this case) might generate benefits that are essentially as emergent as an individual, monetary benefit. For environmental issues specifically, this needs to be considered in future sustainable development policies since climate change will put pressure on implementing adaptation strategies to deal with a changing, degraded and more extreme environment. Many people face the risk of environmental poverty in the near future, so the link between environmental poverty (as opposed to economic poverty) and impatience needs to be better understood. The difficulty will be how societies should economically prioritize and tackle intertemporal trade-offs when environmental policy is not only a matter of taking future generations into account, but also very much so present generation’s acute needs for environmental services. Social time preferences for environmental goods, and whether they are or should be a reflection of economic rationality or human irrationality, subjective perceptions or objective actions, prescriptive or descriptive approaches, should be a subject of attention for future research.

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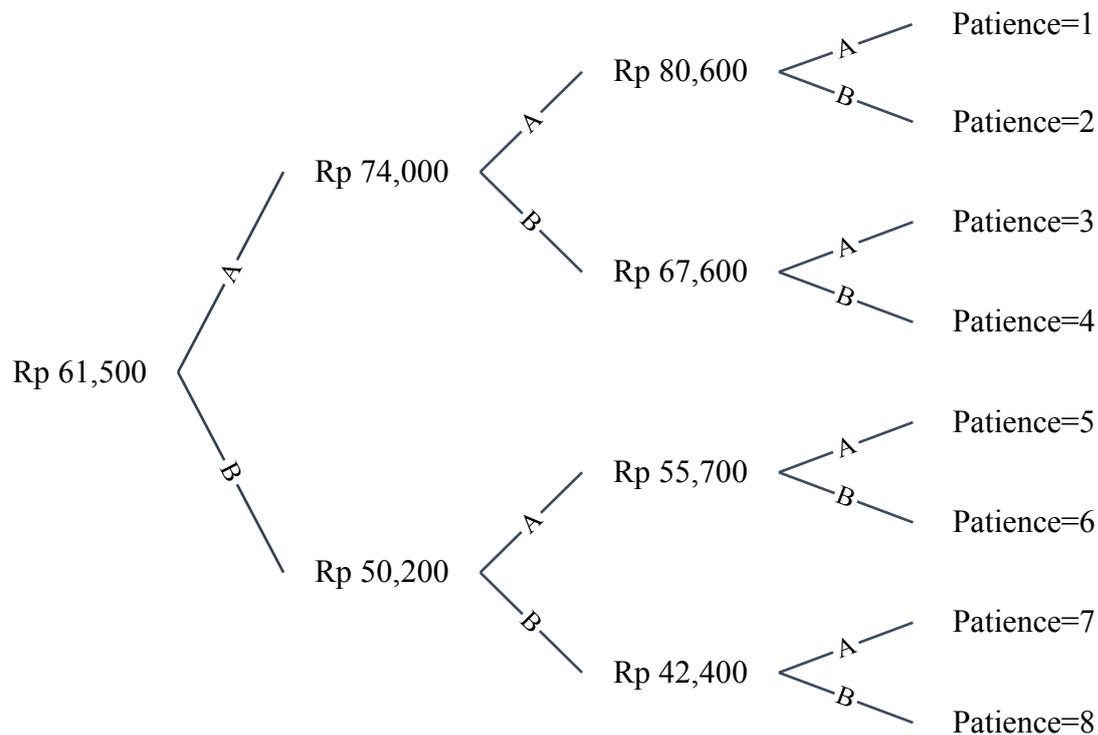
9. Appendix A: List of Survey Questions

List of questions used in survey and their translation to Bahasa Indonesia. Dichotomous variables are marked with **(d)**.

1. In what year are you born? / *Kapan Anda lahir?*
2. What is your gender? / *Jenis kelamin Anda?* **(d)**
3. What is your marital status? / *Apa status perkawinan Anda?* **(d)**
4. What is your highest level of education you have completed? / *Apa tingkat pendidikan tertinggi Anda?*
5. How many children (below the age of 18) live in your household? / *Berapa banyak anak (di bawah umur 18) yang sekarang tinggal di rumah Anda?*
6. Have you been actively involved in the Elephant Patrolling Unit with the Leuser International Foundation sometime in the last 5 years? / *Pernahkah Anda terlibat aktif dalam Unit Patroli Gajah dengan Yayasan Leuser Internasional sekitar 5 tahun terakhir?* **(d)**
7. What is your view on the Elephant Patrolling Unit previously run by the Leuser International Foundation in Aras Napal? / *Bagaimana pandangan Anda mengenai Unit Patroli Gajah, yang dikelola oleh Yayasan Leuser Internasional di Aras Napal sebelumnya?*
8. How willing are you to give up something that is beneficial for you today in order to benefit more from that in the future? / *Sejauh mana Anda bersedia mengorbankan sesuatu hal yang menguntungkan Anda hari ini untuk mendapatkan keuntungan yang lebih besar di kemudian hari?*
9. How willing are you to give up something that would be beneficial for your community today, in order for future generations in your community to benefit more from that in the future? / *Sejauh mana Anda bersedia mengorbankan sesuatu hal yang menguntungkan bagi masyarakat Anda hari ini untuk mendapatkan keuntungan yang lebih besar bagi generasi penerus di masyarakat Anda di kemudian hari?*
10. How willing are you to take risks? / *Sejauh mana Anda bersedia mengambil resiko?*

For the staircase-questions 11 and 12, see Appendix B.

10. Appendix B: Illustration of Staircase Procedure



Each respondent was faced with a choice between receiving a payment of IDR 40,000 today, or the amount X stated in the tree-illustration 12 months from now, starting to the left with $X =$ IDR 61,500. Choosing the immediate reward of IDR 40,000 today meant moving in the direction of (A), with the amount X received in 12 months being adjusted upwards for the next question. Choosing the delayed reward of IDR 61,500 in 12 months meant moving in the direction of (B), with the amount X being adjusted downwards for the next question. The respondent was faced with a total of three questions before ending up at a level of patience between 1 and 8.

The staircase procedure was performed once for individual patience and once for social patience. The monetary benefits were equal for both procedures, but for the individual patience-staircase the respondent was asked to consider individual payments, and for the social patience-staircase the respondent was asked to consider payments that would be spent on re-instating the elephant patrolling unit.