Norwegian University
of Life Sciences

Master's Thesis 2020   30 ECTS
School of Economics and Business

In matters of taste, there can be no disputes

An empirical study of endogenous preferences

Pia Jihan Jonsson
Master of Science in Economics

Abstract

A fundamental assumption in traditional economic theory is exogeneity of preferences. Economists view preferences as innate characteristics that are stable with regards to time and space. This thesis questions this assumption by analyzing if preferences are likely to be shaped by economic circumstances, and thereby endogenized.

The thesis analyzes data collected from 248 households in rural Peru to find out how their stated risk, time, environmental, social and trust preferences relate to each other and how they relate to the household's socio-economic characteristics, livelihood choices and income. Two research questions are answered; (1) "How do stated risk, time, environmental, social and trust preferences relate to each other?" and (2) "How do household socio-economic characteristics and livelihood choices relate to the stated risk, time, environmental, social and trust preferences?".

The first research question is approached by conducting a Principal Component Analysis to identify clusters among the data in the preference variables. Here, I find two spheres of preferences. One individual-personal based sphere, which is mostly explained by risk, time and environmental preferences. Secondly, a social-regarding sphere, where social and trust preferences are dominating.

The second research question is answered by analyzing results from regression models. Here, I find limited evidence of risk, environmental and social preferences being endogenous with regards to livelihoods and income. Due to the nature of the data, the results cannot be interpreted as causal without further evidence.

The results of this thesis recommend three directions for further considerations. Firstly, the relationship between different types of preferences is unclear in the literature and should be further illuminated. Secondly, the relationship between livelihoods and preferences needs further attention to establish whether contingent livelihoods can shape preferences. Lastly, behavioral aspects should be integrated in analyses of rural livelihoods.

Preface

This thesis represents my final contribution to the Master of Science program in Economics at the Norwegian University of Life Sciences.

Writing a master thesis is a demanding project, and it has been a particularly lonely process due to the ongoing Covid-19 pandemic. However, it has also been educational and inspiring. The university has done a tremendous job in communicating with the students and meeting us on new platforms, which has been a great assurance during these trying times.

I want to thank my supervisors, Julia Del Carmen Naime Sanchez Henkel and Arild Angelsen for your time, efforts and useful comments which guided me in the right directions when I was lost. If it was not for you, I would not have been able to write this thesis. Particularly, want to thank Julia for letting me use your data in my thesis and for always available being available to answer my questions.

Finally, I want to thank my fellow students at NMBU for your company and support during my two years in Ås.

Pia J. Jonsson
Oslo, 16 June 2020

Table of contents

List of figures

List of tables

1 Introduction

This thesis aims to test the assumption of exogenous preferences in the neoclassical economic theory, by investigating whether and how household's economic environment can shape preferences.

Neoclassical economic theory explain economic outcomes by external conditions, such as the prices and technologies which the decision maker faces. Preferences are assumed to be given, innate characteristics that are stable over time and across contexts. This means that preferences remain the same regardless of how the society evolve. Thus, neoclassical economic theory has largely ignored the role of preferences in explaining changes in behavior by assuming them to be given.

A growing literature within economics questions this assumption. For instance, Bowles (1998) argue that economic institutions shape preferences by discouraging non-opportunistic behavior, which may erode trust among individuals. Another example is Fehr and Hoff (2011) who discusses the influence of society on preferences by arguing that social institutions can prime individuals' identity and therefore shape preferences. Other researchers have argued that economic circumstances, such as cash constraints, lead to higher rates of time preference for monetary payoffs (Holden, Shiferaw and Wik, 1998). If preferences are shaped by circumstances, then an interesting field of research is to better understand how these circumstances shape individuals' preferences.

Preferences can affect economic outcomes and decisions. For instance, if individuals are impatient, they could be reluctant to save or invest in educating their children. Risk aversion could prevent individuals to take financial risk by, for example, establishing businesses that have risky cash flows. This could explain why some individuals remain poor (Tanaka, Camerer and Nguyen, 2016). Understanding how preferences are shaped, can therefore provide insights in investments decisions, e.g., in health, education or technologies. This is important for understanding societies vulnerability and resilience.

I use data from rural households in Ucayali, Peru to investigate whether there is a relationship between the households' means of livelihood and their stated risk, time, environmental, social and trust preferences.

The aim of the thesis is to answer two research questions.

> (1) How do stated risk, time, environmental, social and trust preferences relate to each other?

(2) How do household socio-economic characteristics and livelihood choices relate to the stated risk, time, environmental, social and trust preferences?

The rest of the thesis is structured as follows. The second chapter presents the relevant theories and review literature on preferences. The third chapter presents the data and methods used for the analyses, including the data collection and data analyses methods. The fourth chapter presents the results, the fifth chapter discusses them, and the last chapter concludes.

2 Theory

The aim of this chapter is to review the literature about preferences. Firstly, I present and define terms and concepts used in the thesis. Secondly, previous literature and empirical findings are discussed with regards to exogenous and endogenous preferences. Finally, I present the expected outcome of the analyses that will be presented and discussed in chapter 4 and 5.

2.1 Definitions

A **household** is defined as a group of individuals living under the same roof, and pooling resources. The individuals are normally family members, however, it is possible to have household members who are not blood relatives of the family, e.g. in-laws, servants or orphans (Sunderlin *et al.*, 2016).

The **livelihood** is defined as the "means to a living" and comprises the assets, the activities and the access to these that together determine the living gained by the household (Ellis, 2000). The primary livelihood is defined by the most time spent on an activity, and not by the amount of money earned (Sunderlin *et al.*, 2016).

Institutions are humanly devised constraints that shape interaction (Ellis, 2000). The institutions can therefore constrain behavior and social relations because they can take different forms such as language, customs, norms, firms and schools. Moreover, they can affect households' access to assets and influence their vulnerability context through e.g. gender empowerment, access to education or the securing of property rights.

A **preference** is here defined as an individual's raking of options. If preferences are stable, consistent attributes, then one can characterize the preferences, and then describe the society that the individuals will create (Fehr and Hoff, 2011). For instance, an individual that have a high preference for financial risk (i.e. risk seeking), can be expected to engage in business creations that may involves risky cash flows. If he is risk averse, he is expected to

avoid risky investments and engage in livelihoods that involve low risk income-earning activities, e.g. wage employment. On the other hand, if preferences are shaped by the circumstances they depend on, for example, institutions, then preferences should, at least to some degree, be explained by the institution's characteristics.

2.2 Concepts

In this section, I present two concepts of preferences. The first section presents a theory of exogenous preferences and explains how heterogeneity in choices can be a explained with stationary preferences. The second section presents a theory of endogenous preference formation, which explains how preferences can be shaped by circumstances.

2.2.1 De gustibus non est disputandum

Exogenous preferences is defined as preferences that are given by nature and stable with respect to time and context (Stigler and Becker, 1977). In their article "*De gustibus non est disputandum*", Stigler and Becker (1977) compare tastes (i.e. preferences) to the Rocky Mountains; the same to all men and will be there next year as well as this year. They claim tastes to be unchangeable axioms that neither change capriciously nor differ importantly between individuals.

According to neoclassical economic theory, an economic agent maximizes a utility function depending on market goods under a budget constraint. However, Stigler and Becker present what they call "*The New Theory of Consumer Choice*" where the economic agent (in their case, the household) seeks to maximize a utility function consisting of objects of choice, called commodities. The commodities are produced with market goods, their own time, skills, training and other inputs. The commodities do not have a market price since they are not purchased or sold, but rather a shadow cost determined by the inputs of the production. They then explain heterogeneity in choices by changes in the accumulation of what they call "consumption capital". For instance, if there is an increase in the consumption of a good, it is because the actor becomes more familiar with consumption of the good and can therefore produce enjoyment from it "more efficiently". When production (i.e. consumption), becomes more efficient, the shadow price decreases. Assuming a normal good, this will then increase consumption of the good, explaining the heterogeneity in choices.

They illustrate this effect by using music as an example. If music is a normal good and a consequence of consuming music is increased familiarity with music, i.e. consumption

becomes more efficient, the shadow price will decrease, but the taste for music will remain the same. Thus, preferences remain stationery and heterogeneity in choices can be rationalized and explained with external factors.

2.2.2   Sour grapes

The theory of exogenous preferences is in contrast to the theory of endogenous preference formation which is defined as circumstances affecting preferences. Jon Elster (2016) presents a theory called "*adaptive preference formation*". This view of preference formation is about *context shaping preferences*. A process that occurs unconsciously by a drive to reduce tension or frustration in having wants that are impossible to fulfill. Elster explains how this works by referring to a fable about a fox that fails to reach a bunch of grapes, and therefore concludes that the grapes are sour, and no longer desirable.

In practice, the theory claims that constraints individuals face shape and limit preferences or choices (Bridges, 2006). For instance, a type of constraint could be cultural practices. Consider a female who is born into a family in a culture where there exist traditional gender roles. She learns how to prepare meals and keeping the house clean, while the males engage in tasks such as car repair and home maintenance. As a result of the exclusion of certain activities, she comes to prefer the activities within her feasible set (Bruckner, 2009).

Bridges (2006) divides these types of constraints into two types; internal and external. The internal constraints could be ignorance or weakness of will. External constraints could be political prohibition or lack of resources. This thesis focuses on the external constraints, which will be proxied with livelihood and income variables in the statistical analyses.

The assumption of endogenous preferences will be further investigated in this thesis. If preferences are shaped by circumstances, then households' socio-economic background and livelihood choices should be able to, at least partially, explain their preferences. If preferences are endogenous, it will constitute a major methodological issue in explaining economic outcomes. For instance, when implementing an economic policy based on the assumption of exogenous preferences. If the preferences are simultaneously determined, it could mean that the effect of the policy is on the preferences, and not the desired economic objective.

2.3   Preferences

The aim of this section is to define and explain interrelation of preferences and the types of preferences that I discuss in the thesis. I present empirical findings and discuss the preferences in the light of exogeneity or endogeneity.

If preferences are exogenous, they should contribute to explaining economic outcomes and thus be included as independent variables in a regression model. If preferences are endogenous, then there will exist a significant relationship between a preference and the circumstances that are assumed to shape them, e.g. income or asset level.

2.3.1   Interrelation

Interrelation of preferences is in this context as to which degree preferences relate to each other.

There is an ongoing discussion in the preference literature of whether- and how risk- and time preferences are related. Economic decisions can include uncertainties and affect the future as well as present. Moreover, future prospects are riskier, which could mean that they require higher risk taking and patience. A study conducted by Andersen, Harrison, Lau and Rutström (2008) show that collectively elicitation of risk preference and discount rates for time preferences result in significantly lower discount rates than separate elicitation. Several researchers have elicited risk preference in conjunction with time preferences, e.g. Binswanger (1980, 1981) and Tanaka, Camerer and Nguyen (2016). However, I find few empirical studies that focus explicitly on the interrelation between risk and time preference. One study find a relationship between patience and tolerance for risk (Abdellaoui, Diecidue and Öncüler, 2011), another find that impatient individuals are more risk averse (Anderhub *et al.*, 2001), while Andreoni and Sprenger (2012) suggests that time and risk preferences are strongly different from each other. Thus, the relationship between risk and trust preference is unclear and needs further attention to reach final conclusions.

Trust preferences can be seen in the light of risk preference. The relationship between trust and risk is often liked in the literature. Mayer, Davis and Schoorman (1995) defines the relationship as trust being the assuming of risk, while Das and Teng (2004) claims that behavioral trust inevitably invites risk taking. Thus, trusting can ultimately be seen as the willingness of making yourself vulnerable to others' actions, which involves an interrelation. Empirical studies on the relationship between risk and trust have yielded different results. While Schechter (2007) show that males are more trusting than females due to females lower

level of risk tolerance, Eckel and Wilson (2004) find no significant relationship between risk and trust. However, in Eckel and Wilsons research the individuals were asked to trust a stranger that they were unlikely to ever meet, whereas in Schechter research the players in the game were fellow villagers. Thus, one possible underlying explanation could be that individuals consider trusting complete strangers differently than trusting members of their own community.

Studies of environmental valuation can be linked to risk, e.g. willingness to pay for less polluted air which can reduce mortality risk (Wang and Mullahy, 2006; Ortiz, Markandya and Hunt, 2009). These studies provide limited insights precisely on how environmental preference and risk are related. However, if findings indicate that the relative willingness to pay for an environmental good or service that reduces health risk is high, it implies that individuals who value the environment highly are risk averse, at least with regards to health risks. Another study focusing on the preservation preferences of environment's link to risk, finds that individuals who have high preference towards preservation of the environment are more cautious in gambles (Bogner, Brengelmann and Wiseman, 2000). Thus, this could indicate that risk aversion is correlated with high willingness to preserve the environment.

2.3.2   Risk

Risk can be defined as known uncertainties. The difference between risk and uncertainty is that for risk the probabilities of possible outcomes are known, whereas for uncertainty they are unknown (Knight, 1921). An individuals desired behavior under risk can be defined as his risk preference and referred to as his degree of risk aversion.

Studies on the relationship between risk aversion and wealth has yielded ambiguous results.

Early studies rejected associations between risk aversion and wealth (Binswanger, 1980, 1981). Later, Binswanger and Sillers (1983) summarize studies from several countries which finds small negative effects of wealth on risk aversion.

The discussion of how risk preferences relate to wealth and socio-economic factors is more recently followed up by other scholars. An experimental study of rural villagers in Vietnam found that individuals with high education and of old age have higher degrees of risk aversion (Tanaka, Camerer and Nguyen, 2016). Other recent studies have provided broad empirical evidence indicating that risk aversion increases with age (Schurer, 2015; Dohmen *et al.*, 2017; Schildberg-Hörisch, 2018). Schildberg-Hörisch (2018) suggest that an underlying

explanation for these results could be that older people are more likely to have dependents such as children or grandchildren and their concern for them causes them to become more risk averse. Other studies have revealed that females are more risk averse than males, an effect which is shown to be particularly evident in field studies (Eckel and Grossman, 2011).

Livelihoods involves different degrees of risk, and the degree of risk aversion is likely to influence the livelihood choices of the households. For instance, generating income through agriculture or livestock is likely to involve high, risky investments and be strongly dependent on external risks, e.g. market prices or weather. Risk averse individuals could therefore be less likely to engage in these activities and more prone towards less risky livelihood activities, e.g. wage employment. Moreover, it is likely that there is a relationship between risk aversion and wealth. An individual with a low level of wealth does not have as much to lose, thus, there could exist a lack of motivation towards being risk averse. On the other hand, it could be that a high level of wealth is causing the individual to be less risk averse. Richer individuals are less financially vulnerable and can invest in productive assets which could lead to more accumulation of wealth. If this direction of causation can be established, it indicates endogenous preferences.

2.3.3 Time

Time preference can be defined as the current relative valuation placed on receiving a good at an earlier time compared to receiving the same good at a later time. An individual's consumer rate of interest (CRI) depend on his time preference ρ and diminishing marginal utility ηg, where η is the elasticity of marginal consumption and g is the annual growth rate, $CRI = \rho + \eta g$. This theory of intertemporal choice show how consumer maximize their lifetime satisfaction (Fisher, 1930).

The main focus of the literature of time preference is on eliciting discount rates. The discount rate is a single parameter that captures all factors that might influence an actor's intertemporal choice. Early work focused on intertemporal consumption profiles that was formulated in a discounted utility model (Samuelson, 1937). However, eliciting time preferences by use of experiments have later revealed that there are systematic variation with size of reward (magnitude effect) and length of time (hyperbolic discounting) (Thaler, 1981), violating the critical assumption of stationary utility in the discounted utility model.

Researchers have found correlations between age (Green, Fry and Myerson, 1994), gender (Silverman, 2003) and patience, which indicate that these variables should be included

in these analyses. A possible reason for older people to be more impatient is that the probability of dying increases with age, an argument supporting endogenous time preferences.

There exists a substantial amount of studies that focus on the relationship between wealth and time preferences. Some found that wealthier people are more patient (Hausman, 1979; Binswanger, 1980, 1981; Lawrance, 1991; Harrison, Lau and Williams, 2002; Yesuf and Bluffstone, 2008; Tanaka, Camerer and Nguyen, 2016), others have failed to establish a significant relationship between wealth and time preferences (Kirby *et al.*, 2002; Anderson *et al.*, 2004). Thus, the relationship between wealth and time preferences and wealth will be investigated here as well.

A possible reason for time preferences to be endogenous is that they could be shaped by cash constraints. If wealthier individuals are more patient, it could be because they are not in an immediate need of cash. On the other hand, patience can lead to more accumulation of wealth through e.g. saving a small part of the income over time. Thus, the direction of causality could go in both directions. Several of the findings in the empirical literature presented here are related to a given point of time, meaning that the direction of causality is assumed and not assured. This issue is acknowledged and addressed by some researchers who include past and current wealth in their regression analyses (Holden, Shiferaw and Wik, 1998) and find that past wealth is correlated with patience. This could be interpreted as evidence of causality; however, past wealth is likely to correlate with current wealth. Thus, there could exist alternative explanations of their findings.

2.3.4 Environment

There is no clear definition of environmental preference in the literature. Thus, I use my own definition, which is that an individual's environmental preference is defined as their preference towards inclining the environment. Environmental preference is in particular relevant for this group of individuals because some of their most important livelihood options is based on natural resources.

A high preference towards inclining the environment implies a high willingness to pay for the environmental goods and services. The total economic value of a marginal change in biodiversity and ecosystem services comprises several components. There is the direct use value which is the goods that are derived and consumed directly, e.g. fish, meat, fuelwoods and timber. The indirect use value is the regulating services that the ecosystem provides, such as flood control, recreation and tourism. The option value is the value of preserving option for

future use, and lastly, the non-use value that is the value of existence and bequest values (Perman *et al.*, 2003). It is likely that individuals who value the option of preserving the environment for future use, e.g. their decedents, also have a low rate of time preference. This is because a direct use value involves immediate gratification, similar to a high time preference factor. This is backed up by a recent study by Wang, Rieger and Hens (2016) who found that farmers who discount the future more strongly are less likely to use soil conservation measures. Because soil conservation involves preserving the environment, this can mean that time preference is related to inclining the environment. On the other hand, researchers argue that environmentally consequential decisions e.g. consumer decisions such as investments in soil conservation, are affected by so many other considerations that the environmental component may be given little weight (Dietz, Fitzgerald and Shwom, 2005).

There exists a wide scope of literature in the field of environmental valuation. A study analyzed data collected over 20 years showed that preferences for ecosystem services derived from forests change over time (Zandersen, Termansen and Jensen, 2007). Although this study was not longitudinal, the sample was substantial, which increases the validity of the findings. A similar meta-study, but of willingness to pay, including use and non-use values showed that the general results of the studies indicated that an increase in income by 1 % yield an increase between 0.3-0.7 % in the willingness to pay for the environmental services (Hökby and Söderqvist, 2003). These findings indicate that income has an association with environmental preference which are later backed up by the findings of Morey, Thacher and Breffle (2006) who show that environmental preference vary significantly with gender, assets and income.

2.3.5   Social

Social preference is a defined as to which degree an actor cares about the well-being (payoff) of others. If an individual has social preferences, his well-being is not only dependent on his own payoff, but also by how payoffs are distributed between others (Fehr and Schmidt, 2003). Social preference can be driven by altruism, fairness or egalitarian principles. These attributes could be positive, for instance by giving more to others, or negative, e.g. envying actors that receive more.

Empirical research of social preferences have yielded ambiguous results with regards to stability over time and situations. Carpenter (2005) conducts experiments and find that social preferences alter when individuals interact repeatedly in economic circumstances. However, the interactions in the experiment occurred under anonymous conditions, which is

often not the case in a real market setting. In particular, for smaller communities where consequences of executing negative social behavior such as spitefulness or selfishness could lead to vengeance and social punishments, effects that can be neglected in experiments where individuals are anonymous. Other empirical research analyzing data from rural communities show that social preferences can be stable over long periods of time (Carlsson, Johansson-Stenman and Nam, 2014; Chuang and Schechter, 2015). These findings are consistent with the view of exogenous preferences.

Henrich *et al.*, (2001) find that social behavior in experiments are consistent with patterns of everyday life in the societies they live in. Participants that live in societies where families have a higher degree of economic independence with regards to their livelihoods, allocate smaller amounts to other respondents in experimental games, indicating that they care less about the well-being of others. Thus, the type of society the participants live in, can predict offers in the games. They also find that individual measures such as sex, age, wealth and village population does not have a significant relationship to offers in the games.

Other research have focused on the role of gender in altruistic behavior. Andreoni and Vesterlund (2001) finds that females tend to share resources more evenly, while Bezu and Holden (2015) find that females are less generous than men. Thus, experimental studies of the relationship between socio-economic characteristics and altruistic behavior give mixed results.

2.3.6   Trust

The economists view of trust is defined in various ways in the literature. This thesis adopts a definition of trust drawn on psychological literature. The definition is that trusting behavior consists of actions that increases one's vulnerability to another whose behavior is not under one's control and takes place in a situation where the penalty suffered if the trust is abused would lead one to regret the action (Lorenz, 1988).

Almost all economic interaction involves some element of trust. For instance, in market participation, buyers rely on sellers to provide the product that are requesting, and sellers trust the buyers to pay the bill. However, it is unclear in the literature whether trust is a byproduct of good institutions or if it plays a role of shaping economic outcomes (Fehr, 2009).

Henrich *et al.* (2001) suggests that preferences over economic choices are shaped by economic and social interactions of everyday life. They show that trust increases with social

interactions which were controlled for with degree of market integration. This could indicate that households who engage in productive activities at the family level and thus have a higher degree of economic independence have lower levels of trust preferences. However, the study show that trust depends highly on local circumstances, which indicate that trust preferences are endogenous to regional institutions. This view supported by Fehr (2009) who agrees that trust preferences are endogenous to regional institutions, but not easily malleable. However, if trust is endogenous with regards to local institutions, it can be challenging to generalize these findings across different sites.

There also exist studies of the relationship between trust and socio-economic variables such as gender and income. One study show that females are more trusting than men (Lu, Shi and Zhong, 2018), while others find that men are more trusting than females (Buchan, Croson and Solnick, 2008). Some have failed to find significant relationships between the two variables (Chaudhuri and Sbai, 2011). Thus, the relationship between gender and trust is unclear and needs further attention to reach definite conclusions.

Recent findings on the relationship between income and trust and found that lower levels of income are correlated with lower degrees of trust (Ananyev and Guriev, 2019). This could indicate that poorer households are less trusting, which will be controlled for in the statistical analyses.

Endogenous trust preferences could involve trust changing over time. Researchers have approached this matter by comparing the trust of villagers in the aftermath of natural disasters with the trust of villagers not affected by a natural disaster. Fleming, Chong and Bejarano (2014) conduct a study in the aftermath of an earthquake in Chile in 2010. They find that trust do not vary significantly between groups, indicating that they are stable over time. On the other hand, Cassar, Healy and von Kessler (2017) find evidence of increased trust in the aftermath of the tsunami in Thailand in 2004. These two studies were conducted on two completely different sites which could explain the differences in the findings. The literature on trust indicate that there is no clear consensus about trust being endogenous with respect to time and situation. Thus, this field demands further attention.

2.4   *The sustainable livelihood framework*

Explaining livelihoods and poverty or affluence is a major – perhaps the main - part of development economics. Thus, if preferences are not a part of explaining wealth and

livelihoods, it is useful to look at how a standard approach in microeconomic theory on rural livelihoods approach these issues, and how preferences can potentially be incorporated.

The sustainable livelihood framework (SLF) in figure 1 adopted from Ellis (2000) is an instrument for analyses of rural livelihoods. The starting point of the SLF is the household livelihood platform. This consist of their natural, physical, human, financial and social capital which can be seen as stocks of capital that can be utilized or used to generate means of survival. Access to the capitals are conditioned by social relations, institutions and organizations, which together with trends and shocks determine the household livelihood strategies. Their livelihood strategies are diverse, and the SLF divides it into natural resources-based (NR-based) activities and non-NR-based activities. The activities they decide on then has an impact on their livelihood security and environmental sustainability.

How does preferences fit into this framework? If preferences are exogenous, then they could co-explain several of the stages in the SLF. Take human capital, which consist of, for example, the level of education. A household that is less risk averse and has a low rate of time preference, is more likely to invest their time and efforts in education, because it provides broader livelihood options through the opportunity to participate in skilled work.

Preferences could also co-explain the livelihood strategies that the households choose to engage in. For instance, NR-based activities are often more prone to shocks such as droughts or natural disasters. This indicate that a household which has a high degree of risk aversion would choose a more secure livelihood, e.g. wage employment. A household with a high degree of environmental preference is less likely to engage in work that involves environmental degradation.

Another example could be related to participation in markets. Market participation is related to trust (Tu and Bulte, 2010), thus institutions and organizations can adopt (or abstain from) mechanisms that affect the level of trust that exist in the market. Trust preferences should therefore be included in explaining market participation.

This brief discussion displays the lack of behavioral aspects in the SLF. Thus, if preferences are shown to be endogenous, it indicates that the individuals choose their activities based on their preferences, which means that some of the processes in the framework should be reversed. However, a discussion of causality will be addressed in later sections. The main aspect is to show that there is a missing element in the theory and practice of explaining livelihoods.
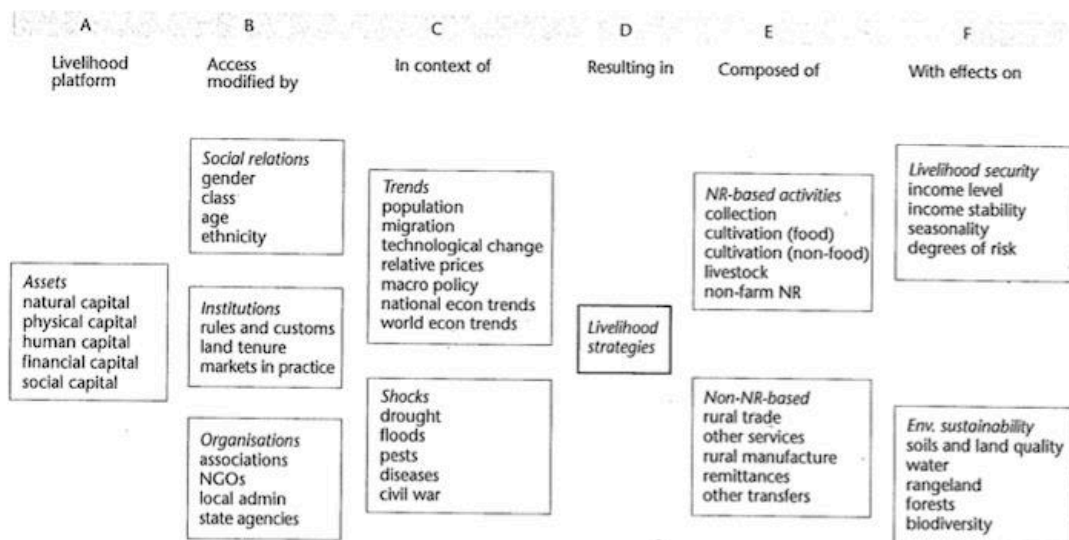
Figure 1 The sustainable livelihoods framework (Ellis, 2000).

2.5 Hypotheses

The hypotheses, i.e. the expected results of the data analyses, are presented in this section. The relationships are stated on the basis of which characteristics that are likely to correlate and the relationships found in previous empirical research.

Table 1 represent the expected relationships between the types of preferences. Some of the relationships are unspecified, because their expected relationships are ambiguous due to a lack of literature. Thus, some of the relationships are based on my own expectations.

Preference	Relation to	Expected relationship	Argument
Risk	Time	Patience and risk aversion	Future prospects are riskier
	Environmental	High env. preference and risk aversion	Conserving environment can reduce risks, e.g. health or climate risk
	Social		
	Trust	Trust aversion and risk aversion	Trusting means relying, on others which is risky.
Time	Environmental	Patience and high env. preference	Conserving environment could involve preserving for for future use.
	Social		
	Trust	Patience and higher trust preference	Trusting others could involve patience.

Environmental	Social		
	Trust		
Social	Trust	Higher social preference and higher trust preference	Altruism and reciprocity involves higher degree of trust

Table 1 Expected interrelations between preferences.

Table 2 show the expected relationship between preference variables and the explanatory variables. The sign represents the expected sign of the variable coefficient, while 0 indicate that the variable is the reference variable.

The first assumption is that households engaging in livelihoods that rely more on natural resources are expected to be more risk seeking. These livelihoods rely more on external factors, e.g. weather or market prices. Thus, these means of income are riskier.

Secondly, households engaging in livelihoods that rely on natural resources are expected to be more impatient. This is because the natural resources tend to be non-renewable, indicating that they choose to extract them sooner rather than later.

Households engaging in livelihoods that rely on natural resources are expected to care less about conserving the environment. This is because they maximize their income from the environment which indicate that they are not inclined towards conserving the natural environment.

Relationships between social preferences and the livelihood and income share variables are ambiguous. On one hand, it could be that households who care more about their fellow villagers do not prefer to generate their income from natural resources because they want to conserve these resources for others in the village or future generations. Another view could be that households that engage in more socially oriented livelihoods care more about their fellow villagers because they engage in social interactions through their livelihood activities. However, there are no clear expectation about these relationships.

Livelihoods that are more dependent on collective efforts and that have a higher degree of market dependence are likely to be correlated with trustfulness. Agriculture, fisheries, forestry and livestock are likely to be more dependent on market prices than the reference categories. While fisheries might be more dependent on individualistic efforts, forestry and agriculture are more likely to involve a higher degree of collective effort. Wage employment is more dependent on individualistic effort, thus the coefficient for this variable is negative. However, some of these relationships are unclear.

	Risk preference	Time preference	Environmental preference	Social preference	Trust preference
Socio-economic variables					
Age	-	-	-	+/-	+/-
Age squared	-	-	-	+/-	+/-
Education	-	+/-	+/-	+/-	+/-
Household size	+/-	+/-	+/-	+/-	+/-
Gender	-	+/-	+/-	+/-	+
Household income	+	+	+	+/-	-
Livelihood					
Agriculture	+	-	-	+/-	+
Fisheries	+	-	-	+/-	+
Forestry	+	-	-	+/-	+
Other	0	0	0	0	0
Income shares					
Agricultural	+	-	-	+/-	+
Environmental	+	-	-	+/-	+
Livestock	+	-	-	+/-	+
Wage	-	+/-	+	+/-	-
Miscellaneous income	0	0	0	0	0

Table 2 Expected relationship between livelihood and income share and the preferences

3 Data and method

This chapter presents the data and methods used in the thesis. The first sections focus on the data collection, while the later sections focus on the data analyses. The last section of the chapter discusses limits to this study.

3.1 Data collection

This section aims to discuss methods of obtaining preference data. I discuss preference elicitation by the use of surveys, experiments and observations. Strengths and possible biases of each method is discussed.

3.1.1 Stated preference

Collecting data through surveys with non-consequential questions is called stated preference. The advantage of stated preference data is that the researcher can collect information about any subject and control most aspects of the study (Lusk, 2011). In addition, it is possible to collect information about behavior that could be private and not accessible through observable choices (Vetschera and Kainz, 2013). However, this methodology has been proven to have several weaknesses. Individuals tend to over-report their desired behavior and under-report their undesired behavior (Vetschera and Kainz, 2013). For instance, the study made by Chuang and Schechter (2015) on stability of social preference yielded different results from stated and revealed preference. This indicates a gap between the respondents' desired behavior and their actual behavior in an experiment. Possible explanations could be that the actors are not fully aware of how they would behave in the actual situation or that they want to disguise their real preferences. On the other hand, studies have shown self-reported strategies of social preference match actual behavior in experiments (Vetschera and Kainz, 2013). This indicate that questionnaires provide some insights, at least for social preference.

3.1.2 Revealed preferences through experiments

An alternative data collection method is revealed preference through actions in experiments. Preferences can be revealed through experiments in lab or field. In lab experiments, the environment is controlled, thus it minimizes bias due to disturbances. There are also less costs involved, as the subject pool has to attend the experiment in the lab contrary to a field experiment where the researcher consults each subject in the field. However, lab experiments could involve several selection biases. There could be self-selection related to the decision of interest with regards to the experiment, in addition to self-selecting to participate in the experiment. For instance, more risk averse subjects could be risk averse towards participating in the experiment. In addition, the participants could be more willing to take more risk in a hypothetical setting than in real life (Lusk, 2011). Lab experiments often involve a lack of variability (i.e. WEIRD students) in the socio-economic characteristics of the subject pool. Thus, field experiments allow for more context relevant experimental design.

Revealed risk preferences can be elicited through pairwise lottery choice experiments. A study conducted by Holt and Laury (2002) is frequently mentioned in the literature. They did a comparison of choices made between ten pairs of lotteries. The subjects were presented with a menu of pairs of lotteries which typically had one option where there was a lottery with some probability of a high payoff or a very low payoff, and the second option where the lotteries had some probability of two payoffs with less extreme values. The probability change across the ten pairs of lotteries, and the point where the subject switches from one lottery to another makes it possible for the researcher to elicit the risk preference. Holt and Laury conducted this experiment with real monetary payoff, to provide incentives for the subjects to reveal their true preferences. They compare hypothetical and real payoff experiments and find that subjects underestimate their risk aversion in the hypothetical assignments. This can indicate that real payoff tasks give more insights with regards to risk preference.

Time preferences can be revealed by a similar method. Subjects are given a menu of choices between two payoffs, one present and one in the future. The rate of interest changes which means that e.g. the future amount becomes bigger. The preference is elicited by investigating at which point the subject changes from the present to the future payoff (Andersen, Harrison, Lau and Rutström, 2008).

A method for revealing environmental preference is hedonic pricing. This can be applied to property prices where environmental characteristics of the property are analyzed, e.g. the effect of reduced probability of flooding on property prices (Brouwer *et al.*, 2007). However, this method requires extensive data, in addition to assumptions about perfect information and functioning markets which under some circumstances is implausible.

The dominating methods for revealing social preferences are experimental games. The most frequent games are ultimatum game, dictator game and public goods games. Games can be played in several stages to capture the effect of repeated interaction. Typically, there is a first stage where a player chooses to allocate an amount to another player, and the second stage where the second player choose to reciprocate. The majority of players in social preference games allocate a positive amount, indicating positive social preferences i.e. actors have characteristics of fairness and altruism (Levitt and List, 2007).

Revealing trust preferences is also frequently done by experimental games. A trust game is a two-player game where typically both of them are endowed with an amount. One of the players choose to allocate an amount to the second player. The amount allocated gets multiplied by some factor, and the second player chooses to allocate an amount back to the

first player. Trust preferences are then elicited by investigating the size of the allocated amounts. The typical result of a trust game is that the first player allocate roughly 50 % and the average repayment rate is nearly 50 % of the transfer (Levitt and List, 2007), indicating positive trust preference.

Preference elicitation through experiments are often combined with survey data for statistical analyses, e.g. Andersen, Harrison, Lau and Elisabet Rutström (2008) or Tanaka, Camerer and Nguyen (2016). By combining these two methods, it could be possible to extend the research of preferences and its relationship with external factors.

3.1.3   Revealed preference though observational data

Preferences can also be revealed through analysis of observational data. This type of data can be obtained through analyses of market data or natural experiments.

Observed data deals with bias related to self-selection, because the subjects do not know that they are part of an experiment and there is no intervening in their actions. This means that the data have to be obtained in the natural environment of the subjects, which can be challenging. Observed data is most often obtained through either natural experiments or the demand for certain goods such as insurance or investments in new technologies.

Carlsson, Johansson-Stenman and Nam (2014) obtains social preference data by analyzing contributions to a bridge in a small community in Vietnam. The subjects made contributions to the bridge anonymously. The results showed that the subjects were willing to contribute to the social good, and the bridge was built. However, even though the bias in these types of experiments are low, the lack of control makes it difficult to test for reliability. In addition, there could be confounding variables which weakens the validity. Thus, the method solves some of the challenges, but raises other important questions.

3.2   Study area

Data was collected in the province of Ucayali, Peru. It is the second largest region of the country with roughly 430,000 inhabitants. The main city in the province is Pucallpa and hosts around half of the region's population (Sills *et al.*, 2014). It is a region rich in cultural and biological diversity: not only does there exist a wide range of plants and animals, the region also hosts 27 different ethnicities of indigenous people (Sills *et al.*, 2014). Ucayali is largely covered by the Amazon rainforest.

About 87 % of the region is covered by the Amazon rainforest forest. The climate is tropical, which means there are dry and wet periods with temperatures ranging between 19 to 30 degrees Celsius (Sills *et al.*, 2014). Because of the heavy seasonal rainfall, the livelihood activities in the area varies around the seasons. As the flood level varies, it provides access to areas at different times. In addition to this, flooding also affects fishing activities and possibilities for farming.

Figure 2 The Ucayali region (Wikipedia, 2020).

The communities in these areas engage in multiple, site-specific activities to provide for their livelihood (Porro, Lopez-Feldman and Vela-Alvarado, 2015). Forest product harvesting and fishing are important livelihood activities within the indigenous communities, and the main economic sectors of the area is agriculture, commerce and manufacturing (Sills *et al.*, 2014). Moreover, the households income consist of environmental products, agriculture and wage (Porro, Lopez-Feldman and Vela-Alvarado, 2015).

The villages surveyed have been subject to different REDD+ (Reducing Emissions through Deforestation and forest Degradation) initiatives since 2010 (Sills *et al.*, 2014). The purpose of these initiatives is to promote sustainable forest management in the indigenous communities, which is done through reduction of deforestation and degradation, biodiversity conversation, increasing of forest carbon reserves and improvement of livelihoods (Sills *et al.*, 2014).

3.3 The household surveys

The data used in this thesis is relatively new, it was collected in the period October-December 2018. The surveys were conducted by group of seven local enumerators coordinated by Julia Naime, a PhD candidate at the Norwegian University of Life Sciences. The surveys were a part of a study called "the Global Comparative Study on REDD+", coordinated by the Center for International Forestry Research (CIFOR) and were conducted in eight villages. There were approximately 30 households per village which resulted in a total of 248 interviews.

The household survey included an extensive set of questions, including basic household information, asset status, income, well-being, participation in forest conservation interventions and preferences. In 219 of the 248 interviews, the respondent was the head of the household.

In addition to collecting basic household information on demographics, income and assets, a separate section included a preferences survey. The full questionnaire is found in appendix 1. The preference questions were as follows:

"*We will now ask you a few questions about how you think about yourself as a person, compared to other people in the village. For each question, we ask you to select a number between 1 and 5, and you can choose 1, 2, 3, 4 or 5.*

Risk

How do you see yourself: are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?

Please choose on a scale from 1 to 5, where 1 means 'not at all willing to take risks' and 5 means 'very willing to take risks'

Time

How do you see yourself: are you generally a person who is impatient and want to have 'things' now, or can you wait until later to get them?

Please choose on a scale from 1 to 5, where 1 means that you mainly prefer to have things now, and 5 means that you mainly are willing to wait.

Environmental

How do you see yourself: are you generally a person who wants to maximize your income from the natural environment, or do you want to conserve the natural environment?

Please choose on a scale from 1 to 5, where 1 means that you mainly want to maximize income, and 5 means that you mainly want to conserve the natural environment.

Social

How do you see yourself: are you generally a person who thinks about the well-being of your family, or do you think of the well-being of others in the village?

Please choose on a scale from 1 to 5, where 1 means that you mainly think about your family, and 5 means that you mainly think about others in the village.

Trust

Do you in general trust people in the village (community)?

Please choose on a scale from 1 to 5, where 1 is not means 'not at all' And 5 means that you trust people a lot."

3.4 Variables

The variables that will be used in the thesis is shown in Table 3 Variable names, descriptions and measurements. 3. The table is divided into five parts; the socio-economic characteristics of the households, the village characteristics, livelihood categories and their income. The main variables of interest are the livelihood and income variables and their effect on the dependent variables, which are the preference variables.

Variable	Variable description	Measurement
Preferences		
Risk	Risk preference	Categorical 1 to 5
Time	Time preference	Categorical 1 to 5
Environmental	Environmental preference	Categorical 1 to 5
Social	Social preference	Categorical 1 to 5
Trust	Trust preference	Categorical 1 to 5
Socio-economic characteristics		
Age	Age of household head	Number of years
Age squared	Square of household head's age	Square of number of years
Education	Head of household education	Number of years
Household size	Individuals living in household	Number of individuals

Income	Household monthly net income	Net income in local currency (PEN)
Village characteristics		
Distance to main market	Distance from village main market	Euclid distance measured in km
Gini coefficient	Village Gini measure of inequality	Fraction [0,1]
Livelihood		
Agriculture	Own farm production, share cropping or agricultural labor	Factor
Fisheries	Own fishery production, fisheries labor or fishery business owner	Factor
Forestry	Own forestry production, forestry labor, forestry business owner or forestry service sector	Factor
Other	Domestic or community labor, household business, retired	Factor
Income		
Agricultural income	Income from agriculture; mostly sales of fruits, cocoa and other products	Share of total household income
Environmental income	Environmental income, forest and non-forest, mostly timber and food products obtained from the environment	Share of total household income
Livestock income	Income from livestock and animal products, mostly poultry and pigs	Share of total household income
Miscellaneous income	Government remittances, pensions, gifts, alms	Share of total household income
Wage income	Wage income, mostly from forestry and agricultural labor	Share of total household income

Table 3 Variable names, descriptions and measurements.

3.5 Data analysis

3.5.1 PCA

The purpose of the principal component analysis (PCA) is to examine the relationship between the preference variables to find out if they are related to each other. The PCA is a multivariate data analysis technique which can be applied to examine correlations or identify patterns and clusters in the data. The latter is the purpose of this PCA. The preference variables will be used as input in the PCA. A PCA require common factors among the variables, if there is not sufficient correlation, there is no ground for summarizing the variables. It is therefore useful to examine the correlations between the variables before conducting the PCA.

The method reduces dimensionality of a dataset in a rotated coordinate system, while retaining as much as the variation of the data as possible (Jolliffe, 2002; Xue *et al.*, 2011).

The projection of the variables lies on the axis and is called its loading. It indicates the relative importance of each variable. The projection of each sample on the new axis is called its score. The method generates principal components (PCs) based on the variation in the variables. The PCs are linear combinations of the variables and are orthogonal to each other. The score of the first PC of the sample will be on the first axis, the second PC on the second axis, and so on (Xue *et al.*, 2011).

A central question when using PCA is to determine how many PCs that should be retained. The strategy that will be implemented here is called "*Kayser's rule*" and it says that it is appropriate to retain any PCs whose variances exceed 1 (Jolliffe, 2002).

To assess the PCA results, a Kaiser-Meyer-Olkin (KMO) test is conducted. The test is a measurement of sample adequacy. It yields a result between 0 and 1, where values above 0.5 are considered satisfactory for a PCA (Hair, 1995).

3.5.2   Ordinal logistic regression

The dependent variables in these analyses are ordered categorical variables, which means that they break the standard assumptions of an ordinary linear regression model. The ordinal logistic regression (OLR) makes it possible to estimate a regression where there exist are than two outcomes of the dependent variable. Unlike the multinominal logistic model, which can also be used for categorical data, the OLR takes into account the ranking of the categories. Ranking means that the difference between the first and second outcome is not the same as the difference between the first and fourth outcome.

The OLR is a non-linear model and the magnitude of the change in the outcome probability for a given change in the independent variables depends on the levels of all the independent variables. The model observes the cutoff points between the different categories and assumes a linear effect on the dependent variable from each independent variable. In this way the categories of answers are observed, instead of observing them directly (Long and Freese, 2001).

The change in the outcome probability for a given change in one of the independent variables are dependent on the level of all the independent variables (Long and Freese, 2001). The OLR estimates the effect of the independent variables and the cutoff values for the dependent variable. The cutoff values are unknown, which means that is it not possible to know the exact value that will change a response from one category to another. The values can also vary within respondents, especially when the questions are qualitative.

The respondent's answers with regards to their individual reference level, which varies in intensity. However, it is assumed that responses choose the alternative that is closest to their opinion. Their responses are dependent of some factors that are measured in the independent variables, in addition to some factors that cannot be observed which will end up in the error term (Greene, 2012).

3.5.3 Maximum likelihood estimation

The OLR estimate the model using the Maximum Likelihood (ML) method. ML obtains estimates by the likelihood function. The function calculates how likely it is to observe the observation, if the given set of parameters were the true population parameters. The ML estimates are the values of the parameters that have the greatest probability to generate the observed data given that the model assumptions are fulfilled (Long and Freese, 2001).

When the model assumptions are fulfilled, the estimates from the OLR are asymptotic normally distributed. In a linear regression estimation, where the intercept and slope coefficient are estimated, the likelihood function tells us how likely it is to observe these values given that they are the true population parameters. Graphically, where the intercept value is on one axis and the slope coefficient on the other axis, the ML function looks like a hill, where the estimates are the values corresponding to the top of this hill. The variance corresponds to how quickly the slope is changing near the top of the hill (Long and Freese, 2001).

To assess the variables included in the estimation, it is useful to do post estimation analyses. Likelihood-ratio (LR) tests are used to test the OLR estimations. The test assesses the models' parameters by testing for joint significance of the coefficients. The purpose is to compare nested models. If the tests yields significant results, it indicates that the effects of the independent variables are different than zero, and thus there are reasons for them to be included in the model (Long and Freese, 2001).

3.6 *Study limits*

In this section I will discuss limits to this study. In any cross-sectional study, the challenge is inferring causality from correlations. The discussion will therefore be focused on causality in the context of direction of causality and simultaneity bias and the possible approaches to these challenges.

A causal effect is defined as a *ceteris paribus* change in a variable that has an effect on another variable (Wooldridge, 2014). Because causality is a time-dependent concept, it is not possible to determine causality in a cross-sectional study. If there are significant correlations in the regression analyses, it could be that the variables depend on a common underlying factor or that there exist reverse causality that affects them.

Explanatory variables that are determined jointly could lead to simultaneity bias. Simultaneity bias yields biased and inconsistent estimation results (Wooldridge, 2014). For instance, having a low income might cause someone to be more willing to take risk because they have nothing to lose. But at the same time, a high preference for risk is could be the reason that they have a low income in the first place.

Instrumental variable (IV) estimation is a possible method for estimating simultaneous equation models (Wooldridge, 2014). The challenge with IV estimations is finding instruments that meet the requirements of *relevance*, *exclusion* and *exchangeability* (Wooldridge, 2014). Tanaka, Camerer and Nguyen (2016) addresses the challenge of endogeneity of the income variable by using instrumental variables of rainfall and households head ability to work, assuming that these are uncorrelated with preferences. Rainfall is a popular instrument in economic research because it can affect agriculture and is exogenous to other economic activity. However, in studies like this one, where agriculture is not the only livelihood examined, using rainfall as an instrument is implausible.

An ideal study of the relationship between preferences and socio-economic variables could be conducted with a panel data. In a panel data set, the same individuals are randomly selected from a population at subsequent points in time. This means that it takes both the cross-sectional and time dimension into account. Doing the analyses with panel data could therefore yield more accurate estimations with regards to causality.

Despite of its limitations, this study is highly relevant and important because it addresses preferences from a perspective which there exist limited amount of research on. However, it is essential to be cautious of drawing solid interpretations about causality. Causality in these findings can be further validated by comparing the study with similar studies or to view in conjunction with market behavior.

4 Results

In this chapter I present the results of the analyses. The first section presents the descriptive statistics of variables used in the analyses. The second section presents the PCA analyses, while the third section presents four sets of regressions.

4.1 Descriptive statistics

4.1.1 Dependent variables

The descriptive statistics of the preference variables can lead to a conjecture of the trends and patterns in the data.

Figure 3 show the distribution of the stated preferences. The trend in the responses seem to be that the extreme values are favored over the middle values in all variables except for trust preference where the data seems to be more centered towards the middle values. For social preferences, roughly half of the sample reported the lowest possible number, which is surprising. It could be an early indication of the households being independent or self-reliant.
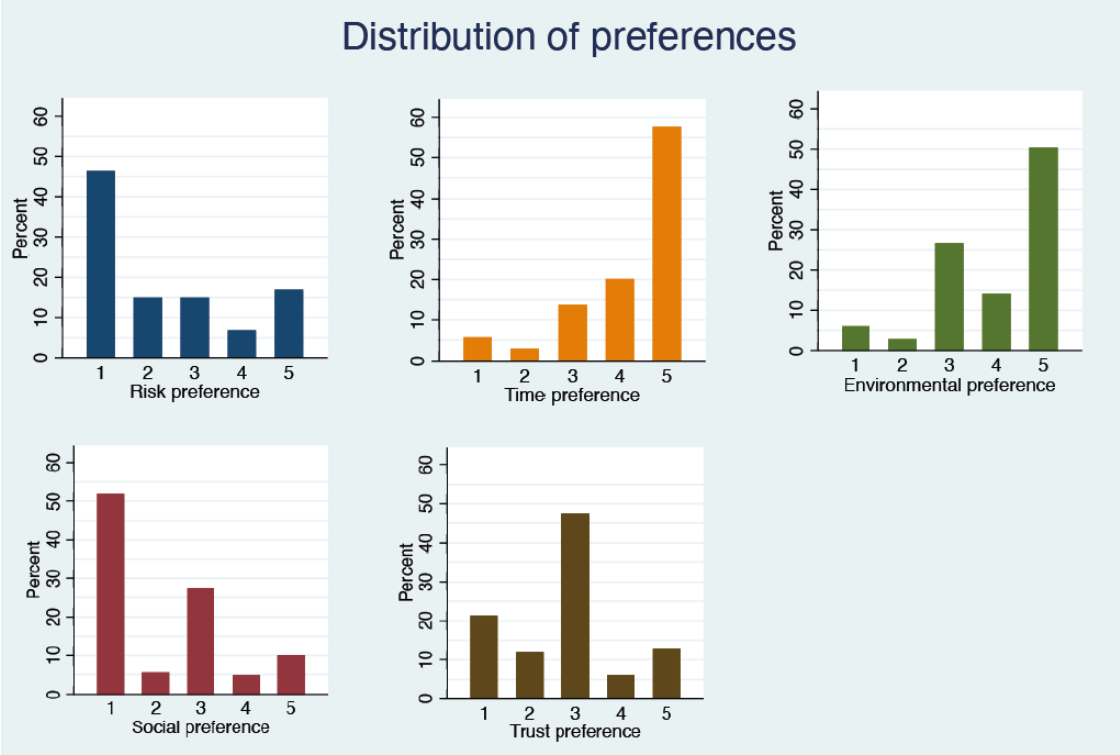
Figure 3 The distribution of preferences

Descriptive statistics for the dependent variables are shown in Table 4 Descriptive statistics of the dependent variables. The numbers show that the mean of risk, social and trust preferences are lower than the mean of time and environmental preferences. The standard deviations of the variables range from time with a variation of 1.13 to risk with 1.52.

	Obs	Mean	Std. Dev.	Min	Max
Risk	248	2.33	1.52	1	5
Time	248	4.21	1.13	1	5
Environmental	248	4	1.19	1	5
Social	248	2.15	1.37	1	5
Trust	248	2.77	1.22	1	5

Table 4 Descriptive statistics of the dependent variables

The correlation matrix of the dependent variables presented in <small>Stars indicate significance levels: $* p < 0.1$, $** p < 0.05$, $*** p < 0.01$</small>
Table 5 Correlation matrix of dependent variablesshow that most of the correlation coefficients are low. The stars indicate the significance level and the given sign of the coefficients indicates if the correlation is positive or negative. The highest correlation is of 0.21, between time and environmental preferences, while the lowest correlation is close to zero, between trust and time preferences. Social and trust have the overall lowest correlation with the other variables, equivalent to -0.005 between social and risk, -0.0341 between social and time and -0.0025 between social and environmental.

The correlations between time, environmental and risk preferences are the highest.

	Risk	Time	Environmental	Social	Trust
Risk	1.0000				
Time	-0.0902	1.0000			
Environmental	-0.1824***	0.2111***	1.0000		
Social	-0.0050	-0.0341	-0.0025	1.0000	
Trust	0.0235	0.0005	-0.0110	-0.0175	1.0000

Stars indicate significance levels: $* p < 0.1$, $** p < 0.05$, $*** p < 0.01$

Table 5 Correlation matrix of dependent variables.

4.1.2   Independent variables

Descriptive statistics of the independent variables can provide valuable insights, indicate relationships and challenges such as collinearity.

Table 6 presents the descriptive statistics of all the independent variables used in these analyses. The first part of the table shows the socio-economic variables. Mean age of head of the household is close to 48 years. The lowest age is 21 and the highest is 83, which is a quite large gap. Age squared is included in the analyses to test a quadratic relationship between the preferences and age. Mean years education is almost 9 years, which indicate that the average individual has completed secondary school. Average size of household is nearly 7 individuals per household; however, this number varies from 1 to 17 individuals, which means that there

is large variation in household size. The dummy variables for gender show low variation, as 97 % of the sample head of household are males. This indicate that men are more likely to be households head in these communities. The mean monthly income of a household is 932 PEN. For reference, the poverty rate in Peru is 3.7 PEN per day (World Bank Group, 2020).

Furthermore, the table show that just over half of the sample have agriculture as their primary livelihood, followed by fisheries with 26 % and forestry with 6 %. However, only 22 % of the shares of total income is generated from agriculture, which could indicate that agriculture is likely to be a low paid activity, or that the crops are mainly for private use. The minimum value of share of agricultural income is negative, which is because the income is their calculated net income, meaning that their reported costs are subtracted from their reported earnings. Some households had higher costs than earnings, which could be because of investments that are waiting to pay off or loss of crop due to e.g. bad weather. The largest share of income stems from the environmental segment with an average share of 44 % of the total income. The minimum is 0 and the maximum is 1.08. The reason that the maximum number is above 1, which should in practice not be feasible, is because there is one household that has negative agricultural income. This means that their total income decreased and became less than the income they generate from the environment. For the remaining sample, livestock income consists of 6 %, miscellaneous income 13 % and wage income 27 %.

	Obs.	Mean	Std. Dev.	Min	Max
Socio-economic characteristics					
Age	248	47.8	14.2	21	83
Age squared	248	2487	1449	441	6889
Education	248	8.7	4.1	0	17
Household size	248	6.7	2.8	1	17
Gender (male=1)	248	.97	.16	0	1
Income	248	932	789	6.5	6248
Primary livelihood			Frequency	Percent of sample	
Agriculture	248		132	53.23	
Fisheries	248		65	26.21	
Forestry	248		15	6.05	
Other	248		36	14.52	
Income					
Agricultural	248	.22	.22	-.15	.93
Environmental	248	.44	.26	0	1.08
Livestock	248	.03	.06	-.10	.50
Miscellaneous	248	.07	.13	0	1
Wage	248	.22	.27	0	.96

Village characteristics		
Village name	**Dist. to nearest market**	**Gini-coef.**
Cacomacaya	112.96	0.42
Calleria	30.75	0.24
Curiaca	114.89	0.33
Nuevo Ahuaypa	76.25	0.34
Nuevo Saposoa	39.31	0.41
Patria Nueva	37.77	0.39
Pueblo Nuevo del Caco	118.13	0.40
Roya	92.92	0.44

Table 6 Descriptive statistics of independent variables

The village variables show some of the main characteristics of the 8 villages where the sample was collected. The regressions were estimated with village-clustered standard errors to control for the potential non-independence of observations within sites. In addition, some of the village characteristics are included as explanatory variables to control for confounding factors. The descriptive statistics in table 6 show that Calleria is the village closest to a market, while Pueblo Nuevo del Caco is furthest away. The Gini measurements show that the inequality range from Calleria that has a coefficient of 0.24 to Roya that has a coefficient of 0.44.

Table 7 shows the correlations among the socio-economic variables in the sample. The correlation between age and education is particularly high. Surprisingly, this coefficient is negative, indicating that lower age is correlated with higher education. It could be that there was an increase in the availability of educational institutions in the villages in more recent times. However, most correlations are low, which is positive because it indicates low collinearity, which could have affected the regression outcomes.

	Age	**Education**	**Household size**	**Gender**	**Income**
Age	1.0000				
Education	-0.5334***	1.0000			
Household size	0.0303	-0.0217	1.0000		
Gender	0.0159	-0.0850	-0.0034	1.0000	
Income	-0.0809	0.1095*	-0.1057*	0.0038	1.0000

Stars indicate significance levels: $* \, p < 0.1$, $** \, p < 0.05$, $*** \, p < 0.01$

Table 7 Correlation matrix of socio-economic characteristics

4.2 *Principal component analysis*

The first research question was examined by the use of a PCA. The results from the PCA indicated that risk, time and environmental preferences are closer related to each other than to social and trust preferences. Moreover, social and trust preferences are found to relate closer to each other than to the other variables.

The PCA results in Table 8 Principal component analysisshow that the first two components are above 1. They explain nearly half of the variation in the data. The numbers show that is a significant break in the eigenvalues of PC1 and PC2, but the eigenvalues of PC2 and PC3 are relatively close.

Component	Eigenvalue	Difference	Proportion	Cumulative
PC1	**1.32**	.30	.26	.26
PC2	**1.02**	.04	.20	.47
PC3	.98	.07	.19	.66
PC4	.90	.14	.18	.84
PC5	.76	0	.15	1.00

Table 8 Principal component analysis

Table 9 show the loadings of the PCs. The loadings represent the correlation between the PCs and the original variables. The right column indicates how much of the variation in the variables that is unexplained by using 2 components. It shows that social and trust have a much higher degree of explained variation than environmental, time and risk.

The loadings also indicate which variables that group together. In this case the PC1 loads high on environment, time and risk. PC2 loads high on social and trust, in addition to capturing some of the variation in risk and time preferences.

Variable	PC1	PC2	Unexplained
Risk	**-0.51**	0.18	0.60
Time	**0.55**	0.18	0.54
Environmental	**0.64**	-0.01	0.43
Social	-0.05	**-0.71**	0.04
Trust	-0.05	**0.65**	0.01

Table 9 Loadings of PCs.

The biplot of the PCA in figure 4 is a graphical representation of some of the information from table 9. It shows the vectors which represent the variables of interest. The two axes are the PC dimensions. The biplot confirms the results from table 9, showing that the variation in time, risk and environmental preferences are captured PC1, and social and trust is captured in PC2. The lengths of the vectors represent the quality of the PCA dimension. If a variable has shorter length, then the information it contains is less represented on that dimension. On PC1, the variation from environmental preferences is most explained, whereas time and risk have roughly the same amount of representation in absolute numbers, but positively and negatively respectively. Social and trust load high on PC2, where trust loads negatively and social positively.
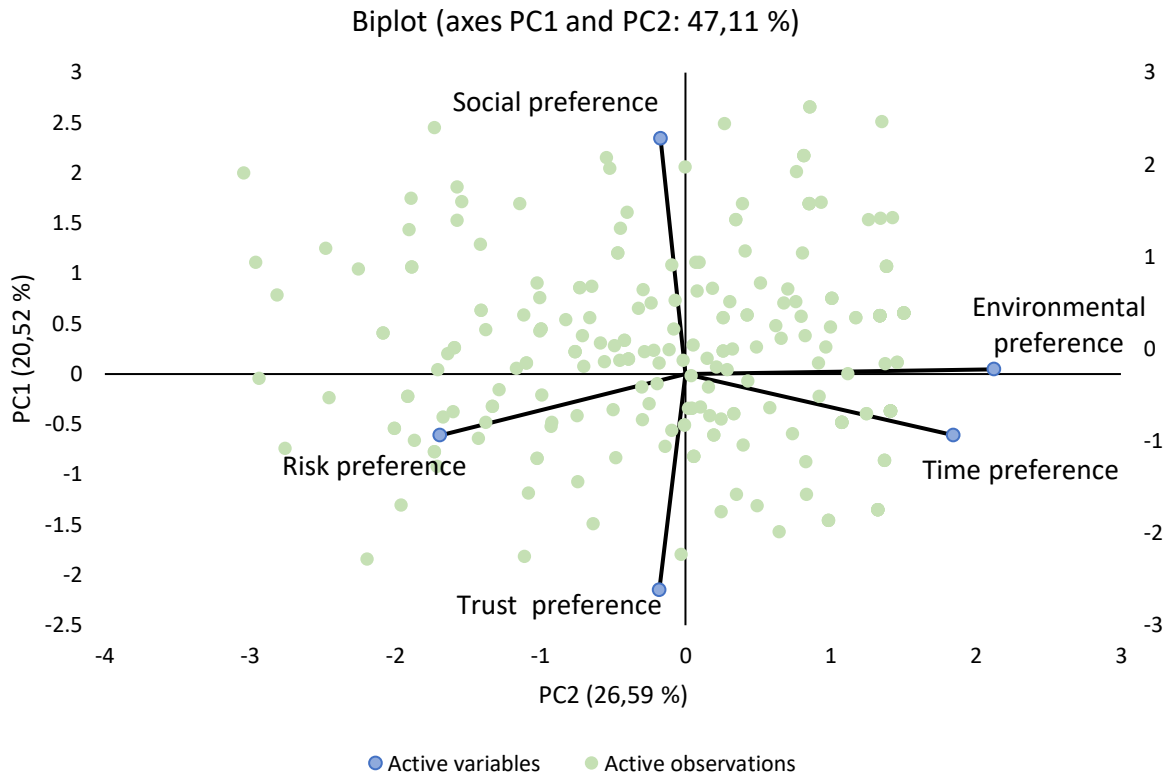
Figure 4 Biplot of PCA.

Narrow angles between the vectors indicate that they are positively related. Obtuse angles indicate a negative relationship, and right angles indicate unrelated relationships. The biplot shows that being risk averse, have strong environmental preferences and being patient (low rate of time preference) go together. Social and trust are also negatively related to each other. Trust and social preferences appear to be weakly related to time and risk preferences.

The green scatter plots in the biplot marks the observations. There seem to be low redundancy in the data, as the data points are relatively spread out and centered towards the middle. It is difficult to identify any evident clusters or patterns. However, the loadings indicated that the preferences related to environment, time and risk are more closely related than to the social and trust preferences, which seems to be a different "preference sphere".

4.3   Regressions

The second research question was approached by the use of regression analyses. In this section I present two sets of regressions. The socio-economic characteristics and village variables are included as explanatory variables throughout the analyses.

The first set of regressions includes the livelihood categories as explanatory variables. The second models replace the livelihood variables with the income shares. The reason for having two sets of regressions are that the LR-tests indicated that including both of these sets of variables in one regression was likely to cause problems of multicollinearity. This strategy also makes it possible to examine how, or if, the socio-economic characteristics alters by including different measurements of livelihood.

To make comparison of the coefficients comprehensible when variables are measured in different units, some of the variables have been standardized. This involves subtracting the mean of the value and dividing it on the standard deviation. The variables that have been standardized are age, age squared, income, the income share variables and the distance to nearest market.

The regression model with the primary livelihoods effect on preferences is shown in table 10.

	Risk preference	Time preference	Environmental preference	Social preference	Trust preference
Regression model with livelihood categories					
Age	-0.152	-0.033	-0.126	0.848	-0.758
	(0.525)	(0.381)	(0.830)	(1.462)	(1.123)
Age squared	-0.073	0.055	0.072	-0.542	0.565
	(0.449)	(0.539)	(0.876)	(1.409)	(1.273)
Education	**-0.077**✶✶	0.059	0.054	**0.081**✶	-0.068
	(0.037)	(0.048)	(0.048)	**(0.042)**	(0.051)
Household size	0.016	**-0.066**✶	-0.024	0.033	-0.063
	(0.044)	**(0.035)**	(0.037)	(0.042)	(0.048)
Gender	-0.518	-0.605	0.293	0.508	0.538
	(0.703)	(0.522)	(0.416)	(0.711)	(0.726)
Income	-0.028	-0.126	**-0.157**✶	-0.051	-0.065
	(0.098)	(0.128)	**(0.081)**	(0.164)	(0.114)
Agriculture	**0.783**✶✶	-0.102	-0.676	**0.849**✶✶✶	-0.347
	(0.379)	(0.422)	(0.647)	**(0.268)**	(0.599)
Fisheries	**0.770**✶	-0.441	-0.139	**0.910**✶✶✶	-0.072
	(0.452)	(0.523)	(0.584)	**(0.276)**	(0.537)
Forestry	1.213	**-1.212**✶✶✶	**-1.838**✶✶✶	**1.360**✶✶✶	0.267
	(0.902)	**(0.344)**	**(0.690)**	**(0.299)**	(0.728)
Dist. to nearest marked	-0.124	0.017	0.163	0.028	0.035
	(0.191)	(0.079)	(0.138)	(0.183)	(0.054)
Village gini	**7.496**✶✶✶	-1.239	**-4.592**✶✶	0.347	**-3.145**✶
	(2.295)	(2.614)	**(2.133)**	(2.247)	**(1.647)**
Observations	248	248	248	248	248
Log likelihood	-338.219	-284.837	-297.530	-300.110	-332.231

Standard errors in parentheses. Stars indicate significance levels: ✶ $p < 0.1$, ✶✶ $p < 0.05$, ✶✶✶ $p < 0.01$

Table 10 Regression model with livelihood categories

The coefficient for education is significant with $p<0.05$ for risk and social preferences. For risk, the coefficient is negative, indicating that individuals with higher levels of education

is more likely to be in the lower categories of risk preferences. For social preference the coefficient is positive, indicating that an increase in education is related to higher levels of social preference.

The coefficients for agriculture and fisheries are positive and significant for risk preferences. This means that households that have these livelihoods as their primary basis for a living, are more likely to be less risk averse.

For social preferences, all three livelihoods have positive and significant coefficients. Time preference and environmental preferences have negative and significant coefficients for forestry.

For social preferences, all three livelihoods have positive and significant coefficients. Time and environmental preference have negative and significant coefficients for forestry.

Regression models with income shares					
	Risk preference	**Time preference**	**Environmental preference**	**Social preference**	**Trust preference**
Age	-0.292 (0.439)	0.071 (0.630)	0.031 (0.767)	0.823 (1.392)	-0.572 (1.214)
Age squared	0.105 (0.366)	-0.013 (0.821)	-0.188 (0.856)	-0.610 (1.361)	0.411 (1.395)
Education	**-0.094**∗∗ **(0.041)**	0.061 (0.057)	0.047 (0.051)	0.063 (0.040)	**-0.081**∗∗ **(0.039)**
Household size	0.003 (0.048)	-0.058 (0.042)	-0.013 (0.037)	0.015 (0.043)	-0.056 (0.050)
Gender	**-1.223**∗∗ **(0.526)**	-0.338 (0.421)	0.669 (0.412)	-0.316 (0.541)	0.627 (0.745)
Income	-0.127 (0.103)	-0.196 (0.129)	**-0.134**∗∗ **(0.063)**	-0.032 (0.167)	-0.099 (0.141)
Agricultural income	0.555 (0.447)	0.131 (0.163)	-0.280 (0.327)	-0.087 (0.155)	-0.026 (0.317)
Environmental income	0.414 (0.453)	0.023 (0.193)	**-0.520**∗ **(0.312)**	-0.158 (0.193)	0.090 (0.361)
Livestock income	0.025 (0.205)	-0.263 (0.267)	**-0.333**∗ **(0.184)**	0.020 (0.141)	-0.086 (0.167)
Wage income	0.555 (0.577)	0.059 (0.188)	**-0.555**∗ **(0.319)**	-0.230 (0.212)	0.229 (0.363)
Dist. to nearest marked	-0.096 (0.198)	0.090 (0.100)	0.023 (0.166)	-0.003 (0.123)	0.045 (0.073)
Village gini	**6.646**∗∗∗ **(1.507)**	-0.699 (3.135)	-3.622 (2.678)	0.073 (1.910)	**-3.241**∗∗ **(1.549)**
Observations	248	248	248	248	248
Log likelihood	-337.771	-285.337	-300.399	-302.695	-331.458

Standard errors in parentheses. Stars indicate significance levels: ∗ $p < 0.1$, ∗∗ $p < 0.05$, ∗∗∗ $p < 0.01$

Table 11 Regression models with income shares

Table 11 show the results from the regression using income shares as the explanatory variables. The education and gender variables are significant and negative for risk

preferences. Education is also significant and negative for trust, indicating that households with higher levels of education are more likely to have lower levels of trust.

For environmental preferences, the variable for income is now negative and significant with $p<0.05$. For the income shares effect on environmental preferences, environmental income shares, livestock and wage are all significant and negative.

5 Discussion

This chapter aims to discuss the results in light of the hypotheses. The first section focuses on the interrelations between preferences, while the second section is devoted to the preferences relation to livelihood and income.

5.1 Interrelation of preferences

The aim of this section is to discuss the results in light of the expectations and to answer the research question:

(1) How do stated risk, time, environmental, social and trust preferences relate to each other?

The PCA indicated that risk, time and environmental preferences were closer related to each other than to social and trust preferences. At the same time, social and trust preferences were found to relate closer to each other than to risk, time and environmental. This could indicate two "spheres" of preferences; one of individual-personal based preferences (time, environmental and risk) and one related to social relations (social and trust).

Patience and high inclination towards the environmental were positively correlated with each other, in addition to both of them correlating positively with risk aversion. This result is consistent with the expectations with regards to environmental inclination and patience which could be explained by households that are more patient, have higher appreciation of the environment. In particular, environmental conservation can be considered to enlarge future options, and more patient respondents therefore emphasize that more.

The relationship between risk aversion and patience was not in line with the expected findings which suggested that households with less risky attitudes was related to impatience. Households who are risk averse are more patient, which could be because they consider later

gains to be an insurance of future income. For instance, patient households were more inclined towards preserving the environment as well, which involve preserving resources that can be utilized at a later point of time. This can be seen as a form of insurance for future income, which can explain why risk aversion and patience are related. Another possible explanation could be that if patient households have accumulated more wealth, then they might not have as strict cash constraints which could make them more willing to take (at least financial) risk.

The main outcome of PC2 was that low social preference and higher trust was related. This is a surprising result; an individual who is more trusting, care less about the well-being of others in the community. A possible explanation for this could be that exist culturally transmitted behavior which substantially affect decision making. Henrich (2000) finds that the Machiguenga tribe, which is a tribe in the southeastern Peruvian Amazon contributes less than the average player in an ultimatum game, indicating that low social preference could be explained by "cultural differences". The researcher perceived that the Machiguenga players did not expect to receive an equal share of the endowment and seemed to think that the low offers (an average of 15 %) were fair. If their culture coincides with the culture of the households in Ucayali, then this could explain why their social preferences are fundamentally low. On the other hand, this does not say anything about why the households at the same time have a high degree of trust towards fellow villagers. Perhaps trusting and caring are perceived as two completely independent characteristics, where trust could reflect solidarity and loyalty among the villagers, while social is considered more in terms of sharing resources. For instance, imagine a fruit seller who sees someone drop a bill, he would run after the individual to make sure the bill is returned, however, later, he would try to claim a higher price when selling his bananas to someone. In this way, his personality reflects trustworthiness, but with regards to his resources he is profit maximizing.

Further, PC2 showed that trustfulness had a weak relationship with risk aversion and patience which were consistent with the expectations. Low levels of social preference were weakly correlated with patience and higher willingness to take risk.

There is a lack of studies directed towards the relationship between preferences. Thus, anticipating results of the analyses was challenging. It is useful with more research on this topic, for example, to establish if, and how, preferences relate. Particularly, this study suggests that it might be useful to group preferences in individual-personal oriented and social-oriented, as these groups were shown to have strong intra-relationships among the preferences.

5.2   Explaining variation in the preferences

This section aims to discuss the findings in the estimated regressions with regards to the expected results and answers the second research question:

> (2) How do household socio-economic characteristics and livelihood choices relate to the stated risk, time, environmental, social and trust preferences?

Table 12 show a summary of the results of the two sets of regression models. The sign indicates a positive (+) or negative (-) effect in one of the regression models, while a double sign (++ or --) indicate that the effect of the variable is significant all regression models. A 0 indicate that the variable is insignificant in all regression models. To make interpretations straightforward, the expression in the parentheses under the preferences will be used to explain the effects in the discussion. For instance, a negative (-) for age with regards to risk will indicate less risk averse.

The regression analyses gave some significant relationships. Higher degrees of education is significantly related to higher risk aversion in both models, consistent with the findings of Tanaka, Camerer and Nguyen (2016). Higher degrees of education were also shown to be significant with regards to less trusting and more caring attitudes. This could indicate that, at least some, preferences are endogenous with regards to education. Unlike several other studies, for almost all types of preferences, this study does not find significant relationships between gender and preferences. However, this is likely to be due to little variation in the gender variable, as 97 % of the sample were males.

The relationship between wealth (income) and the preferences were insignificant for almost all models. Income had a significant negative coefficient for trusting, indicating that households with higher income are likely to be more trusting. The descriptive statistics indicated that environmental income was highly profitable; thus, it could be that the households who are in the higher income groups are households that have bigger shares of environmental income. This result is backed up by the significance of the environmental share income variable. Table 12 show that households with a higher share of environmental income are more likely to be less willing to preserve the environment. In addition to this, the forestry livelihood variable is significant and negative with regards to patience, which also backs up

this result. They need income now, implying that they disregard later use of resources and are relatively less willing to preserve the environment for their immediate benefit.

Table 12 Summary of regression models

	Risk preference (risk aversion)	Time preference (patience)	Environmental preference (willingness to preserve the environment)	Social preference (caring)	Trust preference (trusting)
Household characteristics					
Age	0	0	0	0	0
Age squared	0	0	0	0	0
Education	++	0	0	+	-
Household size	0	-	0	0	0
Gender	+	0	0	0	0
Income	0	0	--	0	0
Village level variables					
Dist. to nearest marked	0	0	0	0	0
Village Gini	--	0	-	0	--
Livelihood					
Agriculture	-	0	0	+	0
Fisheries	-	0	0	+	0
Forestry	0	-	-	+	0
Income shares					
Agriculture	0	0	0	0	0
Environmental	0	0	-	0	0
Livestock	0	0	-	0	0
Wage	0	0	-	0	0

Similarly, the wage income shares variable show that households that have a larger share of wage income are more likely to be less willing to preserve the environment. The wage category includes households that are employed in the forestry and agricultural sector, which could be an explanation for this. Working in these sectors show that they are willing to deplete the environment for the gains provided by using natural resources.

Households who have agriculture and fisheries as their main livelihood were more likely to be less risk averse. These livelihoods rely highly on natural resources, with fluctuating weather and market prices, in addition to involving high investments in productive assets. Thus, these livelihoods can be perceived as riskier. Whether the correlation is due to more risk loving individuals being attracted to these occupations, or whether the risky environment had taught them to live with and accept higher risk, is hard to tell from our models, and require studies with, for example, panel data.

The Gini-coefficient was significant in all models for risk and trust preferences. Higher Gini, which involves more village inequality was related to less risk aversion, and more inequality was related to less trusting. Households living in villages with higher inequality are more likely to be poor, and therefore have little or nothing to lose when it comes to taking more risk. On the other hand, it could be that they are poor because they take risks, or that the richer households can take more risks because they are less cash constrained. Thus, the direction of causality has to be examined more closely in order to be determined. If households that live in villages with high inequality are less trusting, this implies that the households living in villages with less inequality is more trusting. A possible explanation for this could be that there are generally less cash constraints in villages with less inequality, and this causes them to be less distressed about others executing negative behavior towards them such as stealing or dishonesty. Research on inequality and trust have given strong evidence of inequality and trusting being related on several levels (Jordahl, 2011), thus, it is likely that this is the case for these communities as well.

All three livelihood categories had a positive, significant coefficient for social preference, indicating that households in one of these categories are more likely to be more caring of the well-being of others in the community than those in the reference category. A possible reason for that could be that those engaged in agriculture, fisheries or forestry are more socially engaged in the local community than those in the "other" category. The "other" category included business income, retired individuals and employment in the community or domestic sector which could include governmental jobs. Thus, these occupations could be more individual based, while engaging in agriculture, fisheries and forestry work at local sites together with other employees, implies that they interact more with other community members. This would be in line with the findings of Henrich *et al.* (2001) who found that social behavior are consistent with patterns of everyday life.

It is difficult to draw general conclusions when comparing my results with results from empirical research done across different cultures on preferences. This is because

societies and societies and groups can differ in a vast number of dimensions which makes it impossible to determine which factors that influence the preferences (Fehr and Hoff, 2011). This was particularly evident in the measurement of social preferences in this study where the households seemed to be more individualistic which is likely to be due to cultural practices.

Influential research on endogenous preferences suggest that cultural factors play a significant role in shaping preferences (Henrich, 2000; Henrich *et al.*, 2001; Fehr and Hoff, 2011). Studies including limited numbers of cultural groups are shown to have inherent difficulties in distinguishing the impacts of socio-economic and cultural factors (Wang, Rieger and Hens, 2016). This study focused on only one cultural group; thus, the results can be interpreted for this specific group, but if it can be interpreted as externally validity and relevance for, for example rural communities in developing countries – can be questioned.

This study therefore provides limited evidence on preferences being endogenous with regards to livelihoods and income sources. Most of the socio-economic characteristics were insignificant in the regression analyses. This finding is not peculiar in the literature, for instance, Binswanger (1980); Holden, Shiferaw and Wik (1998), Tanaka, Camerer and Nguyen (2016); Wang, Rieger and Hens (2016) also finds that most socio-economic characteristics are insignificant. However, the discussion of endogenous preferences persists, indicating that there is not yet scientific consensus in the field.

It is not clear to which concept these results lean more towards, "*de gustibusnon est disputandum*" or the "*Sour grapes*". The statistical analyses indicated that preferences are stable with regards to some situations or characteristics. On the other hand, there are significant correlations between some economic contexts and livelihood situations and preferences, indicating that preferences could be malleable. In this study, time and trust preferences seem more likely to be exogenous than risk, environmental and social preferences, particularly with regards to income and livelihoods.

5.3 Methodological limitations

There were several implications of this study. The preferences were measured using hypothetical choice based on self-reporting, which may bias the results. Moreover, the subject pool answers the survey with regards to their own reference level, which might differ across responses. For instance, when asked about time preference there was not given a specific scope of time, they were asked if they prefer to have things "now" or "later". Thus, there is room for different interpretations, in particularly of "later". The preference-questions that

were surveyed were general, and it could be that the respondents have several preferences directed towards different dimensions. For instance, one risk preference towards income, and another towards health, and so on. Thus, it can be difficult to draw general conclusions about some preferences. Moreover, the survey questions focused only on gains, while behavioral economics suggest that individual exhibit different preferences towards losses and gains (Kahneman and Tversky, 1979), which was not taken into account here.

In addition, the respondents had no real incentives, which means they could lack motivation towards giving carefully thought-through answers. There is also a chance that the respondents reported their desired behavior or that they were not fully aware of how they would behave in given situations. It could therefore be highly valuable for future studies to elicit preferences from the same subject pool through revealing (e.g. experimental) methods and comparing the two results.

The PCA analyses also had some weaknesses. Firstly, the correlations between the preference variables were low, indicating that there were few common factors among the variables. A Kayser-Meier-Olkin test for sampling adequacy was conducted, which showed that the sample was weak, but adequate. The results from the test is attached in appendix II. Secondly, 47 % of the variation of the sample were captured in the two PCs, which means that more than half of the variation was left unexplained. In particular, a considerable part of the information in risk, time and environmental preference variables was left unexplained.

For the regression analyses, there were two main concerns; the direction of causality and the likely endogenous income variable. In any cross-sectional study like this one, it is difficult to determine causality, moreover, because the study was not designed to do so. Therefore, the findings in the regression model must be interpreted as correlations and not causalities. In order to determine causal effects, it is required to either conduct a longitudinal study, or to estimate simultaneously equation models with good instruments. In addition, it was likely that the income variable suffered from endogeneity and should ideally have been estimated in a simultaneous equation system. However, identifying instruments was difficult for several reasons, one of them being that there was large variation in the income sources.

6 Conclusions

Anyone who has taken a basic course in economics have learned that assumptions are a central part of the discipline. The aim of this thesis was to look deeper into one of the most fundamental assumptions in economics; exogeneity of preferences. I wanted to see how

preferences relate to each other, and how and if livelihoods and socio-economic relate to preferences.

The results indicate two phenomena; preferences can be divided into two "preference-spheres", one individual-personal preference sphere, and one social-regarding preference sphere. The individual-personal based sphere comprised preferences that mostly regarded oneself, in this study they were risk, time and environmental preferences. While social-regarding preferences incorporated others to some degree, here, social and trust preferences.

Secondly, the results indicate limited evidence of preferences being endogenous with regards to livelihoods and income. Risk, environmental and social preferences were shown to correlate with income sources or livelihood choices, thus, they were more likely to be endogenous. For time and trust preferences there were little or no evidence of correlations with income and livelihoods, indicating that they are more likely to be exogenous.

Due to methodological and data limitations, the direction of causality could not be ensured in this study. This constitute a difficulty when determining if preferences are shaped by economic circumstances. However, there are logical justifications that, at least some of, the findings are likely to be causal.

Furthermore, the results from this thesis suggest three directions of further consideration. Firstly, the interrelation of preferences should be further illuminated, and a suggested approach would be to consider a distinction between individual-personal preferences and other-regarding preferences. Secondly, the relationships between preferences and livelihoods needs further attention to establish whether contingent livelihoods can shape preferences. Lastly, studies of rural livelihoods should integrate behavioral aspects into their assessments so that implementations and prediction of policy changes can be made more accurately.

7 References

Abdellaoui, M., Diecidue, E. and Öncüler, A. (2011) 'Risk preferences at different time periods: An experimental investigation', *Management Science*. doi: 10.1287/mnsc.1110.1324.

Ananyev, M. and Guriev, S. (2019) 'Effect of income on trust: Evidence from the 2009 economic crisis in Russia', *Economic Journal*. doi: 10.1111/ecoj.12612.

Anderhub, V. *et al.* (2001) 'On the interaction of risk and time preferences: An experimental study', *German Economic Review*, 2(3), p. 239 253. doi: 10.1111/1468-0475.00036.

Andersen, S., Harrison, G. W., Lau, M. I. and Rutström, E. E. (2008) 'Eliciting risk and time preferences', *Econometrica*, 76(3), pp. 583–618. doi: 10.1111/j.1468-0262.2008.00848.x.

Andersen, S., Harrison, G. W., Lau, M. I. and Elisabet Rutström, E. (2008) 'Lost in state

space: Are preferences stable?', *International Economic Review*, 49(3). doi: 10.1111/j.1468-2354.2008.00507.

Anderson, C. L. *et al.* (2004) 'Discount rates in Vietnam', *Economic Development and Cultural Change*, 54(4), pp. 873–887. doi: 10.1086/381111.

Andreoni, J. and Sprenger, C. (2012) 'Risk preferences are not time preferences', *American Economic Review*, 102(7), pp. 3357–3376. doi: 10.1257/aer.102.7.3357.

Andreoni, J. and Vesterlund, L. (2001) 'Which is the fair sex? Gender differences in altruism', *Quarterly Journal of Economics*, 116, pp. 293–312. doi: 10.1162/003355301556419.

Bezu, S. and Holden, S. T. (2015) 'Generosity and sharing among villagers: Do women give more?', *Journal of Behavioral and Experimental Economics* . Elsevier Ltd., 57, pp. 103–111. doi: 10.1016/j.socec.2015.05.005.

Binswanger, H. P. (1980) 'Attitudes Toward Risk: Experimental Measurement in Rural India', *American Journal of Agricultural Economics*. doi: 10.2307/1240194.

Binswanger, H. P. (1981) 'Attitudes Toward Risk: Theoretical Implications of an Experiment in Rural India', *The Economic Journal*, 91(364), pp. 867–890. doi: 10.2307/2232497.

Binswanger, H. P. and Sillers, D. A. (1983) 'Risk Aversion and Credit Constraints in Farmers' Decision-Making: A Reinterpretation', *The Journal of Development Studies*. doi: 10.1080/00220388308421885.

Bogner, F. X. ., Brengelmann, J. C. . and Wiseman, M. (2000) 'Risk-taking and environmental perception', *The Environmentalist*, 20, pp. 49–62.

Bowles, S. (1998) 'Endogenous Preferences: The Cultural Consequences of Markets and other Economic Institutions', *Journal of Economic Literature*, 36(1), pp. 75–111.

Bridges, D. (2006) 'Adaptive preference, justice and identity in the context of widening participation in higher education', *Ethics and Education*. doi: 10.1080/17449640600584946.

Brouwer, R. *et al.* (2007) 'Socioeconomic vulnerability and adaptation to environmental risk: A case study of climate change and flooding in Bangladesh', *Risk Analysis*, 27(2). doi: 10.1111/j.1539-6924.2007.00884.x.

Bruckner, D. W. (2009) 'In defense of adaptive preferences', *Philosophical Studies*, 142, pp. 307–324. doi: 10.1007/s11098-007-9188-7.

Buchan, N. R., Croson, R. T. A. and Solnick, S. (2008) 'Trust and gender: An examination of behavior and beliefs in the Investment Game', *Journal of Economic Behavior and Organization*, 68(3–4), pp. 466–476. doi: 10.1016/j.jebo.2007.10.006.

Carlsson, F., Johansson-Stenman, O. and Nam, P. K. (2014) 'Social preferences are stable

over long periods of time', *Journal of Public Economics*, 117, pp. 104–114. doi:
http://dx.doi.org/10.1016/j.jpubeco.2014.05.009.

Carpenter, J. P. (2005) 'Endogenous social preferences', *Review of Radical Political
Economics*, 37(1), pp. 63–84. doi: https://doi.org/10.1177/0486613404272330.

Cassar, A., Healy, A. and von Kessler, C. (2017) 'Trust, Risk, and Time Preferences After a
Natural Disaster: Experimental Evidence from Thailand', *World Development*, 94, pp. 90–
105. doi: 10.1016/j.worlddev.2016.12.042.

Chaudhuri, A. and Sbai, E. (2011) 'Gender differences in trust and reciprocity in repeated gift
exchange games', *New Zealand Economic Papers*, 45(1–2), pp. 81–95. doi:
10.1080/00779954.2011.556072.

Chuang, Y. and Schechter, L. (2015) 'Stability of experimental and survey measures of risk,
time, and social preferences: A review and some new results', *Journal of Development
Economics*. doi: 10.1016/j.jdeveco.2015.07.008.

Das, T. K. and Teng, B. S. (2004) 'The risk-based view of trust: A conceptual framework',
Journal of Business and Psychology, 19(1), pp. 85–116. doi:
10.1023/B:JOBU.0000040274.23551.1b.

Dietz, T., Fitzgerald, A. and Shwom, R. (2005) 'Environmental Values', *Annual Review of
Environment and Resources*, 30, pp. 335–372. doi:
https://doi.org/10.1146/annurev.energy.30.050504.144444.

Dohmen, T. *et al.* (2017) 'Risk Attitudes Across The Life Course', *Economic Journal*,
127(605). doi: 10.1111/ecoj.12322.

Eckel, C. C. . and Grossman, P. J. (2011) 'Men, Women and Risk Aversion: Experimental
Evidence', *Handbook of experimental economics results*, 1(113), pp. 1061–1073.

Eckel, C. C. and Wilson, R. K. (2004) 'Is trust a risky decision?', *Journal of Economic
Behavior and Organization*, 55, pp. 447–465. doi: 10.1016/j.jebo.2003.11.003.

Ellis, F. (2000) *Rural Livelihood Diversity in Developing Countries*, *Oxford University Press*.
Oxford: Oxford University Press.

Elster, J. (2016) *Sour grapes: Studies in the subversion of rationality*, *Sour Grapes: Studies in
the Subversion of Rationality*. doi: 10.1017/CBO9781316494172.

Fehr, E. (2009) 'On the economics and biology of trust', *Journal of the European Economic
Association*, 7(2–3), pp. 235–266. doi: 10.1162/JEEA.2009.7.2-3.235.

Fehr, E. and Hoff, K. (2011) 'Tastes, Castes and Culture: The Influence of Society on
Preferences', *IZA Discussion Papers*, 5919. Available at: http://hdl.handle.net/10419/51672.

Fehr, E. and Schmidt, K. M. (2003) 'Theories of fairness and reciprocity: Evidence and

economic applications', in *Advances in Economics and Econometrics: Theory and Applications, Eighth World Congress, Volume 1*. doi: 10.1017/CBO9780511610240.008.

Fisher, I. (1930) *The Theory of Interest, as determined by Impatience to Spend Income and Opportunity to Invest it*. New York: Macmillan. Available at: https://oll.libertyfund.org/titles/1416.

Fleming, D. A., Chong, A. and Bejarano, H. D. (2014) 'Trust and Reciprocity in the Aftermath of Natural Disasters', *Journal of Development Studies*, 50(11), pp. 1482–1493. doi: 10.1080/00220388.2014.936395.

Green, L., Fry, A. F. and Myerson, J. (1994) 'Discounting of delayed rewards: A Life-Span Comparison', *Psychological Science*, 5(1), pp. 33–36. doi: 10.1111/j.1467-9280.1994.tb00610.x.

Greene, W. W. H. . (2012) *Econometric analysis 7th Ed, Prentice Hall*.

Hair, J. F. (1995) *Multivariate data analysis : with readings*. 4rd edn. New York: Prentice Hall.

Harrison, G. W., Lau, M. I. and Williams, M. B. (2002) 'Estimating individual discount rates in Denmark: A field experiment', *American Economic Review*, 92(5), pp. 1606–1617. doi: 10.1257/000282802762024674.

Hausman, J. A. (1979) 'Individual Discount Rates and the Purchase and Utilization of Energy-Using Durables', *The Bell Journal of Economics*, 10(1), pp. 33–54. doi: 10.2307/3003318.

Henrich, J. (2000) 'Does culture matter in economic behavior? Ultimatum game bargaining among the Machiguenga of the Peruvian Amazon', *American Economic Review*, 90(2), pp. 973–979. doi: 10.1257/aer.90.4.973.

Henrich, J. *et al.* (2001) 'In search of Homo economicus: Behavioral experiments in 15 small-scale societies', *American Economic Review*, 91(2), pp. 73–78. doi: 10.1257/aer.91.2.73.

Hökby, S. and Söderqvist, T. (2003) 'Elasticities of Demand and Willingness to Pay for Environmental Services in Sweden', *Environmental and Resource Economics*, 26(3), pp. 361–383. doi: 10.1023/B:EARE.0000003581.97411.75.

Holden, S. T., Shiferaw, B. and Wik, M. (1998) 'Poverty, market imperfections and time preferences: Of relevance for environmental policy?', *Environment and Development Economics*. doi: 10.1017/S1355770X98000060.

Holt, C. A. and Laury, S. K. (2002) 'Risk aversion and incentive effects', *American Economic Review*, 92(5), pp. 1644–1655. doi: 10.1257/000282802762024700.

Jolliffe, I. T. (2002) *Principal Component Analysis, Second Edition*. 2nd edn. New York:

Springer.

Jordahl, H. (2011) *Inequality and Trust, IFN Working Paper*. 715. doi:
https://dx.doi.org/10.2139/ssrn.1012786.

Kahneman, D. and Tversky, A. (1979) 'Prospect theory: An analysis of decision under risk',
Econometrica, 47(2), pp. 263–292. doi: 10.2307/1914185.

Kirby, K. N. *et al.* (2002) 'Correlates of delay-discount rates: Evidence from Tsimane'
Amerindians of the Bolivian rain forest', *Journal of Economic Psychology*, 23, pp. 291–316.
doi: 10.1016/S0167-4870(02)00078-8.

Knight, F. (1921) 'Risk, Uncertainty and Profit', *University of Illinois at Urbana-
Champaign's Academy for Entrepreneurial Leadership Historical Research Reference in
Entrepreneurship*. Available at: https://ssrn.com/abstract=1496192.

Lawrance, E. C. (1991) 'Poverty and the Rate of Time Preference: Evidence from Panel
Data', *Journal of Political Economy*. doi: 10.1086/261740.

Levitt, S. D. and List, J. A. (2007) 'What do laboratory experiments measuring social
preferences reveal about the real world?', *Journal of Economic Perspectives*, 21(2), pp. 153–
174. doi: 10.1257/jep.21.2.153.

Long, J. S. and Freese, J. (2001) *Regression Models for Categorical Dependent Variables
Using STATA, Sociology The Journal Of The British Sociological Association*. doi:
10.1186/2051-3933-2-4.

Lorenz, E. H. (1988) 'Neither friends nor strangers: informal networks of subcontracting in
French industry', in Gambetta, D. (ed.) *Trust - Making and Breaking Relationships*. Oxford:
Basil Blackwell, pp. 194–210.

Lu, Y., Shi, X. and Zhong, S. (2018) 'Competitive experience and gender difference in risk
preference, trust preference and academic performance: Evidence from Gaokao in China',
Journal of Comparative Economics, 46(4), pp. 1388–1410. doi:
https://doi.org/10.1016/j.jce.2018.05.002.

Lusk, J. L. (2011) *The Oxford Handbook of the Economics of Food Consumption and Policy*.
Oxford University Press.

Mayer, R. C., Davis, J. H. and Schoorman, F. D. (1995) 'An Integrative Model of
Organizational Trust', *Academy of Management Review*, 20(3), pp. 709–734. doi:
10.5465/amr.1995.9508080335.

Morey, E., Thacher, J. and Breffle, W. (2006) 'Using angler characteristics and attitudinal
data to identify environmental preference classes: A latent-class model', *Environmental and
Resource Economics*, 34, pp. 91–115. doi: 10.1007/s10640-005-3794-7.

Ortiz, R. A., Markandya, A. and Hunt, A. (2009) 'Willingness to pay for mortality risk reduction associated with air pollution in São Paulo', *Revista Brasileira de Economia*, 63(1), pp. 3–22. doi: 10.1590/S0034-71402009000100001.

Perman, R. *et al.* (2003) *Natural resource and enviromental economics*. 3rd edn. Harlow: Pearson. doi: 10.2174/156802606777323773.

Porro, R., Lopez-Feldman, A. and Vela-Alvarado, J. W. (2015) 'Forest use and agriculture in Ucayali, Peru: Livelihood strategies, poverty and wealth in an Amazon frontier', *Forest Policy and Economics*, 51, pp. 47–56. doi: 10.1016/j.forpol.2014.12.001.

Samuelson, P. A. (1937) 'A Note on Measurement of Utility', *The Review of Economic Studies*. doi: 10.2307/2967612.

Schechter, L. (2007) 'Traditional trust measurement and the risk confound: An experiment in rural Paraguay', *Journal of Economic Behavior and Organization*, 62, pp. 272–292. doi: 10.1016/j.jebo.2005.03.006.

Schildberg-Hörisch, H. (2018) 'Are risk preferences stable?', *Journal of Economic Perspectives*, 32(2), pp. 135–154. doi: 10.1257/jep.32.2.135.

Schurer, S. (2015) 'Lifecycle patterns in the socioeconomic gradient of risk preferences', *Journal of Economic Behavior and Organization*, 119, pp. 482–495. doi: 10.1016/j.jebo.2015.09.024.

Sills, E. O. *et al.* (2014) *REDD+ on the ground*. Bogor, Indonesia: Center for International Forestry Research (CIFOR).

Silverman, I. W. (2003) 'Gender Differences in Delay of Gratification: A Meta-Analysis', *Sex Roles*, 49, pp. 451–463. doi: 10.1023/A:1025872421115.

Stigler, G. and Becker, G. (1977) 'De Gustibus Non Est Disputandum', *The American Economic Review*, 67(2), pp. 76–90. doi: 10.1257/000282806777212116.

Sunderlin, W. D. *et al.* (2016) *Technical guidelines for research on REDD+ subnational initiatives*. Center for International Forestry Research (CIFOR). doi: https://doi.org/10.17528/cifor/006009.

Tanaka, T., Camerer, C. F. and Nguyen, Q. (2016) 'Risk and time preferences: Linking experimental and household survey data from Vietnam', in *Behavioral Economics of Preferences, Choices, and Happiness*. doi: 10.1007/978-4-431-55402-8_1.

Thaler, R. (1981) 'Some empirical evidence on dynamic inconsistency', *Economics Letters*, 8(3), pp. 201–207. doi: 10.1016/0165-1765(81)90067-7.

Tu, Q. and Bulte, E. (2010) 'Trust, Market Participation and Economic Outcomes: Evidence from Rural China', *World Development*, 38(8), pp. 1179–1190. doi:

10.1016/j.worlddev.2009.12.014.

Vetschera, R. and Kainz, G. (2013) 'Do Self-Reported Strategies Match Actual Behavior in a Social Preference Experiment?', *Group Decision and Negotiation*, 22, pp. 823–849. doi: 10.1007/s10726-012-9295-5.

Wang, H. and Mullahy, J. (2006) 'Willingness to pay for reducing fatal risk by improving air quality: A contingent valuation study in Chongqing, China', *Science of the Total Environment*, 367, pp. 50–57. doi: 10.1016/j.scitotenv.2006.02.049.

Wang, M., Rieger, M. O. and Hens, T. (2016) 'How time preferences differ: Evidence from 53 countries', *Journal of Economic Psychology*, 52, pp. 115–135. doi: 10.1016/j.joep.2015.12.001.

Wikipedia (2020) *Department of Ucayali*, *Wikipedia*. Available at: https://en.wikipedia.org/wiki/Department_of_Ucayali (Accessed: 12 June 2020).

Wooldridge, J. M. (2014) *Introduction to Econometrics*. Europe, Mi. CENGAGE Learning.

World Bank Group (2020) *Poverty & Equity Brief*. Available at: povertydata.worldbank.org .

Xue, J. *et al.* (2011) 'Using principal components analysis (PCA) with cluster analysis to study the organic geochemistry of sinking particles in the ocean', *Organic Geochemistry*. Elsevier Ltd, 42(4), pp. 356–367. doi: 10.1016/j.orggeochem.2011.01.012.

Yesuf, M. and Bluffstone, R. (2008) 'Wealth and Time Preference in Rural Ethiopia', *EfD Discussion Papers*, No. 08-16.

Zandersen, M., Termansen, M. and Jensen, F. S. (2007) 'Testing benefits transfer of forest recreation values over a twenty-year time horizon', *Land Economics*, 83(3), pp. 412–440. doi: 10.3368/le.83.3.412.

8 Appendices

Appendix I: household questionnaire

In section 3.3 I refer to the full household questionnaire which is found in this appendix.

Household Questionnaire

Global Comparative Study on REDD+
Module 2 on REDD+ Subnational Initiatives

Center for International Forestry Research (CIFOR), Bogor, Indonesia

---

Basic information

Country code [   ]   REDD+ initiative site code [   ]

District name [   ]   Village name [   ]

Intervention village [   ]   or control village [   ]   Household code [   ]

GPS location [UTM zone:]   [X: Y:]

Distance from village center in km (post-survey calculation based on GPS data) [   ]

Information on household's interviews

	Phase 1	Phase 2	Phase 3
Month-Year			
Household interviewed (yes/no)			
If yes: **Enumerator name (if household interviewed)**			
Date interviewed (if interviewed)			
If no: **Reason**	-- NA --	1) Moved away 2) Temporarily away 3) Dissolved (died, divorced, etc) 4) Refused	1) Moved away 2) Temporarily away 3) Dissolved (died, divorced, etc) 4) Refused

		5) Other	5) Other
Household lived in study village (yes/no)			

Type of population the household is drawn from:

Please select one code:

1)All households living in the village in phase 1 (P1);

2)New households arrived between P1 and P2 (replacement procedure P2);

3)New households arrived between P2 and P3 (replacement procedure P3);

4)All households living in the village in phase 2 but not already in the sample (supplementary procedure P2);

5)All households living in the village in phase 3 but not already in the sample (supplementary procedure P3)

6)Other – Specify (e.g. treated household in case of stratification)

Fulfillment of research tasks		
Task	**By whom**	**Date (DD/MM/YR)**
Check Phase 1 and 2 information inserted in form		
Conduct interview		
Fill out questionnaire during interview		
Verification of accuracy by FRS		
Fill out weight of the household after fieldwork		

Tasks for getting the interview underway (for FRS: review TGs pp.44-65 prior to interview):

- **Remind respondent of previous visit and interview**
- **Remind respondent of CIFOR and the goals of GCS-REDD Module 2**
- **This interview will take about 1.5 to 2 hours, so assure that the respondents have time**
- **State that the village will receive a summary of the findings in 2019/2020**
- **Explain the guarantees of anonymity and confidentiality, and distinctness from proponent**
- **Summarize parts of interview: basic household information; assets; income; perception of wellbeing; forest conservation interventions (including REDD+ in intervention villages)**
- **Explain the 1 and 2-year recall method (for FRS: see TG pp.105-106)**
- **Ask for consent to conduct the interview**

All the tables of the Household questionnaire will be filled in paper first for more accurate data collection, using the document "Household_questionnaire_Tables_ To_Print". Data will be entered into the tablet after verification by the FRS. During the interview, enumerators will take a picture of each completed table before moving to the next section. They will also take a picture of the sketch of the landholding drawn with the interviewee(s) to help fill table 2A.

1. BASIC INFORMATION ON HOUSEHOLD MEMBERS

Explain to respondents: (1) that names will be written in this form to facilitate conducting the interview and for finding the household again at a later date, but will be kept completely confidential; (2) that 'livelihood' (columns 6 &7) is defined by the most time spent on an activity and not amount of money; and (3) that 'the last 12 months' is the 12-month period prior to the date of the interview, and not last year (January-December of 2017). In phase 3, where phase 2 information is provided, enumerators should check and update this information.

Table 1A. BASIC INFORMATION ON HOUSEHOLD MEMBERS

We want to ask you some basic information about all members of your household.

1. No.	Name of household member	2. Rela-tion to head of house-hold *Codes below*	3. Gender *0 = male 1 = female*	4. Age in years	5. Years of educa-tion	6. Primary livelihood in last 12 months (for those 16 and older)	7. Secondary livelihood in last 12 months (for those 16 and older)	8. Days of illness in the last 12 months (for those 16 and older)
1.		1						
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								
11.								
12.								
13.								
14.								

1B. Identification of main respondents *List the number (from column 1 above) and the name (from column 2) of the two main respondents. If there is just one respondent use code -8.*	No.	Name
	No.	Name

Codes for column 2: Relation to head of household		
1 = head of household	*6 = father/mother*	*11 = nephew/niece*

2 = spouse	7 = father/mother in law	12 = step/foster child
3 = son/daughter	8 = brother/sister	13 = other family member
4 = son/daughter in law	9 = brother/sister in law	14 = non-family household member
5 = grandson/granddaughter	10 = uncle/aunt	

CODES FOR COLUMNS 6 AND 7 SEE CODE BOOK: LIVELIHOOD

1C. INFORMATION ON HEAD OF HOUSEHOLD AND SPOUSE

We would like to ask you some questions about the head of this household and the spouse (if applicable).

1. What is the marital status (legal or common law) of household head? *Codes: 1=married and living together; 2=married but spouse living/working away; 3=widow/widower; 4=divorced; 5=never married; 9=other (specify)*	
2. How many years ago was this household first formed? *Indicate answer in years*	
3. Was the household head born in this village? *1 = yes; 0 = no*	
4. How many years has the household head lived in the village? *Indicate answer in years*	
5. Does the household head belong to the largest ethnic group, tribe, or caste in the village? *If there is only one ethnic group, tribe, or caste in the village answer 'yes.' 1 = yes; 0 = no*	
6. Was the spouse born in this village? *1 = yes; 0 = no; -8 = does not apply (there is no spouse)*	
8. Does the spouse belong to the largest ethnic group, tribe, or caste in the village? *If there is only one ethnic group, tribe or cast in the village answer 'yes' 1 = yes; 0 = no; -8 = does not apply (there is no spouse)*	

The following three questions are to be posed only to households not interviewed in Phases 1 or 2!

9. Did your household move to this village after (month/year) of Phase 1? *1 = yes; 0 = no. If Q9 = 0, proceed to Section 2.*	

10. *(If answer to Q9=1)* What were your reasons for moving to this village? *If Q9=0, Q10 = -8*	
11. *(If answer to Q9=1)* How were you able to acquire land in this village? *If Q9=0, Q11 = -8*	

2. HOUSEHOLD ASSETS

We will now ask you questions about the assets of the household. We begin by asking you about your land assets *within the boundaries of this village*. To help answer these questions, we will draw together a sketch of your landholding. We want to know about the area of this land, in hectares, in the following four categories:

- Land controlled by and used by the household. "In saying "controlled by" we mean land that the household manages on its own and is able to exclude others from using, whether or not it is owned. By "used" we mean lands on which there is a current activity (e.g. producing crops, harvesting forest products, preserving forest) or on which there is potential future activity (e.g. lands in fallow that might be used at a future time by the household).
- Land controlled by but *not* used by the household. We mean land controlled by the household, but rented out or lent out for use by another household or households.
- Land not controlled by the household but used privately by the household. We mean land not controlled by the household, but rented or borrowed in by the household for its own use.
- Lands not controlled by the household but used in common with other households. We mean lands with shared access among households and no one having exclusive use rights.

Fill in the area, in hectares, for the land uses in the four asset categories in Table 2A below.

Table 2A. AREAS OF HOUSEHOLD LAND ASSETS BY LAND USE CATEGORIES

Please fill out this section on paper first and take a photo of the completed table!

We will now ask questions about the specific land uses and the area of those uses in these four categories of land assets. We want to know about the area, in hectares, used for: crops, agroforestry, pasture, and silvopasture. We also want to know the area of particular forest types, and of other land uses such as residential areas, infrastructure, shrubs, grasslands, or wetlands. Note that oil palm should not be classified as 'Plantation' but as 'Crops'.

Fill in the area, in hectares, for the land uses in the four asset categories in Table 2A below.

Land cover Type	Land use category *See code book: Land use classifications (definitions)*	CONTROLLED BY THE HOUSEHOLD		NOT CONTROLLED BY THE HOUSEHOLD	
		1. Area (ha) of land used by the household	**2. Area (ha) of land rented out or lent out by the household**	**3. Area (ha) of land rented in or borrowed in and used by the household**	**4. Does HH use shared access land of this category?** *1=yes; 0=no*
1. Agri-culture	1. Crops				
	2. Agroforestry				
	3. Pasture				
	4. Silvopasture				
2. Forest	1. Plantation				
	2. Early secondary forest				
	3. Int. secondary forest				
	4. Mature forest				
3. Other	*See definition below**				
TOTAL					

* The 'other' land cover type category is composed of: residential areas, infrastructure, shrubs, natural grasslands, wetlands, lakes, and rivers.

Table 2B. TENURE OF LAND BY CONTROL AND USE CATEGORIES AND LAND COVER TYPE

Please fill out this section on paper first and take a photo of the completed table!

What are the tenure arrangements of lands your household uses – both those controlled and not controlled by the household – and the degree of security of that tenure? By tenure security, we mean your confidence that your household will continue to be able to use, at least for the next 25 years, the land assets you currently have.

Make sure the area totals in Tables 2A and 2B correspond to each other! Note that in this table the four asset categories exclude the 'other' land use!

1. Tenure category of land	2. Land cover Type	3. Area of parcel	4. Type of tenure *Use 3-digit code* *See code book: Tenure*	5. Tenure security *Codes:* *1 = secure* *0 = insecure*	6. Reason for insecurity if insecure *List up to 3 reasons.* *See code book: Reasons for tenure in-security*
1. Land controlled and used by HH (Col. 1 in Table 2A)	1. Agriculture				
	2. Forest				
2. Land controlled but not used by HH (Col. 2 in Table 2A)	1. Agriculture				
	2. Forest				
3. Land not controlled but rented or borrowed in by HH (Col. 3 in Table 2A)	1. Agriculture				
	2. Forest				
4. Communal land shared by HH with other HHs (Col. 4 in Table 2A)	1. Agriculture				
	2. Forest				

Table 2C. CONDITION OF THE HOUSE We would like to ask you some questions about the materials that are used in the construction of this house. *Use the 'scale of housing materials' created specifically for this village. In Phase 3, in case the scale of housing materials differs from Phase 2, the enumerators will be informed by the FRS and should update this table accordingly.*		
Floor	1. What is the *main* material used in the construction of the floor of the house? *Write the name of the material.*	
	2. *Indicate the relative value (on a village scale) of the main material used in the construction of the floor of the house.* *Codes: 1=low; 2=medium; 3=high*	
Walls	3. What is the *main* material used in the construction of the walls of the house? *Write the name of the material.*	
	4. *Indicate the relative value (on a village scale) of the main material used in the construction of the walls of the house.* *Codes: 1=low; 2=medium; 3=high*	
Roof	5. What is the *main* material used in the construction of the roof of the house? *Write the name of the material.*	
	6. *Indicate the relative value (on a village scale) of the main material used in the construction of the roof of the house.* *Codes: 1=low; 2=medium; 3=high*	

Instructions:

The values in the table above (low, medium, high) are to be based on a village-specific scale of local housing materials made before the beginning of the household survey. See the research instrument titled "scale of housing materials." See the technical guidelines for further instructions.

Table 2D. ACCESS TO UTILITIES

We would like to ask you questions about your household's access to various kinds of utilities, like water, toilet facilities, and electricity.

In all cases, be sure to list just one code. For example if there is more than one type of source of water for the household, choose the type that accounts for most water usage in the household.

1. Source of water	2. Type of toilet	3. Electricity
What is the *main* source of water for this household? *Use codes below*	What is the *main* type of toilet facility used by this household? *Use codes below*	Does this household use electricity, and if yes, what kind of access does it have? *Use codes below*

Codes for water	Codes for toilet	Codes for electricity
1 = stream, river, pond	1 = stream, river, pond, field, forest	1 = no electricity used
2 = common faucet or well, or neighbor's faucet or well, or common rain-fed reservoir	2 = shared latrine with pit or floating over water (not flushed with water)	2 = yes, through unpaid connection to grid or through village system (mini-generator, mini-hydro, solar-battery system)
3 = own well or own rain-fed reservoir	3 = own latrine with pit or floating over water (not flushed with water)	3 = yes, through paid connection to electrical grid
4 = piped water from groundwater beneath house	4 = own latrine, with water (flushed by pouring water)	4 = use of own generator
5 = piped water from municipal system or water company	5 = own flush toilet, with piped water but not septic system	
	6 = own flush toilet, with piped water and with septic system	

4. Cooking fuel What is the *main* type of cooking fuel used by the household? *Codes: 1 = fuelwood; 2 = charcoal; 3 = other vegetative biomass (shrubs, leaves, agricultural residues); 4 = dung; 5 = biogas; 6 = coal; 7 = oil; 8 = kerosene; 9 = liquefied petroleum gas (LPG); 10 = electricity; 11 = solar;*	
5. Cooking technology *If the household uses woody biomass fuel (codes 1-3 above) ask:* Do you use a three-stone (open) fire or an improved stove for your cooking? *Codes: 1 = three stone (open) fire; 2 = improved stove; 0=neither; -8=does not apply*	

Table 2E. OTHER ASSETS OWNED BY THE HOUSEHOLD

1. How many houses does the household own in this village?

2. How many houses does the household own outside of this village?

3. Please tell us the items you may have in the following household asset categories, including their number and current market value.

Instructions:
- *This inventory of household assets should be for assets in <u>all</u> houses owned.*
- *Value per unit is the current market value the respondent could get if the item is sold on the market today.*
- *If the item is broken, take this into account in the current market value (e.g. price if not broken minus the cost of repair).*
- *If it is culturally inappropriate to inquire about the value, ask for the age in years of the item and whether it is in good condition. You can calculate the value independently outside the interview.*
- *If it is impossible to ask about ownership of an item because it is illegal (e.g. a chain saw or a gun in some locations), tick the box indicating that ownership is illegal.*

Instructions for Phase 3:
- All assets owned in Phase 2, along with their values, will be pre-filled.
- Enumerators should check if the number and value of each asset owned in Phase 2 has changed, and update if needed.
- They should then ask the interviewees if they own any new item in each category, e.g. 'Do you have any other asset related to transportation?'

Type of asset	Number owned	Value per unit (average)	Total value
TRANSPORTATION			
1. Automobile			
2. Truck/van			
3. Motorcycle			
4. Bicycle			
5. Boat			
6. Boat engine			
7. Saddle			
8. Other (>$25) _____			
9. Other (>$25) _____			
10. Other (>$25) _____			
HOUSEHOLD ELECTRICAL/MECHANICAL GOODS			
11. Electric generator			
12. Cell phone			
13. Regular telephone (land line)			
14. Television			
15. Satellite dish			
16. Radio			
17. Cassette/CD/ VHS/VCD/DVD player			
18. Computer			
19. Camera			
20. Washing machine			

Table 2E Other assets owned by the household (continued)			
Type of asset	**Number owned**	**Value per unit (average)**	**Total value**
21. Sewing machine			
22. Lawn mower			
23. Chainsaw [Item illegal. Question not asked: ___]			
24. Gun [Item illegal. Question not asked: ___]			
25. Solar panel			
26. Other (>$25) _____			
27. Other (>$25) _____			
28. Other (>$25) _____			
FURNITURE			
29. Sofa set			
30. Dining room table			
31. Wall clock			
32. Other (>$25) _____			
33. Other (>$25) _____			
34. Other (>$25) _____			
35. Other (>$25) _____			
KITCHEN EQUIPMENT			
36. Stove for cooking (gas or electric)			
37. Stove for cooking (non-gas or electric)			
38. Oven			
39. Refrigerator/freezer			
40. Mixer/blender			
41. Other (>$25) _____			
42. Other (>$25) _____			
43. Other (>$25) _____			
AGRICULTURAL/FARM EQUIPMENT			
44. Tractor			
45. Plow			
46. Chemical spraying device			
47. Water pump			
48. Wooden cart or wheelbarrow			
49. Grain/flour mill			
50. Scale			
51. Other (>$25) _____			
52. Other (>$25) _____			
53. Other (>$25) _____			
54. Other (>$25) _____			
MISCELLANEOUS			
55. Family heirloom			
56. Fishing equipment			
57. Carpentry/woodworking tools			
58. Plumbing tools			
59. Musical instrument			
60. Other (>$25) _____			
61. Other (>$25) _____			
62. Other (>$25) _____			
63. Other (>$25) _____			
64. Other (>$25) _____			
65. Other (>$25) _____			

3.   HOUSEHOLD INCOME

Production and costs should be calculated in tables A and B over a 12-month period. If the unit provided by the interviewee is not metric, make sure to provide the necessary information for subsequent conversion.

Table 3A AGRICULTURAL PRODUCTION DURING THE 12 MONTHS BEFORE THE INTERVIEW

We would like to calculate your production from agriculture during the last 12 months. We want to know about *all* the products your households has produced, including cereals, roots and tubers, legumes, vegetables, fruits, tree crops, trees, forage, cotton, tobacco, herbs and spices, medicinal plants, and flowers. In separate sections of this survey, we will ask about your production of animals and animal products, and also products collected from the wild.

Ask about all agricultural products produced by household in last 12 months, then verify completeness of answer by asking about all products in the list below. If there are local products not in the list below, ask about those.

1. Product *See code book*	2. Total production (4+5)	3. Unit of measure	4. Own use (including gifts & storage)	5. Sold (including barter)	6. Price per unit	7. Total value (2X6)

Table 3B. COST OF AGRICULTURAL PRODUCTION IN THE 12 MONTHS PRIOR TO INTERVIEW

We would like to calculate the cost of your agricultural production during the last 12 months.

These should be <u>purchased</u> inputs only. If it is easiest just to list the total cost (col. 5), do so. Make sure to ask about the costs of production for all crops listed in Table 3A1.

No.	1. Item	2. Quantity	3. Unit of measure	4. Price per unit	5. Total cost
1.	Seeds, seedlings, planting material				
2.	Fertilizers				
3.	Manure				
4.	Pesticides/herbicides/fungicides				
5.	Draught power				
6.	Hired labor				
7.	Hired machinery				
8.	Transport/marketing				
9.	Payment for land rental				
10.	Gasoline/fuel				
99.	Other, specify: _____				

TABLE 3E. OWNERSHIP OF LIVESTOCK AND OTHER ANIMALS AND INCOME IN THE LAST 12 MONTHS

We now want to ask some questions about your ownership, consumption, and sale of livestock and animals in the last 12 months.

*For the types of animals marked by an asterisk (*) ask about adult animals only. For "other" animals, refer to Codebook section 7 (Products), codes 500-549. Check to be sure there is no double counting with Table 3F.*

1. Type of animal	2. Beginning number 12 months ago	3.Sold (including bartered), live or slaughtered	4.Slaugh-tered for own use (or gift or share given)	5. Lost (theft, death)	6. Bought or received as a gift or as earned share	7. New from own stock	8. End number now) (2-3-4-5+6+7)	9. Price per animal	10. Total stock value (8X9)	11. Total income [(3+4) X 9]
500. Cow										
501. Bull										
502. Oxen										
503. Steer/heifer										
504. Calf										
505. Buffalo - adult										
506. Buffalo - young										
507. Horse - adult										
508. Horse - young										
509. Donkey/mule*										
510. Goat*										
511. Sheep*										
512. Pig*										
513. Turkeys*										
514. Ducks*										
515. Chickens*										
516. Rooster*										
517. Guinea fowl*										
518. Geese*										
519. Rabbits*										
520. Fish										
521. Bee hive										
549. Other (specify)										

Table 3F.   INCOME FROM ANIMAL PRODUCTS IN THE LAST 12 MONTHS

What are the quantities and values of animal products and services that you have produced during the last 12 months?

For "other" products, refer to Codebook section 7 (Products), codes for table 3F. Check to be sure there is no double counting with Table 3E.

1. Product/service	2. Unit of measure	3. Units produced (4+5)	4. Own use (including gifts)	5. Sold (including barter)	6. Price per unit	7. Total value (3X6)
550. Milk[1]						
551. Butter						
552. Cheese						
553. Eggs						
554. Hides / skin						
555. Wool						
556. Manure						
557. Draught power						
558. Honey						
559. Soap						
589. Other (specify)						

Table 3G. COSTS OF INPUTS FOR ANIMAL HUSBANDRY AND PRODUCTS IN THE LAST 12 MONTHS

What are the quantities and values of inputs used in livestock and animal production during the past 12 months? *We want to record cash expenditures in this table. If it is easiest just to list the total cost (col. 5), do so.*

1. Inputs	2. Unit	3. Quantity	4. Price per unit	5. Total costs (3X4)
1. Feed/fodder				
2. Rental of grazing land				
3. Medicines, veterinary services				
4. Costs of maintaining barns, pens, etc.				
5. Hired labor				
6. Inputs from own farm				
7. Water treatment				
8. Other _____				

---

[1] *Make sure to avoid double-counting in calculating the amounts of dairy products (milk, butter, cheese). A portion of the milk produced may be used to make butter or cheese. List under 'milk' only the amount consumed or sold (as milk) by the household.*

Table 3HI.   ENVIRONMENTAL INCOME IN THE LAST 12 MONTHS – FOREST AND NON-FOREST

We would like to know about your household income from <u>products gotten from low or no management areas</u> (forest and non-forest) in the last 12 months. *Please do not record forest products used as inputs in household business. Their value will be recorded in Table 3K. For product code, see Codebook Section 7, "forest/environment income" (590-999).*

1a. Product category	1b. Product code *See code book: Product*	1c. Where collected: *1 = Forest; 2 = Non-forest*	2. Tenure of land used *3-digit code See code book: tenure*	Production					Costs		10. Income (7 minus 8 minus 9)
				3. Units of measure	4. Quantity harvested	5. Quantity sold	6. Mean price per unit	7. Gross income (4 x 6)	8. Hired labor	9. Inputs, transport, taxes, share, etc.	
590. Logs											
591. Sawn timber											
592. Poles											
593. Bamboo											
594. Rattan											
595. Firewood											
596. Charcoal											
597. Latex (e.g. rubber)											
598. Resin											
599. Forage											
600. Thatch											
601. Lianas and vines											
602. Medicinal plants											
603. Medicinal animals											
604. Food: mammals											
605. Food: birds											
606. Food: fish											
607. Food: reptiles/amph.											
608. Food: insects											
609. Food: fruit											
610. Food: vegetable											
611. Food: mushroom											
612. Food: nut											
613. Food: honey											
614. Wildlife: mammals											
615. Wildlife: birds											
616. Wildlife: fish											
617. Wildlife: rept./amph.											
618. Mineral, ore, rock											
619. Frond											
620. Tree barks											
621. Tree leaves											
622. Tree roots											
623. Tree branches											
624. Tree seedlings											
625. Tree seeds											
999. Other _____											

3J. CHANGE IN FOREST COVER AND FOREST INCOME IN THE LAST TWO YEARS

We want to know how your forest-based income has changed in the last <u>two</u> years (24 months) and the reasons for that change.

			Parcel 1	Parcel 2	Parcel 3
	1. Has your household cleared any forest during the past two years? *1 = yes; 0 = no* *If 'yes,' go to 2. If 'no', go to 9.*				
If YES:	2. How much forest was cleared in total in the last 2 years? *Indicate total area cleared in hectares, in up to 3 parcels total.*				
	3. What was the main purpose of clearing the forest land? *Codes: 1=cropping; 2=pasture; 3=tree plantation; 4=non-agricultural uses*				
	4. [If used for crops (code '1' in question above):] Which principal crop was grown? *See code book: Product*				
	5. What type of forest did you clear? *See code book: Forest type*				
	5b. Was the forest cleared primary (never cleared before) or secondary (cleared before)? *1=primary; 2=secondary; -8=DNA (forest not cleared; -9=respondent does not know*				
	6. If secondary forest, what was the age of the forest? *Indicate age of forest in years.*				
	7. What was the tenure status of the forest cleared? *Use 3 digit code. See code book: Tenure.*				
	8. How far from the house was the forest that was cleared? *Indicate distance in kilometers*				
9. How much land used by the household has been left fallow and/or abandoned (left to convert to natural re-vegetation) over the last 2 years? *Indicate area in hectares.*					
10. In the last two years, compared to the past, has your household's clearing of forest land increased, stayed the same, or decreased? *1 = increased* *2 = stayed the same* *3 = decreased* *-8 = does not apply (household does not clear forest land or has not cleared land for more than two years)* *-9 = respondent does not know*					
11. If your household's clearing of forest land has **increased**, what are the main reasons? *Select from responses below:* 1. __(code responses)_____ 2. _____ 3. _____					

12. If your household's clearing of forest land has **decreased**, what are the main reasons? *Select from code responses*

    1. __(code responses)_____

    2. _____

    3. _____

13. In the last two years, has your household consumption of forest products increased, stayed the same, or decreased? *If the situation varies by product, enumerators can suggest the interviewees to focus on the most consumed forest product.*
1 =increased
2 = stayed the same
3 = decreased
-8 = does not apply (no forest product subsistence income)
-9 = respondent does not know

14. If the answer to question 13 is 1 (=increased) or 3 (=decreased) ask:
 Why has your household consumption of forest products increased/decreased in the last two years? *Select up to 3 reasons from the list below. Use -8 (does not apply) if the answer to question 13 is 2, 4, -8 or -9.*

    1. __(code responses)_____

    2. _____

    3. _____

15. In the last two years, has the harvesting of forest products <u>for sale (not home consumption)</u> of your household increased, stayed the same, or decreased? *In case the situation varies by product, enumerators can suggest the interviewees to focus on the most sold forest product.*
1 = increased
2 = stayed the same
3 = decreased
-8 = does not apply (no forest product cash income)
-9 = respondent does not know

16. If the answer to question 15 is 1 (=increased) or 3 (=decreased) ask:
 Why has the forest cash income of your household increased/decreased in the last two years?
List up to 3 reasons. Use -8 (does not apply) if the answer to question 15 is 2, 4, -8 or -9.

    1. *(Coded responses)_____*

    2. _____

    3. _____

Table 3K. HOUSEHOLD BUSINESS INCOME IN THE LAST 12 MONTHS

Is anyone in the household conducting a business – even a small one – and if yes, what are the gross income and the costs in the last 12 months?

A household business is defined as an enterprise where income is produced through capital goods (machinery, equipment and inventory) owned by the household itself.

Look in Table 1A to see if any household member is operating a household business. Be sure to look at both the primary and secondary livelihood columns. Be sure to ask if there is a small business not revealed by these codes. It could be a tertiary livelihood.

You may – if easier – get annual sales, costs, and income by asking about values per month and months in operation, and then aggregating.

	Business 1	Business 2	Business 3
1. What is your type of business? *See code book: Livelihood*			
2. What is your type of business? *If the code used above does not provide sufficient information to describe the business, write additional information here.*			
3. What is the amount of gross sales in the last 12 months?			
4. What were the costs of your business in the last 12 months (include inputs bought, hired labor, rentals, etc.)			
5. What is the net income of your business in the last 12 months? *Net income defined as gross sales minus costs (3 minus 4).*			
6. What is the current total value of your business? *The total value of the business includes all its assets (e.g. building, machinery, stock of inputs, etc.) if sold today in current condition.*			

Table 3L.   WAGE OR SALARY INCOME IN THE LAST 12 MONTHS

Has any member of your household been paid a wage (cash or in-kind) or salary for work in the last 12 months?

One person can be listed more than once because that person may have done different jobs. Check Table 1A for indications of this type of work, but be aware that some of this work might be minor and therefore would not appear in Table 1A.

1. Household member *(Number from Table 1A, column 1)*	2. Type of work *See code book: Livelihood*	3. Time unit *Codes: 1 = task (no time unit) 2 = hour; 3 = day; 4 = week; 5 = month; 6 = year; 9 = other (specify)*	4. Units in last 12 months *Use -8 if no. 3 = 1 (payment by task and not time unit)*	5. Rate of payment per unit *Use -8 if no. 3 = 1 (payment by task and not time unit)*	6. Total income (4 X 5)

67

Table 3M. MISCELLANEOUS INCOME IN THE LAST 12 MONTHS

Please tell us about any kinds of income to your household in the last 12 months, cash or in kind, that have not yet been mentioned. I will read out a list. Please tell us if you have received income in this category, and if so, how much in the last 12 months.

No.	1. Type of income	3. Total amount received in last 12 months
1.	Renting out of own land	
2.	Remittances	
3.	Gifts from family or friends	
4.	Inheritance	
5.	Pension	
6A.	Support from government (not agricultural subsidy)	
6B.	Support from government (agricultural subsidy)	
7.	Income from local politicians	
8A.	Support from NGO (not agricultural subsidy)	
8B.	Support from NGO (agricultural subsidy)	
9.	Compensation for lost income	
10.	Dividends from community enterprise	
11.	Payment for the provision of environmental services	
12.	Alms	
13.	Support from a private company	
99.	Other (specify) _____	

4. PERCEPTIONS OF WELLBEING AND WELLBEING CHANGE IN LAST TWO YEARS

Note: In posing the questions in the table below, read out all of the choices (codes) to the respondents and ask them to choose one answer.

We will now ask you questions about the wellbeing of your household, how that has changed in the last two years, and the reasons for the change.

1. Has your household's income over the past two years been sufficient to cover the needs of the household? *Explain that we are defining 'income' as own production and cash income. Read out the codes 1 through 3:* *1=yes; 2=reasonable (just about sufficient); 3=no* *-8 (household not formed two years ago)*	
2. Overall, what is the wellbeing of your household today compared with the situation two years ago? *Explain how we are defining 'wellbeing' (see the technical guidelines). <u>Choose just one code</u>. Read out the codes 1-3 below:* *1=better off now; 2=about the same; 3=worse off now;* *-8 (household not formed two years ago); -9= respondent does not know* *If the answer is 1, go to question 3A. If the answer is 3, go to question 3B. If the answer is 2, -8, or -9 go to section 5.*	

3A. *[If Q2=1]* Please select the 3 main reasons why your household is **better-off** now compared to two years ago.

    1. __(code responses)_____

    _____

    2. _____

    _____

    3. _____

    _____

List up to three <u>distinct</u> reasons.

3B. *[If Q2=3]* Please select the 3 main reasons why your household is **worse-off** now compared to two years ago.

  1. __*(code responses)*_____

  _____

  2. _____

  _____

  3. _____

  _____

List up to three <u>distinct</u> reasons.

5.   INVOLVEMENT IN AND ASSESSMENT OF FOREST CONSERVATION INTERVENTIONS

   A. Participation in REDD+

Note: Questions 9 and 10 are to be asked only in the intervention villages.

9.	Have you or has anyone in your household been involved in the implementation of (name of REDD+ initiative) in your village? *Codes: 1 = yes; 0 = no. If no, proceed to section B.*	
10.	If yes, tell me in what ways you or someone in your household has been involved in the implementation of (name of REDD+ initiative). *See codebook.* *99 = Other (specify)_____* *99 = Other (specify)_____* *-8 = Does not apply (Q9=0)*	

   B. Assessment of interventions

Note: The questions in Table 5B are to be asked in both the intervention and control villages.

In the intervention villages state: "We will now ask questions about a set of interventions carried out in your village in association with the [_____] initiative."

In the control villages state: "We will now ask questions about a set of interventions carried out in your village by an initiative aiming to protect and/or improve area forests.

TABLE 5B. Effect of forest interventions on the household

1. Intervention	2. Intervention type *See codes below*	3. House-hold involved? *1 = yes 0 = no See below*	3a. (*If 3 = 1*) Did [name of intervention] affect the way you use land and other natural resources (e.g agricultural or livestock practices, use of forests and forest resources, forest clearing)? *1 = yes, 0 = no*	4. (If 3a=1) In what ways has it affected your use of land and other natural resources? [Drop-down menu based on Phase 2 data.]	4a. (*If 3 = 1*) Did [name of intervention] affect the wellbeing of your household? *1 = yes 0 = no*	5. (If 4a =1) What is your evaluation of the effect of [name of intervention] on the wellbeing of your household? *Read out choices below 1 = very negative; 2 = negative; 3 = neutral (both positive and negative); 4 = positive; 5 = very positive; -8 = does not apply (3 = 0); -9 = respondent does not know*	6. (If 4a=1) How did the intervention produce this effect? [Either post code or have a drop-down menu]
1.							
2.							
3.							
4.							

Codes:
Column 2: RFAC = restrictions on forest access and/or conversion; FE = forest enhancement; NCLE = non-conditional livelihood enhancement; CLE = conditional livelihood enhancement; EE = environmental education; TC = tenure clarification; OI = other intervention
Column 3: A household is involved if it is an intended target or beneficiary in the implementation of the intervention (e.g. household's forest access has been or will be reduced, or has or will receive livelihood benefits). We do not consider the household involved if it is indirectly affected by another household's involvement (e.g. household is in resource competition with an involved household whose access to forest has been decreased) or if it is merely aware of the intervention.

TABLE 5B. Effect of forest interventions on the household

1. Intervention	2. Inter-vention type *See codes below*	3. House-hold involved? *1 = yes 0 = no See below*	3a. (*If 3 = 1*) Did [name of intervention] affect the way you use land and other natural resources (e.g agricultural or livestock practices, use of forests and forest resources, forest clearing)? *1 = yes, 0 = no*	4. (If 3a=1) In what ways has it affected your use of land and other natural resources? [Drop-down menu based on Phase 2 data.]	4a. *(If 3 = 1)* Did [name of interventio n] affect the wellbeing of your household? *1 = yes 0 = no*	5. (If 4a =1) What is your evaluation of the effect of [name of intervention] on the wellbeing of your household? *Read out choices below 1 = very negative; 2 = negative; 3 = neutral (both positive and negative); 4 = positive; 5 = very positive; -8 = does not apply (3 = 0); -9 = respondent does not know*	6. (If 4a=1) How did the intervention produce this effect? [Either post code or have a drop-down menu]
5.							
6.							
7.							
8.							

Codes:
Column 2: RFAC = restrictions on forest access and/or conversion; FE = forest enhancement; NCLE = non-conditional livelihood enhancement; CLE = conditional livelihood enhancement; EE = environmental education; TC = tenure clarification; OI = other intervention
Column 3: A household is involved if it is an intended target or beneficiary in the implementation of the intervention (e.g. household's forest access has been or will be reduced, or has or will receive livelihood benefits). We do not consider the household involved if it is indirectly affected by another household's involvement (e.g. household is in resource competition with an involved household whose access to forest has been decreased) or if it is merely aware of the intervention.

TABLE 5B. Effect of forest interventions on the household							
1. Intervention	2. Inter-vention type *See codes below*	3. House-hold involved? *1 = yes 0 = no See below*	3a. (*If 3 = 1*) Did [name of intervention] affect the way you use land and other natural resources (e.g agricultural or livestock practices, use of forests and forest resources, forest clearing)? *1 = yes, 0 = no*	4. (If 3a=1) In what ways has it affected your use of land and other natural resources? [Drop-down menu based on Phase 2 data.]	4a. (*If 3 = 1*) Did [name of intervention] affect the wellbeing of your household? *1 = yes 0 = no*	5. (If 4a =1) What is your evaluation of the effect of [name of intervention] on the wellbeing of your household? *Read out choices below 1 = very negative; 2 = negative; 3 = neutral (both positive and negative); 4 = positive; 5 = very positive; -8 = does not apply (3 = 0); -9 = respondent does not know*	6. (If 4a=1) How did the intervention produce this effect? [Either post code or have a drop-down menu]
9.							
10.							
Codes: **Column 2:** RFAC = restrictions on forest access and/or conversion; FE = forest enhancement; NCLE = non-conditional livelihood enhancement; CLE = conditional livelihood enhancement; EE = environmental education; TC = tenure clarification; OI = other intervention **Column 3**: A household is involved if it is an intended target or beneficiary in the implementation of the intervention (e.g. household's forest access has been or will be reduced, or has or will receive livelihood benefits). We do not consider the household involved if it is indirectly affected by another household's involvement (e.g. household is in resource competition with an involved household whose access to forest has been decreased) or if it is merely aware of the intervention.							

73

C. *Assessment of REDD+ as a whole*

Note: Questions in this section should be asked only in the intervention villages.

1. What is your assessment of the overall effect of [name of REDD+ initiative] on the wellbeing of your household?

_____

_____

_____

_____

1.b. What is your assessment of the overall effect of [name of REDD+ initiative] on your forest landholdings?

_____

_____

_____

_____

_____

2. What are your recommendations on how the performance of [name of the REDD+ initiative] can be improved, including continuation of activities that are working well, and discontinuation or change of activities that are not working well?

_____

_____

_____

_____

_____

(NEW) 7. RISK, TIME, SOCIAL, ENVIRONMENTAL AND TRUST PREFERENCES OF THE HOUSEHOLD

Instructions: We will now ask you a few questions about how you think about yourself as a person, compared to other people in the village. For each question, we ask you to select a number between 1 and 5, and you can choose 1, 2, 3, 4 or 5.

1.Risk
How do you see yourself: are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?

Please choose on a scale from 1 to 5, where 1 means 'not at all willing to take risks' and 5 means 'very willing to take risks'

2.Time preference
How do you see yourself: are you generally a person who is impatient and want to have 'things' now, or can you wait until later to get them?

Please choose on a scale from 1 to 5, where 1 means that you mainly prefer to have things now, and 5 means that you mainly are willing to wait.

3.Social preference
How do you see yourself: are you generally a person who thinks about the well-being of your family, or do you think of the well-being of others in the village?

Please choose on a scale from 1 to 5, where 1 means that you mainly think about your family, and 5 means that you mainly think about others in the village.

4.Environmental preference
How do you see yourself: are you generally a person who wants to maximize your income from the natural environment, or do you want to conserve the natural environment?

Please choose on a scale from 1 to 5, where 1 means that you mainly want to maximize income, and 5 means that you mainly want to conserve the natural environment.

5.Trust
Do you in general trust people in the village (community)?

Please choose on a scale from 1 to 5, where 1 is not means 'not at all' And 5 means that you trust people a lot.

(NEW) 8. EXPERIMENTAL GAME TO ASSESS SOCIAL PREFERENCES
We are asking you to think about a situation where you can choose how to distribute some money. You are in a group of 10 people from your village. They are randomly selected, and can include some people who you know and some people who you don't know. I give you a choice between two alternatives: either some money is given to you, or a larger sum of money is given

to the group. As an example, the first option is that you receive 100 [choose local currency] and the others in the group receive nothing. The second option is that you give 200 [choose local currency] to the group, and everyone in the group shares that money equally. With 200 [choose local currency] and 10 people, each person in the group will get 20, including you. No one in the group will know what you chose.

Have you understood the game? Good, let's start. I will ask about different amounts of [choose local currency] for yourself, but the group will always get the same amount if you choose that option.

What would you prefer: X only to you, or 200 to the group, that is 20 to each person in the group including yourself

<u>Instructions on how to ask</u>:

- You have *randomly* selected the opening question to be option no. 17 (X= 160 for individual pay) (do this before the interview)
  - Assume that at the beginning, the respondent chooses the 160 [choose local currency] for themselves and nothing for the group. For the next question, you have to lower the individual pay, i.e. move up in the table. You then move as far from the middle (option 11) in the other direction, i.e. you move to option 6 (option 23-17=6).
    - When asking about option 6, if she says individual pay, you move half way to the extreme (1), i.e. to option 4 (option (6+1)/2=3.5, so round up to option 4).
    - When asking about option 6, if she says group pay, you have to move in the other direction, i.e. towards the middle again. Choose the midpoint between the two previous options, i.e. to option 12 (option 6+17/2=11.5, so round up to option 12).
  - Assume that at the beginning, the respondent chooses the group pay of 200 [choose local currency] instead of 160 for herself. You then move half way to the extreme (option 23), which would be option 20.
- Continue by choosing between the midpoint of the two previous options, or between the last option and the extreme, until you have identified the switching options.

Enumerator records:

What was the opening option? _____

When did the household switch? Between _____ and _____

If the household never switched, what was the extreme option (1 or 23)? _____

Option	A. Individual pay (payment to others)	B. Group pay (payment to me)
1	<10 (0)	200 (20)
2	10 (0)	200 (20)
3	20 (0)	200 (20)
4	30 (0)	200 (20)
5	40 (0)	200 (20)
6	50 (0)	200 (20)
7	60 (0)	200 (20)
8	70 (0)	200 (20)
9	80 (0)	200 (20)
10	90 (0)	200 (20)
11	100 (0)	200 (20)
12	110 (0)	200 (20)
13	120 (0)	200 (20)
14	130 (0)	200 (20)
15	140 (0)	200 (20)
16	150 (0)	200 (20)
17	160 (0)	200 (20)
18	170 (0)	200 (20)
19	180 (0)	200 (20)
20	190 (0)	200 (20)
21	200 (0)	200 (20)
22	210 (0)	200 (20)
23	>210 (0)	200 (20)

Checklist for bringing the interview to an end:

- **State that you have asked the last question and the interview has come to an end**
- **Remind the respondents that CIFOR does not design, finance, or implement REDD initiatives. We are a research team, not planning REDD+ initiatives here or anywhere else.**
- **Ask the respondents if they have any questions about the interview or about CIFOR and GCS-REDD**
- **Remind the respondents that we will convey our findings to the village in 2019/2020**
- **Remind the respondents of the guarantee of anonymity and confidentiality**
- **Express your thanks to the respondents for their willingness to participate in the research and for sharing their valuable time**
- **Provide household with token of appreciation for their participation in the study**
- **Ask the respondents their consent to take a group picture**

6.   EVALUATION BY THE ENUMERATOR

1. How long did the interview take?	*min*
2. In general terms, how reliable is the information provided by this household? *Codes: 1 = poor; 2 = reasonably reliable; 3 = very reliable*	
3. If the reliability of the information is poor, what is the reason? *Codes. List all reasons that apply:* *1=In this village people cannot talk frankly about certain forest practices;* *2=the respondent was not enthusiastic about participating in the interview;* *3=the time available for the interview was too brief;* *4=the attention span of the respondent faded because the interview was too long;* *5= other reason (specify) _____*	

Appendix II: Kaiser-Meyer-Olkin measure

In section 3.5.1 and in section 5.3 I refer to the Kaiser-Meyer-Olkin measure for sample adequacy. Table 1 show the results from the test. All the variables except for the social preferences score above 0.5. The overall score of the model is 0.54, which is slightly above the threshold.

Kaiser-Meyer-Olkin measure	Score
Risk	0.57
Time	0.55
Environmental	0.53
Social	0.49
Trust	0.53
Overall model score	**0.54**

Table 1 Kaiser-Meyer-Ohlin score of measure of sampling adequacy.

Appendix III: likelihood ratio tests

In section 3.5.3 and 4.3 I refer to the likelihood ratio tests of nested models. The test results are included in this appendix.

Regression models with livelihood categories

Risk

Likelihood-ratio test	LR chi2(3) = 4.81
(Assumption: r1 nested in r2)	Prob > chi2 = 0.1866

Time

Likelihood-ratio test	LR chi2(3) = 6.19
(Assumption: ti1 nested in ti2)	Prob > chi2 = 0.1025

Environmental

Likelihood-ratio test	LR chi2(3) = 12.57
(Assumption: e1 nested in e2)	Prob > chi2 = 0.0057

Social

Likelihood-ratio test	LR chi2(3) = 6.34
(Assumption: s1 nested in s2)	Prob > chi2 = 0.0963

Trust

Likelihood-ratio test	LR chi2(3) = 2.34
(Assumption: tr1 nested in tr2)	Prob > chi2 = 0.5055

The test is significant on p<0.1 for environmental and social preference, indicating that the livelihood categorical variable improves the fit of these models.

Regression models with income shares

Risk

Likelihood-ratio test	LR chi2(4) = 5.70
(Assumption: r1 nested in r2)	Prob > chi2 = 0.2226

Time

Likelihood-ratio test	LR chi2(4) = 5.19
(Assumption: ti1 nested in ti2)	Prob > chi2 = 0.2681

Environmental

Likelihood-ratio test	LR chi2(4) = 6.83
(Assumption: e1 nested in e2)	Prob > chi2 = 0.1449

Social

Likelihood-ratio test	LR chi2(4) = 1.17
(Assumption: s1 nested in s2)	Prob > chi2 = 0.8836

Trust

Likelihood-ratio test	LR chi2(4) = 3.88
(Assumption: tr1 nested in tr2)	Prob > chi2 = 0.4221

None of the LR-tests gave significant tests for the income shares variables. This indicate that the less restricted model was a better fit. The income shares were fundamental for the further analyses and were therefore kept in the models.