

ESSAYS ON COLLECTIVE COPING

IN SRI LANKA

ASHIRA ELANEE PERERA

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Abstract

The aim of the thesis is to contribute to our understanding of how individuals in developing countries cope when faced with environmental risks. These themes are explored while focusing on small-scale farming communities in Wellawaya, south-east Sri Lanka, that are heterogeneously exposed to a particular environmental risk, namely the Human-Elephant Conflict (HEC).

First, we examine the strategies which households within farming communities use to cope with exposure to the HEC. We conduct an individual-level household survey of 468 randomly-sampled households across sixteen farming communities which are highly exposed to the HEC. Our unique, cross-sectional data provides a snapshot of the coping strategies which they employ. We find that households which experience greater HEC-related damage are more likely to: rely to a greater extent on non-farm income; cultivate less land in each of the two cropping seasons; and have children who engage in non-farm employment.

Next, we investigate the effect of interdependent risk exposure on individuals' ex-post sharing behaviour. By interdependence, we refer to when an individual's choice over their own risk exposure directly impacts the risk exposure of another individual. The results from our lab-type risk-and-sharing game suggest that individuals positively reciprocate when another individual's decision causes them to face lower risk exposure, but do not negatively reciprocate when another individual's decision causes them to face higher risk exposure. A risk-averse individual who has agency over another's risk exposure is more likely to share ex-post payoffs, while a relatively risk-tolerant individual does not. Our results suggest that risk attitudes and the balance of power

within communities need to be considered by policymakers involved in the design of community-driven development initiatives.

Finally, we adopt a mixed methods approach to investigating how heterogeneity in individual returns to a public good and beneficiaries'/contributors' risk attitudes affect public good contributions. We examine this in the context of Sri Lanka's HEC and conduct a one-shot, framed, lab-in-the-field, public goods experiment (PGG) which reveals subjects' contribution preferences when returns from the public good are asymmetric. Subjects also answer a hypothetical contribution question (HCQ) stating their time contributions to the construction of the public good. We find that heterogeneity in individual returns does not have a negative effect on contribution behaviour. Risk-aversion in the PGG, in this context, motivates people to engage in collective risk mitigation. The mixed method approach provides an encouraging and balanced account of communities' potential engagement in HEC-mitigating public goods provision.

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Table of Contents

Abstract i

Acknowledgements iii

Chapter One: Thesis Introduction 1

1.1 Thesis Motivation 1

1.2 Chapter Summaries 5

Chapter Two: An Investigation into the Current, Non-collective Coping Strategies of Communities at Risk of the Human-Elephant Conflict 10

2.1 Introduction 10

2.2 Related Literature 14

2.2.1 Different Types of Shocks and Their Components 14

2.2.2 Income Diversification as a Coping Strategy 15

2.3 Empirical Strategy and Hypotheses 18

2.4 The Case Study Area 19

2.4.1 Selection of Communities for Inclusion in the Study 20

2.4.2 Land Ownership 21

2.4.3 Methods Used to Mitigate the Human-Elephant Conflict 23

2.4.4 Sources of Household Income 26

2.5 Empirical Results 27

2.5.1 Empirical Estimations – Reliance on Non-farm Income 33

2.5.2 Empirical Estimations – Cultivation Choice 35

2.5.3 Empirical Estimations – Occupational Choice 37

2.6 Summary and Conclusions 40

Appendix A: Cultivation Decisions 43

Appendix B: Additional Estimations 47

Chapter Three: Collective Coping in the Presence of Interdependent and Heterogeneous Risk Exposure 49

3.1 Introduction 49

3.2 Motivation 51

3.3 Risk Sharing in Behavioural Experiments 53

3.4 Experimental Design 56

3.4.1 The Risk-and-Sharing Game 56

3.4.2 The Gamble Choice Task 60

3.4.3 The Participants 63

3.4.4 Implementation 65

3.5 Predictions for the Risk-and-Sharing Game 68

3.5.1 Theoretical Framework 68

3.5.2 Effect on Player *i*'s Sharing Decision When *j* Has Agency Over *i*'s and *j*'s Risk Exposure 71

3.5.3 Effect on Player *j*'s Sharing Decision When *j* Has Agency Over *i*'s and *j*'s Risk Exposure 74

3.6 Results and Empirical Analysis 77

3.6.1 Risk Exposure 77

3.6.2 Mean Treatment Effects on Sharing in the RSG 81

3.6.3 Conditional Treatment Effects on Sharing in the RSG: The Effect of Player *j*'s Agency on Player *i*'s Sharing Behaviour 82

3.6.4 Conditional Treatment Effects on Sharing in the RSG:

The Effect of Player *j*'s Agency on Player *j*'s Sharing Behaviour 88

3.7 Summary 94

3.8 Conclusions 96

Appendix C: Additional Estimations 98

Chapter Four: Collective Action When Public Good Returns and Risk Attitudes are Heterogeneous – A Mixed Methods Approach 99

4.1 Introduction 99

4.2 Literature Review 104

4.2.1 Local Public Goods Provision as a Development Intervention 104

4.2.2 Heterogeneous Preferences in Surveys 106

4.2.3 Heterogeneity in Public Goods Games 107

4.2.4 Barriers to Technology Adoption in Developing Countries 109

4.3 Comparing the Public Goods Game (PGG) and the Hypothetical Contribution Question (HCQ) 111

4.4 Experimental and Survey Designs 115

4.4.1 The Public Goods Game (PGG) 115

4.4.2 The Treatments 116

4.4.3 Beliefs 118

4.4.4 The Participants 118

4.4.5 Implementation 119

4.4.6 The Gamble Choice Task 120

4.5 The Survey 121

4.5.1 The Hypothetical Contribution Question (HCQ) 121

4.5.2 Proxies for Individual Returns and Asymmetric Returns in the HCQ 122

4.5.3 Other Controls in the HCQ Analysis 122

4.5.4 The Participant Sample 123

4.5.5 Descriptive Statistics 123

4.6 Hypotheses 127

4.7 Results 128

4.7.1 Contributions in the PGG 128

4.7.2 Multivariate Analysis of Contributions in the PGG 131

4.7.3 Results from the HCQ 136

4.7.4 Results Regarding Risk Aversion 140

4.8 Discussion 141

4.9 Conclusions 143

Appendix D: PGG Tokens 145

Appendix E: PGG Treatments and Payoff Tables 146

Appendix F: Gamble Choice Task Decision Card and Payoffs Table 149

Appendix G: Hypothetical Contribution Question and Correlations Between HEC-related Variables 150

Appendix H: Additional Estimations 151

Chapter Five: Thesis Conclusion 155

Chapter Six: Experimental Protocols and Household Survey 158

6.1 Welcome Script 158

6.2 Public Goods Game Scripts 161

6.2.1 Symmetric PGG With Electric Fence Frame 161

6.2.2 Asymmetric PGG With Electric Fence Frame 169

6.3 Gamble Choice Task Script 181

6.4 The Risk-and-Sharing Game Group Training Script 185

6.4.1 Treatment: Assigned 186

6.4.2 Treatment: Chosen 189

6.4.3 Treatment: PosCorr 192

6.4.4 Treatment: NegCorr 196

6.5 RSG Decision Card Scenarios 199

6.5.1 Assigned Treatment – Badge Number 1 to 8 199

6.5.2 Assigned Treatment – Badge Number 9 to 16 201

6.5.3 Chosen Treatment 204

6.5.4 NegCorr Treatment – Badge Number 1 to 8 211

6.5.5 NegCorr Treatment – Badge Number 9 to 16 216

6.5.6 PosCorr Treatment – Badge Number 1 to 8 221

6.5.7 PosCorr Treatment – Badge Number 9 to 16 226

6.6 Household Survey 229

References 245

List of Tables

Chapter Two: An Investigation into the Current, Non-collective Coping Strategies of Communities at Risk of the Human-Elephant Conflict

2.1	Summary Statistics for Variables Used in Regressions Regarding Reliance on Non-farm Income and Cultivation Choices	28
2.2	Summary Statistics for Variables Used in Regressions Regarding Engagement of Oldest Children in Non-farm Activities	32
2.3	Linear Model – Effect of Crop Damage on Proportion of Income Generated by Non-farm Activities	34
2.4	Linear Models – Effect of Crop Damage on Proportion of Fallow Land in the Maha and Yala Seasons	37
2.5	Marginal Effects for Probit Models – Effect of Crop Damage on Oldest Children Opting into Non-farm Income-generating Activities	39
A.1	Information Regarding Key Cultivated Crops in the Maha and Yala Seasons	44
B.1	Probit Model Coefficient Estimates – Effect of Crop Damage on Oldest Children Opting into Non-farm Income-generating Activities	47
B.2	Linear Probability Models – Effect of Crop Damage on Oldest Children Opting into Non-farm Income-generating Activities	48

Chapter Three: Collective Coping in the Presence of Interdependent and Heterogeneous Risk Exposure

3.1	RSG Scenarios in Which Players Make Share Decisions	58
3.2	Gamble Choice Task Outcomes and Payoffs	63
3.3	Descriptive Statistics by RSG Treatments and Sub-Treatments	65
3.4	Distribution of Gamble Choice Task Decisions Across RSG Treatments	78
3.5	Risk Exposure Across RSG Treatments	80
3.6	GC Task Risk Attitudes of Subjects Choosing Riskier Gamble in RSG Across Treatments	80
3.7	Linear Probability Models – Sharing Behaviour Where Player *i* Has No Agency Over Own Risk Exposure	86
3.8	Coefficient Estimates for Multinomial Logit Model – Player *j*'s Decisions Regarding Risk Exposure and Sharing When Player *j* Has Agency Over Player *i*'s Risk Exposure	90
C.1	Coefficient Estimates for Multinomial Logit Model – Player *j*'s Decisions Regarding Risk Exposure and Sharing When Player *j* Has Agency Over Player *i*'s Risk Exposure	98

Chapter Four: Collective Action When Public Good Returns and Risk Attitudes are Heterogeneous – A Mixed Methods Approach

4.1	Comparison Between Experimental and Survey Methods	113
4.2	Total Number of Treatments, Sessions and Subjects Included in the Analysis	119
4.3	Variable Description and Descriptive Statistics from the PGG and HCQ Sample	125
4.4	Two-sample Independent t-tests and Mann-Whitney-U Tests for PGG Contributions	130
4.5	Marginal Effects for PGG Logit Models	133
4.6	Marginal Effects for Truncated Tobit Models	138
E.1	Treatments, Session Size and Sample Size	146
E.2	Payoffs from Contribution and Non-contribution to the "group" Account – Symmetric PGG	147
E.3	Payoffs from Contribution and Non-contribution to the "group" Account – Asymmetric PGG	148
F.1	Gamble Choice Task Outcomes and Payoffs	149
G.1	Correlation Between HEC-related Variables	150
H.1	PGG Logit Model Coefficient Estimates	151
H.2	PGG Linear Probability Models	152
H.3	HCQ Truncated Tobit Model Coefficient Estimates	153
H.4	HCQ OLS Estimations	154

List of Figures

Chapter One: Thesis Introduction

1.1	Location of Wellawaya Divisional Secretariat, Sri Lanka	3
1.2	Location of Wellawaya Communities Under Study	3

Chapter Two: An Investigation into the Current, Non-collective Coping Strategies of Communities at Risk of the Human-Elephant Conflict

2.1	Mean Number of Days Per Month Spent Using Four Main HEC Preventative Methods (2011-2014)	24
2.2	Breakdown of Total Household Income for 2013 by Community	26

Chapter Three: Collective Coping in the Presence of Interdependent and Heterogeneous Risk Exposure

3.1	Gamble Choice in the RSG	57
3.2	Gamble Choice Task Decision Card	62
3.3	Proportion of "share" Decisions Made Across All RSG Treatments	82
3.4	Proportion of "share" Decisions Made by Player *i* Under Different Agency and Risk Exposure Conditions	87
3.5	Predicted Likelihoods of a Player *j* Making Each of the Four Possible Choices	93

Chapter Four: Collective Action When Public Good Returns and Risk Attitudes are Heterogeneous – A Mixed Methods Approach

4.1	Proportion of "group" Decisions Made Across all PGG Treatments	129
4.2	Mean Beliefs About "group" Contributions Across All PGG Treatments	135
D.1	Front of Token Used in Symmetric PGG Treatment	145
D.2	Back of Token Used to Elicit Beliefs About Others' Contributions in Symmetric and Asymmetric PGG Treatments	145
D.3	Front of High- and Low-return Tokens Used in Asymmetric PGG Treatment	145
F.1	Gamble Choice Task Decision Card	149
G.1	Extract from Survey Section E Showing HCQs for Construction and Maintenance of the Electric Fence	150
G.2	Distribution of Subjects' Willingness to Contribute Time in Hours to Construct the Electric Fence	150

Chapter One: Thesis Introduction

1.1 Thesis Motivation

The aim of the thesis is to contribute to our understanding of how individuals in developing countries cope when faced with environmental risks. Environmental risks can take many forms including floods, droughts, pest and disease infestations, or wildlife encroachment. While these risks can affect whole communities, they can also affect individuals within those communities heterogeneously – sometimes idiosyncratically, sometimes systematically. The aim of this thesis is to understand how this heterogeneity in risk exposure affects how individuals help themselves and others to mitigate and recover from adverse environmental shocks.

These themes are explored while focusing on how small-scale farming communities in Sri Lanka cope collectively with heterogeneous exposure to a particular environmental risk, namely the Human-Elephant Conflict (henceforth referred to as the HEC). The HEC typifies the struggle between wildlife conservation and sustaining agricultural livelihoods in both Africa and Asia. It is well-documented in the conservation literature that the HEC is characterised by tensions between the expansion of human settlements which bolster the livelihoods of farming communities; and the depletion of elephant habitats and migratory routes (Leimgruber *et al.*, 2003; O'Connell-Rodwell *et al.*, 2000; Tchamba, 1996; Sukumar, 1991; Thouless and Sakwa, 1995). In both Africa and Asia, the HEC leads to increased levels of elephant encroachment onto human settlements; loss of agricultural output; damage to homesteads, water installations and food stores; and the loss of both human and elephant lives (Barua *et al.*, 2013; Jadhav and Barua, 2012; Bandara and Tisdell, 2002).

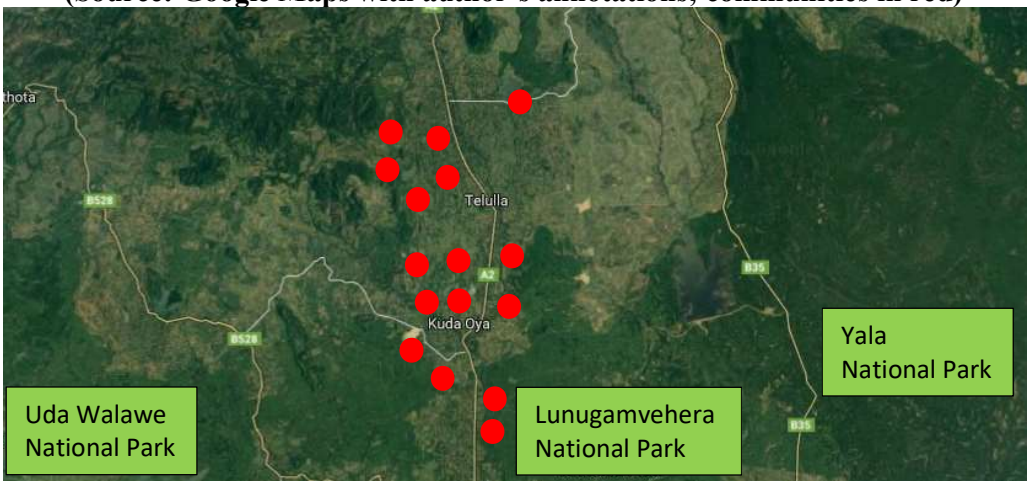
The World Wide Fund for Nature estimates that Asia is home to between 40,000 and 50,000 Asian elephants (*Elephas maximus*)[1] but the population has fallen by 50 per cent in the last three generations. The IUCN (2016) classifies the Asian elephant as an endangered species. The study focuses on Sri Lanka, which is home to 10 per cent of the total Asian elephant population and which has the highest elephant population density in Asia (Fernando *et al*., 2005; Leimgruber *et al.*, 2003). Agricultural employment makes up almost 40 per cent of total employment in Sri Lanka (Human Development Report, 2015) and communities in rural areas where agriculture predominates are more severely affected by the HEC than urban areas (Bandara and Tisdell, 2003). Dry-zone regions in particular have a highly dense elephant population owing to historic human settlement patterns (Jayawardene, 1994 and Wisumperuma, 2004, cited in Fernando *et al.*, 2011). The thesis comprises an investigation into how sixteen rural, dry-zone communities in Wellawaya, south-east Sri Lanka, cope with the HEC (see Figure 1.1). The communities within the study are highly exposed to the HEC due to their proximity to three major wildlife protected areas – Lunugamvehera, Yala and Uda Walawe (shown in Figure 1.2), which are inhabited by 20 per cent of Sri Lanka's total elephant population (de Silva *et al.*, 2011; Fernando *et al.*, 2011).

[1] http://wwf.panda.org/what_we_do/endangered_species/elephants/

Figure 1.1: Location of Wellawaya Divisional Secretariat, Sri Lanka
(Source: Google Maps with location of Wellawaya annotated by the author)



Figure 1.2: Location of Wellawaya Communities Under Study
(Source: Google Maps with author's annotations; communities in red)



The novel contribution of the thesis lies in exploring the behavioural foundations of coping with environmental risk, specifically ex-post sharing behaviour, mutual assistance and cooperation. The research is timely, given its direct relevance to the World Bank's recent report on "*Mind, Society, and Behavior*" (2015) which "captures the idea that paying attention to how humans think (the process of mind) and how history and context shape thinking (the influence of society) can improve the design and implementation of development policies and interventions that target human choice and action (behavior)" (p.2). The research is also policy-relevant given Mansuri and Rao's (2004) estimate of approximately US$7 billion worth of World Bank funds being directed towards community-driven development initiatives. If community participation continues to be an important pre-requisite for many development interventions, it is important to understand the behavioural characteristics of the beneficiary communities.

The thesis is structured as follows. First, to provide some background for later chapters, Chapter 2 outlines the non-collective strategies which the sample population uses to cope with the HEC at present. Chapter 3 examines the effect of heterogeneous and interdependent risk exposure on individuals' ex-post sharing behaviour following an adverse outcome. Chapter 4 uses a mixed methods approach to investigate individual willingness to invest in a public good which is designed to reduce an entire community's exposure to HEC-related risk, while acknowledging that individual returns to such a public good are heterogeneous. The key findings from the three substantive chapters are brought together in Chapter 5.

1.2 Chapter Summaries

Chapter 2 explores whether and how farming households cope non-collectively with the Human-Elephant Conflict at present. The first contribution of this chapter is to document the generation of primary data from an individual-level, cross-sectional household survey. The survey was administered to 468 rural households across sixteen communities within Wellawaya Divisional Secretariat in south-east Sri Lanka which are highly exposed to elephant-related damage to their farmlands and their homes.

Using the survey data, a descriptive analysis of how household-level exposure to elephant-related crop damage is associated with livelihoods decisions is examined. Three key livelihoods decisions were investigated: 1) the decision to diversify into non-farm, income-generating activities; 2) the decision to leave land fallow in each of the two cropping seasons; and 3) the decision of children of working age to participate in non-farm, income-generating activities. The empirical results show consistent patterns across the three livelihoods decisions. First, households which experience an increasing level of crop damage tend to leave more farmland fallow. Second, households which are more exposed to crop damage rely more on non-farm income than households which are less exposed. Third, greater exposure to crop damage is associated with a greater likelihood of children entering into non-farm employment. The overarching message of the chapter is that, in this part of Sri Lanka, exposure to HEC-related risk and households' livelihood strategies are inter-related. The cross-sectional survey data is insufficient to identify the direction of any causal relationships. However, the analysis convincingly indicates that, within communities, exposure to the risk, while being heterogeneous, is not entirely idiosyncratic; households affect or are affected by (or both) their exposure to HEC-related risk.

Chapters 3 and 4 explore the potential for collectively coping with risk. Chapter 3 explores the ex-post sharing behaviour between the sampled Sri Lankan villagers when they face interdependent and heterogeneous risk exposure. Interdependence refers to situations in which an individual's choice over his/her own level of risk exposure directly impacts the level of risk exposure and outcomes of another individual. Little is known about the effect which interdependence in risk exposure has on ex-post sharing behaviour. The contribution of Chapter 3 is to address this gap in the literature by exploring how individuals cope with interdependent and heterogeneous risk exposure.

The method used is a novel lab-in-the-field behavioural experiment which looks at sharing behaviour between pairs of subjects when the structure of risk exposure is both interdependent and heterogeneous. In so doing, the aim is to answer the following research questions: 1) What effect does interdependence in risk exposure have on ex-post sharing behaviour? and 2) Does the effect depend on whether the interdependence involves a positive or a negative correlation in risk exposure? The experiment comprises four variants of a risk-and-sharing game (RSG), where subjects are exposed to financial risks and decide whether or not to assist one another ex post. Rural subjects from the same sixteen communities in Wellawaya, Sri Lanka, participated in the RSG. Their participation is particularly pertinent as they face interdependent environmental risk in their everyday lives through their exposure to the HEC. Two interdependent-risk treatments are designed which are central to the empirical analysis: in one treatment, a player has agency over his own and a co- player's level of risk exposure and risk exposure between the players is positively correlated. In the other treatment, the same agency condition holds but risk exposure between the players is negatively

correlated. A Binswanger-type gamble choice task is conducted to observe whether sharing behaviour under interdependent risk exposure is affected by heterogeneous risk attitudes.

Predictions of sharing behaviour are generated using Cox *et al.*'s (2007) tractable model of reciprocity, and signalling theory as per Spence (1973). Overall, the results demonstrate consistent patterns of behaviour and suggest that interdependence in risk exposure significantly affects ex-post sharing behaviour. A player whose level of risk exposure is chosen by a co-player demonstrates positive reciprocity by sharing ex-post payoffs equally when (s)he faces lower risk exposure, compared to exogenously facing lower exposure. However, (s)he does not engage in negative reciprocity when, owing to his/her co-player, (s)he faces higher risk exposure, compared to facing higher risk exposure exogenously. Regarding the players with agency, risk-averse subjects with agency over own and another's risk exposure are more likely to share ex-post payoffs equally, while the sharing behaviour of relatively risk-tolerant subjects is conditional on satisfying their own risk preferences.

Chapter 4 investigates the effect which heterogeneity in returns and in risk attitudes has on contributions to a hypothetical, risk-mitigating public good. Using a mixed methods approach, empirical answers are provided to the following research questions: 1) At the group-level, is local public goods provision compromised when the returns from the public good vary across group members; 2) Does an individual's willingness to contribute to the public good depend on his/her return from the public good; and 3) What role does heterogeneity in risk aversion play in decision-making regarding public good contributions? The questions are examined in the context of Sri

Lanka's HEC, where the local public good in question is a hypothetical electric fence which is proposed to households from the same sixteen rural communities in Wellawaya which are highly exposed to elephant-related crop and house damage.

The lab-experimental literature shows that in some cases, heterogeneous public good returns lower average contributions (Tan, 2008; Fisher *et al.*, 1995), and, in other cases, heterogeneous returns increase average contributions (Reuben and Riedl, 2013; Marwell and Ames, 1981). The one-shot, lab-in-the-field, public goods experiment (PGG) provides the opportunity to ascertain non-standard and relevant subjects' preferences for contributing to a public good (the electric fence) in an environment of exogenously-imposed asymmetric returns. The behavioural analysis is complemented by the analysis of survey responses to a hypothetical time contribution question (HCQ). The methodological strengths of the PGG include both the experimental control which ensures isolating the effect of heterogeneous returns, and the incentivised nature of the experiment which means the strategic component of the decision-making process is salient to subjects. This is complemented by the HCQ, which provides more context than the PGG around the contribution decision. Subjects state time contributions to the construction of an electric fence, which is in line with community development projects often being conditional on manual labour contributions. In the analysis of the HCQ, variations in public good returns are captured by real-life HEC damage variables.

The empirical results reported in Chapter 4 suggest that: asymmetry in individual returns from a risk-mitigating public good does not have a negative effect on overall contribution behaviour; individuals who are likely to gain higher individual returns

from provision are, if anything, more likely to contribute to public goods provision; and risk aversion has a positive effect on people's willingness to contribute to the PGG, but does not have a statistically significant effect on their engagement with new technologies. From a methodological perspective, the mixed methods approach provides a more balanced view of communities' potential engagement in HEC-mitigating public goods provision.

Chapter Two: An Investigation into the Current, Non-collective Coping Strategies of Communities at Risk of the Human-Elephant Conflict

2.1 Introduction

In this chapter, we investigate the coping strategies that households use when exposed to a particular type of risk – the Human-Elephant Conflict (HEC). The HEC is commonplace throughout Africa and Asia. Our focus is on the HEC in Sri Lanka, a developing country with approximately 82 per cent of the population living in rural areas (IFAD, 2014).[1] Approximately 7.6 per cent of the rural population lives below the national poverty line, with forty percent of those living below the poverty line operating as small-scale farmers, mostly residing in the Central, Uva, Sabaragamuwa and Southern provinces (IFAD, 2014).[2] Our study focuses on how 468 randomly-sampled households from sixteen communities, situated in the Uva Province, cope with being highly exposed to the HEC.

Sri Lanka has one of the highest concentrations of the Asian Elephant population – over 10 per cent of the population of Asian elephants is now concentrated within two per cent of the area of land in Sri Lanka which elephants once roamed (Leimgruber *et al.*, 2003). The area of land where elephants can roam is being reduced in order to facilitate more land for human settlements, causing elephants to frequently trample and consume crops in areas which were once their traditional migratory routes (Santiapillai *et al.*,

[1] http://www.ruralpovertyportal.org/country/home/tags/sri_lanka

[2] http://www.ruralpovertyportal.org/country/statistics/tags/sri_lanka. The national poverty line for 2013 (the base year) following the household income and expenditure survey 2012/13 was Rs.3,624 (taken from http://statistics.gov.lk/poverty/monthly_poverty/).

2010). Consequently, communities settled in these areas face a greater risk of elephant-related damage.

Earlier studies by Bandara and Tisdell (2002), Jayawardene (1998) and De Silva (1998) suggest that the total economic value of crop and property damage due to the HEC amounts to US$11-12 million annually. Santiapillai *et al.*'s (2010) survey of 100 Sri Lankan villages shows that 43 per cent of respondents in their sample report losing over US$200 through HEC annually; almost 33 per cent between US$50-200; and 25 per cent US$50. A loss of US$200 equates to the minimum monthly expenditure required to fulfil the basic needs of an individual in the case study area for eight months (based on national poverty lines provided by the Department of Census and Statistics, Sri Lanka, as of July 2016)[3]. In terms of damage, communities face greater exposure to elephant-related crop damage just before the paddy harvest, and house damage post-harvest. The latter is due to a lack of dedicated storage facilities. As a consequence, grains are often stored in farmers' homes. Furthermore, there is often little or no timely compensation from the government to cover crop damage and other HEC-related losses.

To the best of our knowledge, there are no existing studies on the effect of the HEC on the outcomes studied in this chapter and this is where we aim to contribute to the existing literature. Our sample population is located in Wellawaya Divisional

[3] Figures quoted for Monaragala District which is located in Sri Lanka's Uva Province and which comprises Wellawaya Divisional Secretariat, our case study area. See http://www.statistics.gov.lk/poverty/monthly_poverty/index.htm

Secretariat, south-east Sri Lanka, which comprises 16,236 households[4]. We randomly sample 468 households from communities which are located on the periphery of three major national parks – Yala, Uda Walawe (which has an elephant transit home) and Lunugamvehera – and which are therefore highly exposed to the HEC. Between January and April 2014, in each of sixteen communities, we invited thirty-two heads of households to a one-day workshop during which we conducted an individual-level household survey and three behavioural experiments. This chapter focuses on the unique, cross-sectional data from the household survey, which effectively serves as a snapshot of households' livelihoods and non-collective strategies for coping with the HEC. We use the data to answer three empirical research questions: 1) Are households which are more exposed to the HEC more reliant on non-farm income generation? 2) Are households which are more exposed to the HEC cultivating less of their land? 3) Are households which are more exposed to the HEC more likely to have working-age children who opt out of farming and into non-farm activities?

Our analysis shows that exposure to the HEC is associated with decisions households are making about their livelihoods. Specifically, we find that households which are more affected by the HEC are more likely to: rely on non-farm income generation, cultivate less of their land, and have adult children engaged in non-farm, income-generating activities.

From the outset, we were aware that our analysis may suffer from problems of endogeneity. In particular, we recognised that, with one wave of cross-sectional data, it

[4] Figures quoted from the Monaragala District Statistical Handbook 2014, Department of Census and Statistics. See http://www.statistics.gov.lk/DistrictStatHBook.asp

would be a challenge to determine whether increased HEC damage causes farmers to retreat from agriculture or whether, through economic development, farmers' gradually shift resources from farm to non-farm activities, thereby allowing elephants to cause more crop damage in the process of reclaiming land that was formerly their domain. Knowing this, we included two questions in the survey that were specifically designed to generate potentially valid instruments for exposure to the HEC. These two potentially valid instruments were: the distance (in kilometres) of each farm plot from the nearest wildlife sanctuary; and the distance (in kilometres) of each farm plot from the nearest water source (e.g. river, reservoir). We hypothesised that the closer is each household's farm plot to a wildlife sanctuary and/or a water source, the greater the likelihood of the household's crops being damaged by elephants roaming near the boundary of the wildlife sanctuary and/or seeking water.

Unfortunately, this IV strategy failed in two regards. First, neither of the distance variables were significant in any of the first-stage regressions, possibly because they were insufficiently accurate – they were estimates provided by the survey respondents. Second, had they generated significant IV estimates of the effects of interest, those estimates would have been highly questionable. This is because the land acquisition data arising from the survey revealed that the majority of farm plots were chosen by, rather than being exogenously assigned to, households (see Section 2.4). As a result, the analysis presented below must be viewed as descriptive, not causal.

The chapter is organised as follows: Section 2.2 discusses the literature on how households in developing countries cope with adverse shocks; the empirical strategy is outlined in Section 2.3; an overview of the case study area is presented in Section 2.4;

the empirical results are presented in Section 2.5, and concluding remarks in Section 2.6.

2.2 Related Literature

2.2.1 Different Types of Shocks and Their Components

Poor households are often vulnerable to livelihoods risks which can compromise their capacity to ensure smooth income streams in the event of adverse shocks. Dercon (2002) reviews the literature relating to coping strategies among low-income households in developing countries, the different components of income risk, and how households respond to them. Citing several studies from Cote d'Ivoire (Deaton, 1997), Thailand (Townsend, 1995), India (Morduch, 2002) and Nigeria (Udry, 1991), he notes some characteristics about income risk: first, the idiosyncratic component of income risk often outweighs the common component; second, the poor are able to employ coping mechanisms to insure consumption against small and frequent shocks relatively more easily compared to large, infrequent shocks; finally, persistent shocks are more difficult to insure against. Dercon (2002) also states that risk-sharing at the community level helps to manage idiosyncratic shocks but that this collective strategy breaks down when shocks are covariate in nature. Chapter 3 of this thesis focuses on the effects of interdependent risk, i.e. when an individual's choice of level of risk exposure for him/herself directly affects the level of risk exposure and outcomes for another individual, on risk-sharing, and Chapter 4 on collective risk mitigation. So, in this chapter we focus on how households currently cope individually, and not collectively, with exposure to HEC risk.

2.2.2 Income Diversification as a Coping Strategy

Income diversification is an important coping strategy adopted by households in order to mitigate falls in consumption due to income shocks. Haggblade *et al.* (2010) estimate that non-farm income represents 35-50 per cent of total household income in the developing world. Just over 50 per cent of rural incomes in Asia are attributed to the non-farm sector. One third of non-farm income is generated by financial and social services, followed by trade and transport (29 per cent) and manufacturing (27 per cent).

Ellis (2000) highlights several motives for diversification, which include: insecurity caused by seasonality in crop cultivation and harvesting; risk-reduction, i.e. achieving lower covariance between farm and non-farm incomes; imperfect labour and land markets and weak property rights which cause landless people to rely on generating alternative incomes; missing or weak financial credit markets which impede capital investment; diversifying as an asset strategy to protect future livelihoods; and, diversification as an ex-post coping mechanism. With regards to the latter two, the author distinguishes ex-ante risk management as a strategy which forward planning households undertake "by choice", and ex-post coping as how households overcome a livelihood shock "by necessity". Alderman and Paxson (1994) also provide a similar distinction.

In reality, credit-constrained, asset-poor households are faced with several barriers to adopting income diversification. Barrett *et al.* (2001) argue that diversification relies on a weak or negative correlation between the primary (farm) income-generating activity and an additional (likely non-farm) activity. However, Dercon (2002) notes that during severe economic downturns, even economic activities which would otherwise

be uncorrelated with each other will tend to move in the same direction. Limited education and limited access to physical capital also impede the potential for the poor to enter into higher-return, non-farm activities. Barrett *et al.* (2001) note a positive relationship between wealth and non-farm activity, reinforcing the point regarding high barriers to entry. While many of the households in our sample live below the poverty line, they are located in Sri Lanka which is a lower middle-income country[5] where, in comparison to low-income countries, there are more opportunities for non-farm income generation.

Several studies show that households which suffer adverse shocks reallocate their labour supply as a coping strategy. Using data from the 1993 Indonesian Family Life Survey, Cameron and Worswick (2003) estimate household savings models both including and excluding labour supply responses. Their results show that labour market movements are important for consumption smoothing among relatively credit-constrained households. Households which do not respond to crop shocks with changes in labour supply are those that can smooth their consumption through access to credit markets and/or savings. The total number of hours worked does not significantly increase following a crop shock, suggesting that some households reallocate their labour out of farming and into non-farm employment. Relatedly, Porter (2012) uses data from the Ethiopian Rural Household Dynamics (ERHD) Survey to investigate how rainfall shocks affect household consumption and whether households use non-farm activities to smooth incomes. Using a reduced form, fixed effects model, she shows that individual crop shocks have a negative effect on crop- and wage-income, but a positive

[5] A list of lower middle-income countries according to World Bank classifications can be found at: http://data.worldbank.org/income-level/lower-middle-income

effect on non-crop income and self-employment. An estimated 80 per cent of the fall in crop incomes following a rainfall shock is absorbed by reallocating labour to generate non-farm incomes.

Using ICRISAT data from Central India between 1979 and 1984, Kochar (1999) provides yet more evidence that labour reallocation into non-farm activities helps to smooth consumption following adverse shocks. She finds that negative crop income shocks increase the number of male hours of non-farm work, while the effect on female hours of work is statistically insignificant. Possible explanations for this include non-farm opportunities which are considered taboo for women to undertake. Ito and Kurosaki (2009) analyse the effect which weather risk has on time allocation to different labour market activities using data from India. They present theoretical relationships which suggest that own-farm labour supply declines as production risk increases and agricultural work paid in kind and non-farm labour paid in cash increases. They use household-level data on labour allocation in Uttar Pradesh and Bihar, India, to show that households engage in non-farm activities as a form of risk diversification, and their preference for working in the agricultural sector increases among the relatively food-insecure when agricultural wages are paid in kind.

Overall, the existing literature shows us that income diversification is an important channel through which households overcome risk and smooth the impact of shocks to income and consumption. Furthermore, labour reallocation allows households to switch

between farm and non-farm activities following an adverse shock. We incorporate these two channels into our hypotheses and empirical analysis.[6]

2.3 Empirical Strategy and Hypotheses

We investigate whether and to what extent households' cultivation choices and the allocation of labour are associated with increased exposure to HEC-related risk. We focus on crop damage by elephants as our measure of exposure to the HEC.[7] In terms of labour reallocation from farming into non-farming activities, we investigate whether households which face greater crop damage are more likely to rely on income generated by non-farm activities.

We aim to answer three empirical research questions: 1) Are households which are more exposed to the HEC more reliant on non-farm income generation? 2) Are households which are more exposed to the HEC cultivating less of their land? 3) Are households which are more exposed to the HEC more likely to have working-age

[6] One much-cited coping strategy which households use in adverse conditions is asset-drawdowns through livestock sales (Hoddinott, 2006; Dercon, 2004). In particular, Hoddinott (2006) analyses the extent of livestock sales in three Zimbabwean resettlement schemes in the aftermath of a drought in 1994-1995 and finds that a rainfall shock (in this case, a drought) leads to increased oxen sales. The asset-rich sell more livestock following the drought compared to the asset-poor, which Hoddinott (2006) argues as asset-poor households being less inclined to sell present assets which they may be unable to acquire in the future. However, livestock sales are not especially relevant to our sample as very few households in the Wellawaya communities own livestock and the communities may therefore not be able to rely heavily on livestock sales as a coping strategy at present.

[7] We focus on elephant-related crop damage as it occurs more frequently in our sample than instances of house damage, personal injury or death.

children who opt out of farming and into non-farm activities? These questions correspond to the following hypotheses which are derived from the existing literature reviewed in the previous section:

Hypothesis 1: A higher frequency of crop damage experienced by households is associated with greater reliance on income generated from non-farm activities as a proportion of total household income.

Hypothesis 2: A higher frequency of crop damage experienced by households is associated with a greater proportion of land being left fallow in both cropping seasons.

Hypothesis 3: A higher frequency of crop damage experienced by households is associated with a greater likelihood that children of working age engage in non-farm employment.

2.4 The Case Study Area

We begin this section with a general overview of the case study area before providing descriptive statistics of dependent and explanatory variables used in each set of regressions. The two main cropping seasons in the agricultural calendar are the maha and yala seasons. The maha season lasts from September until March and typically receives more rainfall than the yala season which lasts from April to August. We conducted the survey during the maha 2013/14 harvest period and yala data therefore refers to yala 2013.

2.4.1 Selection of Communities for Inclusion in the Study

Fieldwork was undertaken between January and April 2014 in Wellawaya Divisional Secretariat (DS) which is located in Moneragala District, Uva Province. Prior to this, in August 2013, we used participatory research methods outlined in Chambers (2002) to select communities within Wellawaya DS for participation in the survey and behavioural experiments. Specifically, a comprehensive list of communities within Wellawaya DS was presented to community facilitators (CF) from Artha Vida Intermediary Limited, the local partner NGO for this study. A team of Artha Vida's CFs categorised each community according to whether they suffered from "high", "medium" or "low" exposure to the Human-Elephant Conflict (HEC) and ranked communities within each of the categories by level of exposure to the HEC. Government-appointed village headmen (known as *Grama Sevaka*), the secretary of the Thelulla Farmers' Organisation (the major government-backed agrarian services office in Wellawaya DS), and several key farmers in the Wellawaya area verified that the categorisation of communities according to HEC exposure was accurate. Fifteen communities were then chosen from the "high" exposure category. Following this, in January 2014, 32 households from each community were randomly sampled from the most recent Electoral Register for inclusion in the study.[8] An additional community was included in the study in March 2014 in order to increase the sample size. This community is also highly exposed to the HEC because it is in close proximity to Uda Walawe National Park and an elephant corridor (a natural pathway built to facilitate elephant migration).

[8] We ensured all households were included in the Electoral Register by checking the lists for each community with key farmers and local leaders in each of those communities.

We administered an individual household-level survey and three behavioural experiments in the sixteen communities within Wellawaya DS between January and April 2014. The survey instrument was comprehensive, covering eleven key areas, including details of each respondent's: household composition; tenure and property rights; the frequency and estimated cost of crop and house damage, and personal injury;[9] Human-Elephant Conflict prevention methods; participation in community-based organisations; income from agricultural and non-agricultural activities; remittances and transfers; inventory of durable goods; household construction characteristics; and credit and savings activities.

2.4.2 Land Ownership

We collected data on each household's residence plot, farm plots, cultivation choices, and HEC prevention methods. Each household occupies a residence plot; and on average reports owning 1.5 farm plots, ranging from 0 to 5 plots. We do not observe much variation in plot size – the average acreage for residence plots is 1.8 acres and the average acreage for the primary farm plot is two acres.

The majority of residence plots are owned (97 per cent), while the remainder are either rented, partially rented and partially sharecropped, or fully sharecropped.[10] Of these, 53

[9] We do not claim to construct an all-encompassing measure of HEC-related damage, but we focus in sections of the household survey on the main types of damage caused by the HEC, which include: crop damage, house damage and lives lost or personal injury suffered. We collect data on when the damage occurred, how many acres were damaged (if crops) and the estimated cost of damage, although the latter is noisy.

[10] Households also cultivate on their residential plot but most cultivation takes place on a primary farm plot.

per cent of plots have property deeds assigned to them and 17 per cent have certificates of entitlement. Anecdotal evidence suggests that obtaining formal property rights in the Wellawaya area is a difficult and lengthy process given that much of the occupied land is government owned: the government neither enforces residence restrictions, nor does it formally transfer ownership to those encroaching on government-owned land. This makes it difficult for households which do not formally own their land to insure it against risks. Of the residence plots, 39 per cent were inherited and 23 per cent purchased by the respondent. Of the residence plots that were inherited, 45 per cent of plots have been previously resided on or farmed by other family members, suggesting there is a mixture of households in our sample who have lived here for a long time, and those who arrived relatively recently to the area.

Of the 243 primary farm plots, again, the majority is owned (77 per cent), while 12 per cent are sharecropped. In terms of land acquisition, 26 per cent of plots were purchased, 23 per cent have been encroached upon and 20 per cent were inherited. Of the plots which were inherited, 65 per cent were previously either lived on or farmed by family members. A smaller percentage of primary farm plots have deeds allocated to them (26 per cent compared to 53 per cent of residence plots), and only 12 per cent have a certificate of entitlement (compared to 17 per cent of resident plots). The primary farm plot is situated, on average, 2.1 kilometres away from the residence plot and is accessed mainly on foot (58 per cent of plots), but also by bicycle (28 per cent) or by motorcycle (10 per cent).

A high percentage of plots are reported to have been chosen by the respondents: 65 per cent of residence plots and 71 per cent of primary farm plots. The modal reason given

for choosing a particular plot is "favourable soil conditions" (36 per cent of responses for residence plots, 39 per cent for primary farm plots).

2.4.3 Methods Used to Mitigate the Human-Elephant Conflict

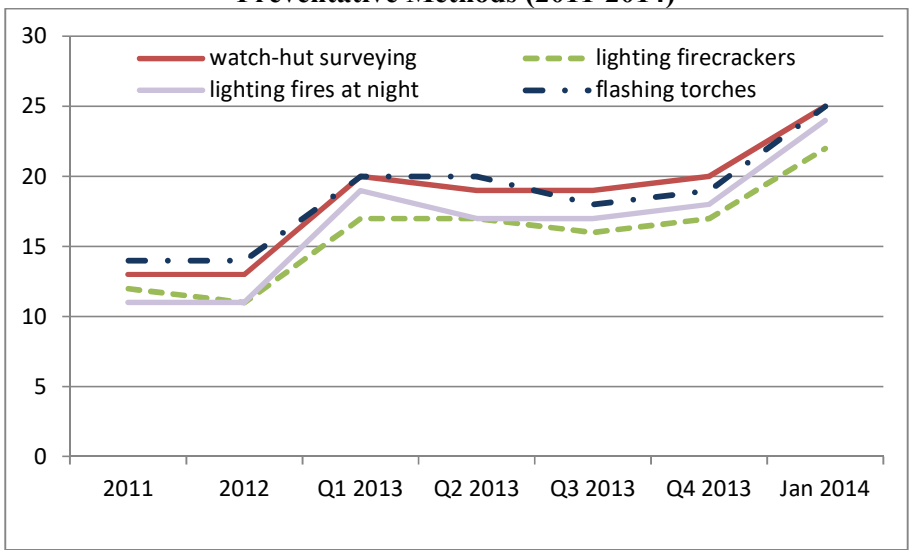
To the best of our knowledge, this is the first attempt to provide rich quantitative data on time allocation to HEC prevention methods. There are several prevention methods which households use in order to protect their land from roaming elephants.[11] We ask respondents to recall days spent using each of the various prevention methods.[12] Households use a combination of methods. Focusing on methods used by households in January 2014, we observe that popular methods include flashing torches (71 per cent), lighting firecrackers (66 per cent), lighting fires at night (58 per cent), and crop-guarding in watch-huts (44 per cent). The figures show that the severity of the HEC has been growing in recent years, as can be seen from the increasing average number of days per month spent using each prevention method between 2011 and January 2014 (see Figure 2.1). This is corroborated by anecdotal accounts during previous visits to the case study area: farmers reported increasing exposure to the HEC due to increasing demarcation of farm plots and therefore decreasing land available for elephants to roam

[11] These include: building wooden or electric fences around farms; creating traps for elephants around farms; digging trenches around farms to make it difficult for elephants to access farmland; cultivating crops which are undesirable to elephants; lighting firecrackers to scare away elephants; lighting fires at night and flashing large torches to deter elephants; firing mock gunshots; crop-guarding from watch-huts (either ground-level shelters or tree-houses built several metres above-ground to oversee farmland and to defend farms at night from roaming elephants).

[12] We collect annual estimates for 2011 and 2012, quarterly estimates for 2013 and a monthly estimate for January 2014.

freely. Furthermore, greater surveillance of farmlands is needed due to the Department of Wildlife Conservation's increased focus on elephant rehabilitation and translocation to nearby nature reserves, which raises the risk of greater elephant migration across nearby farmlands.

Figure 2.1: Mean Number of Days Per Month Spent Using Four Main HEC Preventative Methods (2011-2014)



We focus part of the survey on data relating to the use of watch-huts as this prevention method is time-consuming, labour intensive and impacts family life. Households in our sample spent on average 13 days per month crop-guarding in watch-huts during the whole of 2011, compared to 22 days per month in the last quarter of 2013, and 27 days in January 2014. In line with the increased risk, households appear to spend twice as many days per month manning watch-huts in January 2014 as in the previous three years.

We also collect plot-level data on watch-hut construction: 299 out of 767 plots (39 per cent) have watch-huts. Watch-huts can be built as ground-level shelters or above-

ground tree-houses. Our data show that watch-huts are mostly located at ground level on residence plots and on primary farm plots, and are mainly constructed from straw, cadjan or coconut palms. The majority of financial resources are allocated to the construction of the watch-hut on the primary farm plot, most probably because this farm plot is most important for cultivation. In addition, the homestead on the residence plot may itself serve as a watch-hut, therefore requiring little additional expenditure.

In terms of labour allocation, 79 and 83 per cent of household heads are most likely to survey from watch-huts on both residence plots and primary farm plots, respectively. In terms of time allocation, there is seasonal variation in the number of days per month and hours per day spent surveying land from watch-huts. In the maha season, households spend on average 28 days per month and 12 hours per day surveying from watch-huts. Comparatively less time is spent manning watch-huts during the drier yala season, where an average 10 days per month and 7-8 hours per day are spent in watch-huts. This could be explained by the fact that more crops are cultivated during the maha season and farmers therefore have more cultivated land to protect. In contrast, the proportion of cultivated land during the drier yala season is lower. Lower cultivation in yala could be explained by the fact that cultivation is often only undertaken by farmers who have better access to other water sources such as tube wells, agricultural wells, natural reservoirs and nearby rivers, and who can afford motorised irrigation.

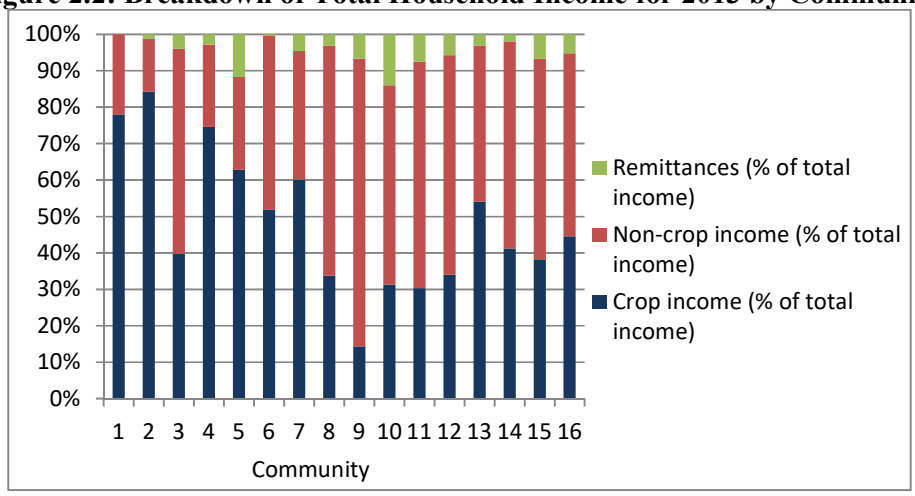
Spatially, we find that watch-huts are concentrated in areas where there are other primary farm plots (8 neighbouring watch-huts on average) relative to areas where there are residence plots (2 neighbouring watch-huts on average). Our data show that there is a high degree of mutual assistance – farmers survey others' farm plots from their

watch-huts and this is reciprocated. In the entire sample, 71.6 per cent of households which have watch-huts on residence plots mutually assist each other. On primary farm plots, the percentage of mutual assistance is 79.2 per cent.

2.4.4 Sources of Household Income

We calculate total annual household income in 2013 (in Sri Lankan Rupees) as the sum of crop revenues in maha and yala season combined, the non-farm income earned in cash by each household member, and cash remittances received by the household.[13]

Figure 2.2: Breakdown of Total Household Income for 2013 by Community



A comparison of income sources by community for 2013 shows that there is variation in the degree to which communities rely on farm and non-farm income: Seven communities generate over 50 per cent of their total annual household income from farming; eight communities derive between 30 and 45 per cent of their income from

[13] The latter two figures are based on bi-annual figures for the period July to December 2013 and we derive an annual 2013 estimate by calculating the monthly average and annualising this figure.

farming[14]; and one community derives only 14 per cent of income from farming and generates 79 per cent of its household income from non-farm activities. Annual remittances make up between 1 and 8 per cent of household income in most communities. Of all the sixteen communities, Community 2 is the most remote of the communities in this study and this explains why most income is generated from farming. Community 9 generates the largest proportion of income from non-farming activities; most homesteads in this community are located on or very near a major tarred road which facilitates easier access to non-farm employment opportunities.

2.5 Empirical Results

The following tables of descriptive statistics relate to the variables used in each set of regressions. Table 2.1 corresponds to regressions regarding households' exposure to HEC-related crop damage and: the proportion of income from non-farming; and the proportion of fallowed land in the maha and yala seasons. When we test Hypothesis 1, the dependent variable (*proportion of income from non-farming*) is continuous between zero and 1 and is the non-farm income generated per household as a proportion of that household's total income in 2013. On average, households derive 33 per cent of their income from non-farm activities.

[14] Communities 3, 8, 10, 11, 12, 14, 15, 16.

Table 2.1: Summary Statistics for Variables Used in Regressions Regarding Reliance on Non-farm Income and Cultivation Choices

Continuous Variables	**Sample Size**	**Mean (s.d.)**	**Min.**	**Max.**
Proportion of income from non-farming (%)	409	0.333 (0.399)	0	1
Proportion of fallow land in maha (%)	409	0.341 (0.318)	0	1
Proportion of fallow land in yala (%)	409	0.693 (0.324)	0	1
Monthly crop damage (2013)	409	0.586 (1.956)	0	29.167
Trajectory of crop damage (2011-2014)	409	-2.255 (7.986)	-106.818	13.636
Distance from tarred road (km)	409	2.468 (1.064)	0.5	4.0
Household size	409	3.946 (1.312)	1	8
Age of household head (yrs.)	409	47.345 (12.541)	19	80
Household head age squared	409	2398.406 (1238.714)	361	6400
Household head's yrs. of schooling	409	7.990 (3.547)	0	14
Dummy Variables	**Sample Size**	**Prop. of Sample (%)**		
Household head in farming	409	0.802		

To test Hypothesis 2, we split the sample according to cultivation decisions in the maha season (September to March) and in the yala season (April to August). The dependent variables are therefore the number of acres of fallow land as a proportion of total cultivated land per household in maha and in yala, respectively.[15,16] We consider the

[15] The dependent variable is constructed by summing the total acreage of all crops cultivated in the maha and yala seasons separately, and dividing each of these by the total numbers of acres occupied. This yields the proportion of cultivated acres and we subtract this from one to give us the proportion of fallowed land in the maha and in the yala season.

[16] Where the household engages in multi-cropping, the total number of cultivated acres stated in Survey Section F may exceed the number of occupied plots as stated in Section B (See

two cultivation seasons separately as there is more rainfall during maha than during yala and this affects the quantity of land and the variety of crops cultivated. In our sample, there is twice as much fallow land in the yala season (69.3 per cent) compared to the maha season (34.1 per cent). We attribute this to households being more reliant on motorised irrigation in the drier yala season than in the wetter maha season and so households without access to alternative water supplies and water motors and pipes may be forced to leave more land fallow in yala.

The decision to cultivate certain crops in the maha season does not appear to be influenced by exposure to the HEC, as the three major crops (groundnuts, cowpea and paddy) are all at risk of being raided by elephants. Moreover, anecdotal evidence suggests that elephants are becoming increasingly accustomed to consuming a wider variety of crops which in previous years deterred them from encroaching on farmland (e.g. capsicum). Please refer to Appendix A for further details regarding crops cultivated in maha 2013/14 and yala 2013.

In testing Hypotheses 1 and 2, the key explanatory variables of interest relate to crop damage arising from the Human-Elephant Conflict.[17] We focus on the average monthly frequency of instances of elephant-related crop damage in 2013 and the trajectory of

Chapter 6 Section 6.6). This would result in a negative proportion of fallow land, which we set to zero. This adjustment does not significantly alter our results.

[17] We collect estimates for the frequency of instances of elephant-related crop damage on an annual basis for 2011 and 2012, on a quarterly basis for 2013 and on a monthly basis for January 2014. We also collect estimates for the same period regarding instances of house damage and personal injury and deaths in the household, but the frequency of these damage data is low and we therefore exclude these data from our empirical analysis.

frequency of instances of elephant-related crop damage during the period 2011 to 2014 (*trajectory*). To construct the variable *trajectory*, we regress the monthly average frequency of instances of crop damage (for each of the seven periods for which we have crop damage data) on a time trend for each household.[18] We harvest the t-value from the coefficient on the time trend for each household-level regression and this forms the variable *trajectory*. Therefore, a higher positive trajectory implies a more strongly increasing trend in the household's experience of HEC-related crop damage. We also control for community-level access to local markets, amenities and non-farm employment using *distance from tarred road*. Communities in this sample are, on average, located approximately 2.5km away from the nearest tarred road. In terms of household characteristics, household heads are on average 47 years old with an average of 8 years of schooling and live in households of four members.

To test Hypothesis 3, we investigate whether households which experience more crop damage are more likely to have an oldest child of working age within the household who is employed off-farm. We focus on children who are the oldest child in their family and who are of working age (at least 15 years old according to the ILO definition for a child of working age).[19] We focus on the oldest child in each household for two reasons:

[18] The time trend is measured in months. A separate regression is performed for each household. We harvest the t-ratios because this is a measure of the strength of the relationship between the frequency of crop damage and time, and it has the same sign as the coefficient. Rather than the slope, we are more interested in how discernible this relationship is to each household. An alternative approach for future research would be to take the log of the damage variable so that the coefficient could be interpreted as a growth rate.

[19] We exclude student children from this definition as we are unable to distinguish between children of working age who would continue in education as a response to HEC exposure, and

first, the oldest child is expected to help on the family farm (especially if the oldest child is male) and, this being the case, if (s)he chooses to opt into non-farming, it is a strong signal of choice. Second, if the oldest child resides in the same household as his/her parents, then the income which (s)he earns from non-farm activities will be a major contribution to the household's total annual income. When we restrict the sample to oldest children who engage in either farming or non-farming activities, this reduces the sample to 178 observations. The dependent variable is a 0-1 dummy variable which takes the value of 1 if the oldest child in the household is of working age and engages in non-farm activities, and zero otherwise (i.e. engages in farming). Descriptive statistics for this sample (see Table 2.2 below) show that approximately 66 per cent of oldest children of working age engage in non-farming. Our key explanatory variables of interest are average monthly frequency of instances of elephant-related crop damage in 2013, and the four-year average monthly frequency of instances of elephant-related crop damage between 2011 and 2014. Households in our sample experienced an average of 0.6 instances of elephant-related crop damage per month in 2013, and 0.5 instances between 2011 and 2014. The oldest child is on average 25 years old, has 11 years of schooling and has one other sibling. Approximately 18.5 per cent of oldest children are married and 27.5 per cent are female. Household heads of this sample are on average 54 years old, have 7 years of schooling, and 84.3 per cent of them are engaged in farming activities.

children of working age who would continue in education in any case. We define farm labour income as "non-farm" as this is income earned from wage employment on someone else's farm, not the family's own farm, and HEC-related risks are therefore predominantly borne by the landholder.

Table 2.2: Summary Statistics for Variables Used in Regressions Regarding Engagement of Oldest Children in Non-farm Activities

Continuous Variables	Sample Size	Mean (s.d.)	Min.	Max.
Monthly crop damage (4-yr. ave.)	178	0.648 (1.186)	0	10.492
Monthly crop damage (2013)	178	0.495 (1.210)	0	10.417
Distance from tarred road (km)	178	2.475 (1.059)	0.5	4.0
Age of oldest child	178	25.449 (6.431)	15	43
Oldest child's yrs. of schooling	178	11.163 (2.619)	0	16
Number of children in household	178	2.174 (1.013)	1	5
Age of household head (yrs.)	178	53.994 (9.246)	19	77
Household head age squared	178	3000.410 (993.701)	361	5929
Household head's yrs. of schooling	178	6.820 (3.537)	0	14
Dummy Variables	**Sample Size**	**Prop. of Sample (%)**		
Oldest child of working age in non-farming	178	0.663		
Oldest child is married	178	0.185		
Oldest child is female	178	0.275		
Household head in farming	178	0.842		

The analysis of the 178 oldest children provides a reasonable indication that there is an association between HEC exposure and children opting for non-farm employment. However, this does not indicate a direction of causality. We attempted to address this by constructing a sub-sample of oldest children of working age who left school in the years 2012, 2013 or 2014, and by using the timing of crop damage in relation to the timing of them leaving school to identify a causal relationship. Specifically, we aimed to observe whether, when an oldest child of working age leaves school, the likelihood of him/her opting into non-farm employment is greater if his/her parents experienced

greater crop damage in recent years.[20] The dummy dependent variable for this set of regressions was equal to 1 if the oldest child of working age engaged in non-farm activities. The key explanatory variable was *crop damage in prior years*, which equalled one if the child's family experienced crop damage in the years preceding the child's entry into the labour market. The sample for which both of these variables could be defined included only 16 observations. For this reason, we do not report the descriptive statistics or the regression results in this chapter.

2.5.1 Empirical Estimations – Reliance on Non-farm Income

One-day workshops in each of the 16 communities comprised two sessions of 16 community members. The entire study consisted of 32 sessions. In all estimations, we control for non-independence in standard errors by bootstrap clustering at the session level (the technique is discussed in further detail in Chapter 3). Table 2.3 presents the results of a linear estimation where the proportion of income from non-farming is the dependent variable and the key independent variable of interest is exposure to HEC risk.

Result 1: Households which experience greater exposure to crop damage are more reliant on income generated from non-farm activities.

In Model 1, the coefficient on the trajectory of crop damage is positive and statistically significant, in line with Hypothesis 1: a one-unit increase in the trajectory of crop

[20] The variable *crop damage in prior years* equals 1 if: school leavers in 2014 experienced crop damage in 2013, 2012 and/or 2011; school leavers in 2013 experienced crop damage in 2012 and/or 2011; and, if school leavers in 2012 experienced crop damage in 2011. The variable equals zero if the school leaver belongs to a household which did not experience crop damage in any of the years preceding the year in which (s)he left school.

damage is associated with a 0.6 percentage points increase in the proportion of income from non-farm activity. Each additional year of schooling of the household head is associated with greater reliance on non-farm income (0.9 percentage points). Larger households are also more reliant on non-farm income (3.5 percentage points).

Table 2.3: Linear Model – Effect of Crop Damage on Proportion of Income Generated by Non-farm Activities

	Model 1 OLS
Trajectory of crop damage (2011-2013)	0.006**
	(0.016)
Distance from tarred road (km)	0.010
	(0.680)
Age of household head	-0.029*
	(0.055)
Household head age squared	$2.659e^{-4}$*
	(0.070)
Household head in farming	-0.350***
	(<0.001)
Household head's yrs. of schooling	0.009**
	(0.035)
Household size	0.035**
	(0.013)
Constant	1.119***
	(0.004)
Observations	409
R-squared	0.213

Notes: The dependent variable is the proportion of total annual household income in 2013 derived from non-farming activities; in Model 1, standard errors are cluster bootstrapped at the session level (32 sessions and 5,000 replications) and p-values are shown in parentheses; *** p<0.01, ** p<0.05, * p<0.1

2.5.2 Empirical Estimations – Cultivation Choice

Table 2.4 presents results from linear estimations where the dependent variable is the proportion of land left fallow in the maha season (Models 1 and 2) and in the yala season (Model 3). To control for non-independence in standard errors, we bootstrap cluster at the session level.

In Model 1, we include monthly crop damage for 2013, as well as the trajectory of crop damage during the period 2011-2014, as key explanatory variables. We include the former to observe whether households which experienced crop damage in 2013 are more likely to cultivate less land in maha 2013/14; and the latter to observe whether households which experienced increasing damage over the period 2011-2013 are more likely to cultivate less land in maha 2013/14. The two explanatory variables are negatively and highly significantly correlated at the 1 per cent level (rho=-0.266, $p<0.001$), and we are therefore concerned about issues of multicollinearity. To investigate this, we test for the joint significance of both variables in the regression and we reject the null hypothesis that the crop damage variables are jointly insignificant, at the 5 per cent level. Furthermore, endogeneity is a concern with regards to the 2013 monthly average of crop damage – it is possible that the more land that is cultivated, the greater the likelihood of crop damage because more crops attract more elephants. Indeed, this may explain the counterintuitive result that greater average monthly crop damage in 2013 is associated with less fallow land (i.e. *more* cultivated land) in the maha season. Given this, we exclude the variable for annual crop damage in 2013 and move to Model 2, where *trajectory* is the only key independent variable of interest.

Result 2: Households which experience a more strongly increasing trend in crop damage leave a greater proportion of land fallow in both the maha and the yala cropping seasons.

In moving from Model 1 to 2, the coefficient on *trajectory* increases by 0.001, is now significant at the 1 per cent level, and is in line with Hypothesis 2. There is a positive and significant association between trajectory of crop damage and the proportion of fallow land in the maha season. The proportion of fallow land in maha is 12.6 percentage points lower in households where the head is a farmer.

In Model 3, we focus on the proportion of fallow land in the yala season and again, *trajectory* is our key independent variable of interest. We find that the coefficient on the trajectory of crop damage on fallow land in yala is positive and has the same magnitude as in the maha sub-sample, but it is statistically insignificant. The proportion of fallow land in yala is 11.2 percentage points lower in households where the head is a farmer, and the coefficient on the variable is more significant than in the maha sub-sample. The other household-level and community-level controls are statistically insignificant.

Table 2.4: Linear Models – Effect of Crop Damage on Proportion of Fallow Land in the Maha and Yala Seasons

	Maha		Yala
	Model 1 OLS	**Model 2** OLS	**Model 3** OLS
Monthly crop damage (2013)	-0.009***		
	(<0.001)		
Trajectory of crop damage (2011-2013)	0.002***	0.003***	0.003
	(<0.001)	(<0.001)	(0.136)
Distance from tarred road (km)	-0.005	-0.005	0.005
	(0.769)	(0.768)	(0.820)
Age of household head	-0.013	-0.013	0.002
	(0.188)	(0.189)	(0.789)
Household head age squared	$1.665e^{-4}$*	$1.665e^{-4}$*	$-1.776e^{-5}$
	(0.100)	(0.100)	(0.848)
Household head in farming	-0.124**	-0.126**	-0.112***
	(0.018)	(0.017)	(0.005)
Household head's yrs. of schooling	-0.001	-0.001	0.005
	(0.791)	(0.824)	(0.303)
Household size	0.006	0.005	$1.843e^{-4}$
	(0.624)	(0.666)	(1.000)
Constant	0.659***	0.660***	0.669***
	(0.005)	(0.005)	(0.002)
Observations	409	409	409
R-squared	0.055	0.052	0.033

Notes: The dependent variable is the proportion of fallow land in the maha/yala season; in Model 1, standard errors are cluster bootstrapped at the session level (32 sessions and 5,000 replications) and p-values are shown in parentheses; *** p<0.01, ** p<0.05, * p<0.1

2.5.3 Empirical Estimations – Occupational Choice

Next, we focus on HEC exposure and household members' engagement in non-farm activities. Recall that the sample comprises 178 children who are the oldest child in their family and are of working age. We focus on oldest children because they may be one of the main income providers in the household. The dependent variable is a 0-1 variable which takes the value of 1 if the oldest child in the household is of working age (15 years old according to the ILO definition) and engages in non-farm activities, and zero if they do not engage in non-farming activities.

Using a Probit model, in Model 1, we estimate the relationship between whether or not an oldest child of working age engages in non-farming activities which do not include full-time education, and the mean monthly crop damage experienced in 2013. The marginal effects are shown in Table 2.5 (see Appendix B, Table B.1 for Probit coefficient estimates). In Model 1, a household which experiences more average monthly crop damage in 2013 is more likely to have an oldest child who engages in non-farming. However, it is likely that the reallocation of a child's labour capacity is part of an on-going decision-making process based on years of experience with the HEC. We therefore move to Model 2, where we focus on the four-year average of crop damage.

Table 2.5: Marginal Effects for Probit Models – Effect of Crop Damage on Oldest Children Opting into Non-farm Income-generating Activities

	Model 1 Probit	**Model 2** Probit
Monthly crop damage (4-yr. ave.)		0.107**
		(0.050)
Monthly crop damage (2013)	0.252***	
	(0.080)	
Distance from tarred road (km)	0.054*	0.057*
	(0.030)	(0.033)
Age of oldest child	-0.025***	-0.025***
	(0.007)	(0.008)
Oldest child is married	-0.149	-0.168*
	(0.099)	(0.103)
Oldest child's yrs. of schooling	0.043***	0.047***
	(0.016)	(0.016)
Oldest child is female	0.242***	0.248***
	(0.058)	(0.071)
Age of household head	-0.019	-0.026
	(0.029)	(0.031)
Household head age squared	<0.001	<0.001
	(<0.001)	(<0.001)
Household head in farming	-0.293***	-0.324***
	(0.060)	(0.064)
Household head's yrs. of schooling	-0.009	-0.011
	(0.011)	(0.011)
Number of children	0.004	-0.004
	(0.042)	(0.045)
Observations	178	178
R-squared value	0.301	0.284
Wald statistic	126.79	99.29

Notes: The dependent variable is whether or not the oldest child of working age is in non-farming; standard errors are shown in parentheses and are clustered at the session level (32 sessions); *** p<0.01, ** p<0.05, * p<0.1; with the exception of *distance from tarred road (km)*, results are robust to an LPM specification and to bootstrap clustering which controls for non-independence in standard errors and controls for a small number of clusters (32 clusters and 5,000 replications – see Appendix B, Table B.2).

Result 3: Working-age children from households which experience a higher frequency of crop damage are more likely to engage in the non-farm labour market.

In Model 2, we observe that households which experience more monthly crop damage over the period 2011 to 2014 are more likely to have an oldest child of working age engaging in non-farm activities. Here, we also find that households which live further away from the nearest tarred road are more likely to engage in non-farm activity, which is counterintuitive, as we would expect that households located closer to the main road have greater access to non-farm employment opportunities. However, the distance of a community from the tarred road may also proxy for their exposure to the HEC. Therefore, households located further away from main roads are generally in closer proximity to wildlife-protected areas and may therefore rely on children to generate non-farm income to recoup losses from HEC-related crop damage.

We find that the older is the oldest child, the lower is the likelihood of non-farming and therefore the greater is the likelihood that (s)he continues the family tradition of farming. Oldest children who are married are less likely to engage in non-farming activities and oldest children who are female are more likely to engage in non-farming. The oldest child's years of schooling are positively and highly significantly associated with that child's engagement in non-farming. An oldest child from a household where the head is a farmer is less likely to engage in non-farming.

2.6 Summary and Conclusions

Many developing countries rely on the agricultural sector to fuel economic growth hence multilateral development organisations, such as the United Nations (UN),[21] are

[21] Sustainable Development Goal (SDG) 2 focuses on the promotion of sustainable rural

concerned with how low-income households cope with risks within agricultural development. In this regard, our policy-relevant results show that, at present, the households in our sample do adopt non-collective strategies in order to cope with exposure to a particular form of environmental and agriculture-related risk – the Human-Elephant Conflict. The overarching message conveyed through the descriptive analysis is that those households in our sample which are highly exposed to the HEC are, according to three distinct but related measures, less reliant on agriculture for their livelihoods. Consistent with the existing literature on livelihoods diversification, households which experience an increasing trend in crop damage rely more on non-farm income-generating activities and leave more of their land fallow in the maha season when most cultivation occurs.[22] Furthermore, oldest children from households

livelihoods. In particular, Goal 2.4 aims to, by 2030, ensure sustainable food production systems and implement resilient agricultural practices that: increase productivity and production; help maintain ecosystems; strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters; and, progressively improve land and soil quality (see https://sustainabledevelopment.un.org/sdgs).

[22] We acknowledge that cultivation choices may be determined by trends in crop prices, especially those in the preceding year such that high prices in year *(t-1)* may lead to cultivation of that crop in year *t*. Although crop prices are an important control, we do not control for them for several reasons: first, households multi-crop and therefore we may include crop prices for crops which are only cultivated by one household out of the entire sample; second, we do not have external data regarding crop prices for the area, therefore imputing crop prices from current output and current revenues and using these values as controls in our estimations may lead to potential endogeneity with our dependent variable which relies on the same revenue data; finally, households sell a substantial amount of their crops to local traders and private moneylenders who have been known to purchase produce at lower prices, either as repayment for subsidising fertilizers and pesticides, or simply to increase their profit margins. The information asymmetry in the latter situation creates a significant divergence between local and national prices and may therefore not reflect the actual prices to which farmers respond through their cultivation decisions.

which experience more crop damage are more likely to engage in non-farming. One possible explanation is that as parents may prefer their children to participate in income-generating activities which entail lower risk compared to the HEC-related risks of farming in the Wellawaya area. A consequence of this could be that a child's non-farm income may also help the farming household to recoup financial losses owing to elephant-related crop damage.

We acknowledge that, with only one wave of household survey data and lack of valid instrumental variables, we are unable to move from a descriptive to a causal analysis of the behaviour of households which are highly exposed to the HEC. More data would allow us to identify whether farming households opt into non-farming in response to an increasing trend in HEC-related crop damage; or whether, through economic development, farmers' gradually shift resources from farm to non-farm activities, thereby allowing elephants to cause more crop damage in the process of reclaiming land that was formerly their domain.. Regardless of the direction of causality, the upshot of the analysis is that elephants appear to be regaining access to their former migratory routes in the Wellawaya area. Our findings may therefore reassure economic and environmental policymakers that economic development and environmental degradation do not always go hand in hand.

Appendix A: Cultivation Decisions

The two main cropping seasons in the agricultural calendar are the maha and yala seasons. The maha season lasts from September until March and typically receives more rainfall than the yala season which lasts from April to August. We collect data on crops cultivated during both seasons. In our sample of 468 households, there are 23 different crops cultivated in maha 2013/14. The three main crops cultivated during this season are groundnuts, cowpea[23] and paddy. During yala 2013, 24 different crops were cultivated and the three main crops cultivated during this season were sesame, capsicum and paddy.

[23] A legume often cultivated in semi-arid regions.

Table A.1: Information Regarding Key Cultivated Crops in the Maha and Yala Seasons

	Maha			Yala		
	Groundnuts	**Cowpea**	**Paddy**	**Sesame**	**Capsicum**	**Paddy**
Number of households who cultivated crop	357	220	110	145	48	36
Average number of acres cultivated	1.3	0.7	1.7	1.5	0.7	1.2
Percentage of households obtaining a loan	35	20	41	17	67	25
Loan amount per acre (Rs.)	10,409	3,262	11,995	2,597	37,359	4,028
Labour cost per acre (Rs.)	9,485	4,888	8,240	3,350	81,645	10,736
Fertilizer cost per acre (Rs.)	34	0	5,470	285	13,170	5,516
Insecticide cost per acre (Rs.)	2,781	3,734	5,924	100	32,786	5,661
Output per acre (kg)	518	122	1,929	186	5,844	1,638
Output stored per acre (kg)	162	12	1,063	11	7	732
Output sales per acre (Rs.)	31,095	12,226	25,347	27,506	146,721	21,653

Rice is Sri Lanka's staple food. It is therefore not surprising that more land in the maha season is dedicated to paddy cultivation compared to the other two popular crops (groundnuts and cowpea). We observe that fewer households in our sample report cultivating paddy compared to the number of households which cultivate groundnuts and cowpea in the maha season, and compared to households which cultivate sesame and capsicum in the yala season. Anecdotal evidence suggests that paddy can be stored and consumed for up to 18 months (55 per cent of output stored in maha 2013/14), and this may explain why less paddy was harvested in maha 2013/14 than we would expect. Fewer households cultivate paddy in the yala season, which in turn translates into smaller loan amounts, lower output and lower output stored per acre. Reduced cultivation in the yala season may be explained by there being less rainfall, which leaves households more reliant on alternative water supplies. However, alternative water supplies are not available to all. Agricultural input costs (fertilizer and insecticides) associated with paddy cultivation are relatively stable between maha and yala, as are per-acre output and per-acre output sales.

Although paddy is the staple food, 357 households in our sample cultivated groundnuts in maha 2013/14. Groundnut cultivation is relatively more labour-intensive, but less input-intensive (with respect to fertilizers but also insecticides) compared to paddy and cowpea cultivation. One acre produces on average 518kg of groundnuts and an average 31 per cent is stored either for future sales (mainly to traders and private moneylenders), own consumption and/or as seeds for the following maha season. About 10 per cent of cowpea output is stored and produce is predominantly sold to local traders and moneylenders. In all cases, there is over 90 per cent reliance on rain-fed irrigation for all three crops.

Our sample shows that there was overall less cultivation during the yala season. However, sesame was the most frequently cultivated crop in yala 2013. Sesame (gingelly) is a major cash crop in Sri Lanka which is cultivated during the dry season (Gunasena and Pushpakumara, 2015). Sesame requires a relatively small average loan amount per acre (Rs.2,597) and the majority of cultivation costs per acre are for hired labour. Households store only 5 per cent of produce, as this is a cash crop and the majority of sales are to traders and private moneylenders. The agricultural costs for capsicum are higher compared to all main crops cultivated in both maha and yala seasons. A relatively small acreage is cultivated (0.7) but capsicum can be harvested several times during one season. There is a heavy reliance on loans (70 per cent of cultivators are borrowers) to cover hired labour, fertilizers and insecticides. Of those who report the place of sale, this is mainly to private moneylenders, from whom cultivators will likely obtain fertilizers, insecticides and farming implements. Finally, only 0.1 per cent of output is stored possibly for own consumption or as seeds for the following season.

Appendix B: Additional Estimations

Table B.1: Probit Model Coefficient Estimates – Effect of Crop Damage on Oldest Children Opting into Non-farm Income-generating Activities

	Model 1 Probit	**Model 2** Probit
Monthly crop damage (4-yr. ave.)		0.331**
		(0.162)
Monthly crop damage (2013)	0.854***	
	(0.302)	
Distance from tarred road (km)	0.183*	0.177*
	(0.097)	(0.101)
Age of oldest child	-0.085***	-0.077***
	(0.027)	(0.026)
Oldest child is married	-0.458	-0.480*
	(0.280)	(0.278)
Oldest child's yrs. of schooling	0.146***	0.147***
	(0.051)	(0.049)
Oldest child is female	1.002***	0.903***
	(0.316)	(0.314)
Age of household head	-0.064	-0.081
	(0.101)	(0.099)
Household head age squared	0.001	0.001
	(0.001)	(0.001)
Household head in farming	-1.716***	-1.626***
	(0.542)	(0.514)
Household head's yrs. of schooling	-0.032	-0.034
	(0.035)	(0.034)
Number of children	0.015	-0.013
	(0.142)	(0.139)
Constant	2.750	3.302
	(2.574)	(2.548)
Observations	178	178
R-squared value	0.310	0.284
Wald statistic	126.79	99.29

Notes: The dependent variable is whether or not the oldest child of working age is in non-farming; robust standard errors, clustered at the session level, are shown in parentheses; *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table B.2: Linear Probability Models – Effect of Crop Damage on Oldest Children Opting into Non-farm Income-generating Activities

	Model 1a[a] LPM	**Model 1b**[b] LPM	**Model 2a**[a] LPM	**Model 2b**[b] LPM
Monthly crop damage (4-yr. ave.)			0.049***	0.049***
			(0.018)	(0.005)
Monthly crop damage (2013)	0.057***	0.057**		
	(0.018)	(0.016)		
Distance from tarred road (km)	0.036	0.036	0.034	0.034
	(0.027)	(0.218)	(0.028)	(0.250)
Age of oldest child	-0.023***	-0.023***	-0.023***	-0.023***
	(0.007)	(0.003)	(0.007)	(0.002)
Oldest child is married	-0.113	-0.113	-0.118	-0.118
	(0.088)	(0.210)	(0.088)	(0.186)
Oldest child's yrs. of schooling	0.043***	0.043**	0.043***	0.043**
	(0.015)	(0.014)	(0.015)	(0.014)
Oldest child is female	0.228***	0.228***	0.218***	0.218**
	(0.073)	(0.008)	(0.074)	(0.013)
Age of household head	-0.024	-0.024	-0.026	-0.026
	(0.036)	(0.590)	(0.036)	(0.549)
Household head age squared	$2.867e^{-4}$	$2.867e^{-4}$	$3.041e^{-4}$	$3.041e^{-4}$
	(<0.001)	(0.500)	(<0.001)	(0.473)
Household head in farming	-0.330***	-0.330***	-0.337***	-0.337***
	(0.085)	(0.002)	(0.084)	(0.001)
Household head's yrs. of schooling	-0.010	-0.010	-0.010	-0.010
	(0.010)	(0.372)	(0.010)	(0.320)
Number of children	0.007	0.007	0.004	0.004
	(0.042)	(0.884)	(0.042)	(0.950)
Constant	1.366	1.366	1.461	1.461
	(0.952)	(0.254)	(0.942)	(0.218)
Observations	178	178	178	178
R-squared	0.301	0.301	0.295	0.295

Notes: The dependent variable is whether or not oldest child of working age is in non-farming; [a] in Models 1a and 2a, standard errors are clustered at the session level (32 sessions) and standard errors are shown in parentheses; [b] in Models 1b and 2b, standard errors are cluster bootstrapped at the session level to control for non-independence (32 sessions and 5,000 replications) and p-values are shown in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Chapter Three: Collective Coping in the Presence of Interdependent and Heterogeneous Risk Exposure

3.1 Introduction

Collective coping, in the form of risk-sharing, helps poor households and individuals in developing countries to cope with the negative consequences of environmental risks (Porter, 2012; Bulte and Rondeau, 2007; Takasaki *et al.*, 2004). When risks are idiosyncratic, individuals may rely on informal risk-sharing via ex-post redistribution and informal loans with flexible terms, but when risks are covariate, i.e. whole communities are affected by the same level of risk exposure, such methods become problematic (de Janvry *et al.*, 2014; Barrett, 2011; Dercon, 2002). The existing literature shows that sharing behaviour can be influenced by numerous factors including heterogeneous risk preferences and whether ex-post inequalities are owing to luck or agency over one's risk exposure (Cettolin and Tausch, 2015; Cappelen *et al.*, 2013; Thral and Radermacher, 2009). However, little is known about the effect which *interdependence* in risk exposure has on individuals' willingness to share with each other after outcomes are realised, and this is where we aim to contribute to the literature. By interdependence, we refer here to when an individual's choice over their own level of risk exposure directly impacts on the level of risk exposure and outcomes of another individual.

We study the effect of interdependent risk exposure on individuals' ex-post redistribution decisions using a specially designed, lab-in-the field experiment. Our research is motivated by whether and how small-scale farming communities in south-east Sri Lanka cope collectively with the Human-Elephant Conflict (HEC), an

environmental risk which is interdependent in nature. The decision of one farmer to mitigate against elephant-related crop and/or house damage, e.g. by installing an electric fence around his farm, sounding horns, igniting firecrackers, or keeping watch over his farm at night, has direct consequences on the risk exposure of and outcomes for neighbouring farmers. We conduct a lab-in-the-field experiment and engage subjects who face interdependent environmental risk in order to provide empirical answers to the following questions: 1) What effect does interdependence in risk exposure have on ex-post sharing behaviour? and, 2) Does the effect depend on whether the interdependence involves a positive or a negative correlation in risk exposure?

Our behavioural experiments involve a simple gamble choice task and four variants of a risk-and-sharing game, each played for money under carefully controlled conditions. We engaged 467 rural-subjects from sixteen villages in the Wellawaya area of south-east Sri Lanka in the experiments. Through the gamble choice task, we observe subjects' risk attitudes. In the risk-and-sharing game, subjects are exposed to financial risks and decide whether or not to assist one another ex post. The game is played by pairs of subjects who are, in some cases, similarly exposed to risk, and in others, differently exposed to risk. In some cases, risk exposure is randomly assigned and in others, it is chosen by the subjects. Finally, in some cases, a subject's risk exposure is determined not by his or her own choices, but as a consequence of the choices made by his or her co-player, i.e., risk is interdependent. We explore the effects of other's agency over own risk exposure and own agency over others' risk exposure on willingness to share after outcomes are realised.

This chapter is organised as follows: in Section 3.2, we provide the motivation to our study; in Section 3.3, we review the behavioural literature regarding risk-sharing; in Section 3.4, we describe our experimental design; in Section 3.5, we outline our predictions of behaviour in the risk-and-sharing game; in Section 3.6, we present our results and empirical analysis; we discuss our findings and how they compare with our predictions in Section 3.7 before concluding with Section 3.8.

3.2 Motivation

Interdependence in risk exposure is not uncommon in everyday life. Consider an individual who decides to install a burglar alarm in his/her house in order to mitigate the risk of being burgled, while his/her neighbours do not. Part of the burglar alarm mechanism is visible at the front of the individual's house and burglars notice this mechanism, as well as whether or not neighbouring houses have the same mechanism fixed to the front of their houses. Burglars may therefore be more likely to burgle neighbouring houses which do not have a burglar alarm. There is interdependence in the structure of risk exposure as the individual's choice to lower his/her own level of risk exposure by installing the burglar alarm impacts on the level of risk exposure and outcomes for his/her neighbours.

Next, consider the example of farmers who cultivate land in hilly areas. Imagine that uphill farmers implement farming techniques, such as terracing, to prevent soil erosion and landslips. Then, ceteris paribus, downhill farmers are, by default, also better protected from landslips and landslides. Again, the choice of uphill farmers to lower their level of risk exposure has consequences for the level of risk exposure and outcomes for downhill farmers.

Now consider two farmers who have neighbouring farm plots, both of which border a nature reserve frequented by roaming elephants. On occasion, elephants cross over to forage for food on both farm plots. Both farmers have constraints on expending physical energy and time on different activities, and these must be allocated between land cultivation and HEC-risk mitigation. The farmers face a trade-off between cultivation and mitigation. If only one farmer decides to mitigate against HEC risk (e.g. by building an electric fence around the perimeter of their farm) this, ceteris paribus, leaves the other farm plot more exposed to elephant-related crop damage because elephants will be more likely to frequent the unprotected farm plot.

Finally, consider another example, where there are two farm plots: the first farmer's plot borders the nature reserve and the second farmer's plot borders the first but is the opposite side from the nature reserve. In this case, if the first farmer takes steps to protect his plot against HEC risk, the second farmer's plot might also benefit from lower risk exposure. This is because elephants will be deterred from encroaching on the first farm plot and will therefore be unable to approach the second.

We designed the risk-and-sharing game to capture certain key aspects of the interdependent structure of risk exposure in order to help us provide empirical answers to the following questions: 1) What effect does interdependence in risk exposure have on ex-post sharing behaviour? 2) Does the effect depend on whether the interdependence involves a positive or a negative correlation in risk exposure?

3.3 Risk Sharing in Behavioural Experiments

The existing behavioural and experimental economics literature shows that many factors affect the willingness of individuals to share risk with each other. Using a sample of over 600 Zimbabwean subjects, Barr and Genicot (2008) show that risk-sharing is greater under externally-enforced commitment compared to more limited forms of commitment. Attanasio *et al.*'s (2012) study, which used a similar experimental design and involved more than 2,000 Colombian subjects, shows that risk-sharing arrangements are positively associated with both social and kinship networks, and with whether or not subjects share similar attitudes to risk.

Our risk-and-sharing game is a variant of Selten and Ockenfels' (1998) three-person solidarity lab experiment which is anonymous and one-shot in nature and focuses on ex-ante choices regarding the redistribution of earnings following the realisation of risky lotteries. In their experiment, the student subjects earn either DM100 with probability 2/3, or zero with probability 1/3, and they decide before the random draw is made how much they will redistribute to the loser(s) in their group in the event that they receive a DM100 payoff. The authors find that just over half of their subjects mitigate ex-post inequalities in payoffs by allocating a fixed amount to losers and dividing that amount by the number of losers in the game.

Our experimental design also bears some relation to that of Bolton *et al.* (2015) whose two-player game shows that group risk taking is more conservative than individual risk taking. In one treatment, a player selects a lottery for both him/herself and a passive co-player. The crucial difference between their experiment and ours is that they focus on risk-taking decisions, while we focus on ex-post sharing decisions and how they are

affected by the prior risk-taking decisions of others. Moreover, Bolton *et al.* (2015) analyse situations where *payoffs* from lotteries are positively or negatively correlated, while we analyse situations where levels of *risk exposure* are positively or negatively correlated. In addition, Bolton *et al.* (2015) pay less attention to the passive player and any decision-making on their part is hypothetical. In contrast, the ex-post sharing behaviour of the "chosen-for" player in the RSG is one of the two primary foci of our analysis. Finally, Bolton *et al.* (2015) engage student subjects in a lab experiment, while we conduct a lab-in-the-field risk-and-sharing game with non-standard, non-student subjects who face interdependence in risk exposure in their everyday lives.

In an earlier and related experiment, Bolton and Ockenfels (2010) explore the role of social comparisons in risk-taking behaviour. They examine a "chooser" player's risk-taking behaviour when the chooser plays with an anonymous "recipient" player and the chooser's actions affect the recipient's payoffs. Once more, the focus is on the chooser's risk-taking behaviour and Bolton and Ockenfels (2010) find that risk taking is more conservative when choices extend to co-players. However, the safe lottery is less preferred when there is payoff inequality, whereas there is no difference in preferences when there are unequal payoffs under the risky lottery. The authors discuss this result in terms of unequal outcomes due to a fair contest being more acceptable than unequal outcomes chosen by the decision-maker.

Two other studies are particularly worthy of note here as they too informed our design. Cettolin and Tausch (2015) conducted a two-player lab experiment to compare levels of risk-sharing when subjects (again students) choose their risk exposure (the *ENDO* treatment) versus when subjects are exogenously assigned risk exposure (*EXO*). In the

first part of the experiment, subjects choose or are assigned a lottery before being paired with a co-player. In the second part of the experiment, one subject in the pair is randomly chosen to select a sharing level in the case that their co-player faces a different level of risk exposure, and a sharing level in the case that their co-player faces the same risk exposure. Cettolin and Tausch (2015) find that there is no significant overall difference between sharing behaviour in the *EXO* and the *ENDO* treatment. However, risk-averse subjects in the *ENDO* treatment condition their sharing behaviour on the risk exposure chosen by their co-player: those who choose low risk exposure for themselves share less with co-players who choose high risk exposure for themselves.

Cappelen *et al*. (2013) conduct a lab experiment to investigate whether subjects' (again students) sharing behaviour depends on whether inequality emerges as a consequence of choice or luck. Their three-person dictator game consists of two stakeholders and an impartial spectator. The game is divided into: a risk-taking phase where stakeholders choose between a risky and safe lottery (four variants of this game type across which the value of the safe alternative varies); and a redistribution phase where stakeholders and spectators redistribute earnings after the lotteries are realised. The authors find that subjects display "choice egalitarianism", i.e. they redistribute more equally when subjects make the same choices regarding risk and so ex-post inequalities are owing to luck, compared to when subjects make different choices regarding risk which leads to ex-post inequalities.

We conduct a lab-type experiment in the field involving small-scale farmers in Sri Lanka. Our experiment has much in common with Cettolin and Tausch (2015). Specifically, it involves a two-person game, like Cettolin and Tausch (2015), as we

wish to exclude any dilution of perceived responsibility in ex-post redistribution. For practical reasons, we deviated from Cettolin and Tausch (2015) by reducing the sharing choice set to an either-or; the deciding player chooses *either* to share ex-post payoffs equally with their co-player *or* to leave payoffs unchanged following the realisation of the gambles they face. However, the critical distinction between Cettolin and Tausch's (2015) experiment and ours is that we add two new treatments that allow us to explore whether and how a player's sharing behaviour is affected by (a) another player having agency over his/her risk exposure and (b) him/her having agency over another player's risk exposure. Our study also has much in common with Cappelen *et al.* (2013) as we also distinguish between sharing behaviour when an player's level of risk exposure and ex-post outcomes are due to luck in the assignment of the level of risk exposure, and sharing behaviour when outcomes are due to the player's level of risk exposure being chosen by him/herself or by a co-player. Finally, our study differs from all the aforementioned literature as we conduct our experiment using a non-student sample of rural, Sri Lankan subjects.

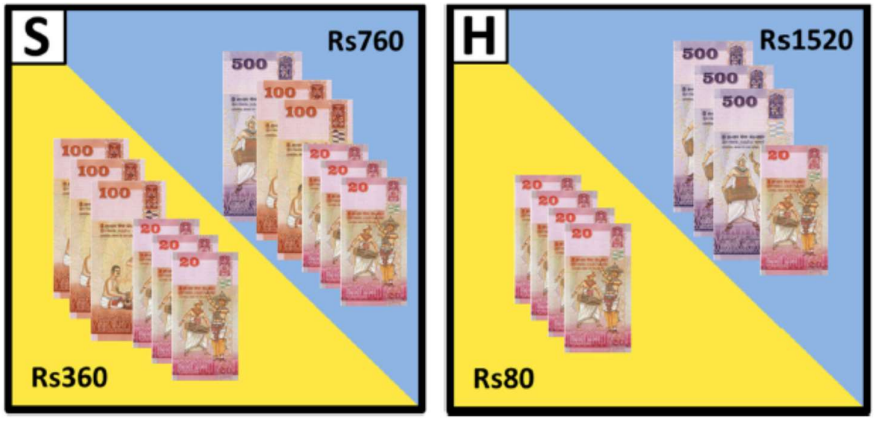
3.4 Experimental Design

3.4.1 The Risk-and-Sharing Game

The risk-and-sharing game (RSG) is one-shot and is played in pairs. Throughout the game and treatment description which follows, we refer to a player who has his/her risk exposure randomly assigned to or chosen for him/her by a co-player as Player *i*. We refer to a player who has agency over his/her own risk exposure and, in some cases, also his/her co-player's risk exposure as Player *j*. A player (*i* or *j*) knows that (s)he is paired with a fellow villager attending the same session, but (s)he never knows precisely who this co-player is. Each subject plays the RSG under only one of the four

treatments: *assigned, chosen, poscorr* or *negcorr*.[1] Depending on the treatment, the game starts by a player choosing or being assigned, either randomly or by the other player, a safer (S) or riskier (H) gamble. Under each gamble, there is an equal probability of a high or low payoff. The expected payoff from the safer gamble is Rs.560 and the standard deviation is 200, while the expected payoff from the riskier gamble is Rs.800 and the standard deviation is 720. Figure 3.1 shows how the gambles were presented to the participants in the Sri Lankan villages.

Figure 3.1: Gamble Choice in the RSG



Under the *assigned* treatment, all subjects are denoted as Player *i*; half of the players are randomly assigned the safer gamble and half the riskier gamble. Each player is then presented with the set of scenarios which leave him/her richer after the outcomes of his/her own and his/her co-player's gambles are realised. For each scenario, a player must decide whether to "share" ex-post payoffs equally or "leave" them as they are. All the possible scenarios that players may face are set out in Table 3.1. If a player is assigned the safer gamble, (s)he must decide whether to "share" or "leave" in Scenarios

[1] The *poscorr* treatment is denoted as such because there is a positive correlation between the gamble chosen by one player and the gamble faced by the co-player, i.e. both players face the same gamble; in the *negcorr* treatment, there is a negative correlation between the gamble chosen by one player and the gamble faced by the co-player, i.e. the players face different gambles.

1, 2, and 5. If a player is assigned the riskier gamble (s)he must decide whether to "share" or "leave" in Scenarios 3, 4 and 6.

Table 3.1: RSG Scenarios in Which Players Make Share Decisions

Scenario	Player's own payoff from gamble	Co-player's payoff from gamble
1	High from safer gamble (Rs.760)	Low from riskier gamble (Rs. 80)
2	Low from safer gamble (Rs. 360)	Low from riskier gamble (Rs. 80)
3	High from riskier gamble (Rs. 1520)	High from safer gamble (Rs. 760)
4	High from riskier gamble (Rs. 1520)	Low from safer gamble (Rs. 360)
5	High from safer gamble (Rs. 760)	Low from safer gamble (Rs. 360)
6	High from riskier gamble (Rs. 1520)	Low from riskier gamble (Rs. 80)

Once all decisions have been made, the players are randomly matched and the gambles are realised. Where the players' payoffs from the gamble outcomes are unequal, the prior decision which each player made with regards to that relevant scenario (i.e. whether or not to share ex-post payoffs equally) is used to determine players' earnings.

Under the *chosen* treatment the game is essentially the same except that all the players are denoted as Player *j*; they have agency over their own risk exposure, i.e. they can choose between the safer and the riskier gamble. If a player chooses the safer gamble, (s)he must decide whether or not to "share" ex-post payoffs equally in Scenarios 1, 2, and 5. If a player chooses the riskier gamble (s)he must decide whether or not to "share" ex-post payoffs equally in Scenarios 3, 4 and 6.

Interdependence in risk exposure is introduced in the *poscorr* and *negcorr* treatments. The *poscorr* treatment consists of two sub-treatments: *poscorr chooser* and *poscorr chosen-for*. If a player attends a *poscorr* session (s)he is randomly assigned (50:50 chance) to either the *poscorr chooser* or the *poscorr chosen-for* sub-treatment. Those assigned to the *poscorr chooser* sub-treatment are denoted as Player *j*. Those assigned to the *poscorr chosen-for* sub-treatment are denoted as Player *i*. A Player *j* under

poscorr chooser must choose either the safer or the riskier gamble for themselves *and* their co-players. If such a Player *j* chooses the safer gamble for both players, (s)he must also decide whether or not to "share" in the one scenario, Scenario 5, where (s)he earns more than his/her Player *i*. A Player *j* also faces only one scenario, Scenario 6, if (s)he chooses the riskier gamble for both players. If a Player *i* is assigned to *poscorr chosen-for*, Player *i* decides whether to "share" or "leave" under Scenario 5, where (s)he ends up the richer when his/her Player *j* chooses the safer gamble for both, and Scenario 6 where (s)he ends up the richer when his/her Player *j* chooses the riskier gamble for both.

The *negcorr* treatment also consists of two sub-treatments: *negcorr chooser* and *negcorr chosen-for*. If a player attends a *negcorr* session, (s)he is randomly assigned (50:50 chance) to either the *negcorr chooser* or the *negcorr chosen-for* sub-treatment. A Player *j* who is assigned to *negcorr chooser* must choose either the safer or the riskier gamble for themselves and their co-player faces the residual gamble. If Player *j* chooses the safer gamble for him/herself, (s)he makes a share decision in Scenarios 1 and 2 where (s)he ends up richer than Player *i*. If Player *j* chooses the riskier gamble for him/herself, (s)he makes a share decision in Scenarios 3 and 4 where (s)he ends up richer than Player *i*. If a Player *i* is assigned to *negcorr chosen-for*, Player *i* decides whether or not to "share" ex-post payoffs equally under: Scenarios 1 and 2, where (s)he ends up the richer when Player *j* chooses the riskier gamble for him/herself and thereby the safer gamble for Player *i*; and, Scenarios 3 and 4 where (s)he ends up the richer when Player *j* chooses the safer gamble for him/herself and thereby the riskier gamble for Player *i*.

3.4.2 The Gamble Choice Task

Immediately prior to the RSG, we elicit subjects' risk attitudes in a non-strategic setting, by engaging them in an individual, Binswanger-type (1980) gamble choice (GC) task. There are numerous risk preference elicitation methods which we could have used (see Charness *et al.* (2013) for a summary of alternative methods including the Balloon Analogue Risk Task (BART), questionnaires, the Gneezy and Potters (1997) method, and the Holt and Laury (2002) multiple price list). However, we choose the GC task because it generates a summary measure of individual risk attitudes that has been used successfully when engaging with semi-literate or illiterate subjects in developing countries (see for example, Barr and Genicot (2008), Attanasio *et al*., (2012) and Cole *et al*. (2013)). It is worth noting that the Binswanger method does assume an expected utility theory (EUT) framework which has been criticised in the literature. There is evidence that EUT is violated and that risk preferences can be better modelled according to alternative theories. These include: prospect theory (Kahneman and Tversky, 1979); rank-dependent utility theory and cumulative prospect theory (Tversky and Kahneman, 1992); decision-weighting functions (Starmer, 2000); and the common consequence effect (Humphrey, 2000). Using a sample of small-scale, eastern Ugandan farmers, Humphrey and Verschoor (2004) provide evidence that farmers' risk preferences violate some of the EUT axioms and more closely adhere to prospect theory and rank-dependent utility theory. However, testing for violations of EUT axioms is not the focus of this chapter. We proceed with the GC to provide a simple summary measure to include in our risk-sharing analysis.

Each subject is presented with the visual aid in Figure 3.2, which displays six gambles (A, B, C, D, E and F). The gambles differ with respect to expected payoffs and increase in riskiness from A to F. Each gamble has a 0.5 probability of a high and a low payoff.[2]

[2] The GC gambles are similar, but not identical to those in Binswanger (1980). First, Binswanger (1980) includes two inefficient gambles which are not relevant to our study and which we therefore exclude from the GC task. Second, we multiply each of the six remaining Binswanger (1980) gamble choices by a factor of four so that outcomes are aligned with the cost of living in Sri Lanka, and so that some gamble outcomes are equivalent to one day's farm labour wage in Sri Lanka (Rs.600-800) at the time the fieldwork was carried out. It is also worth noting that Gamble Choice B is the safer choice in the RSG with the payoffs doubled, while Gamble Choice E is the riskier choice in the RSG doubled.

Figure 3.2: Gamble Choice Task Decision Card

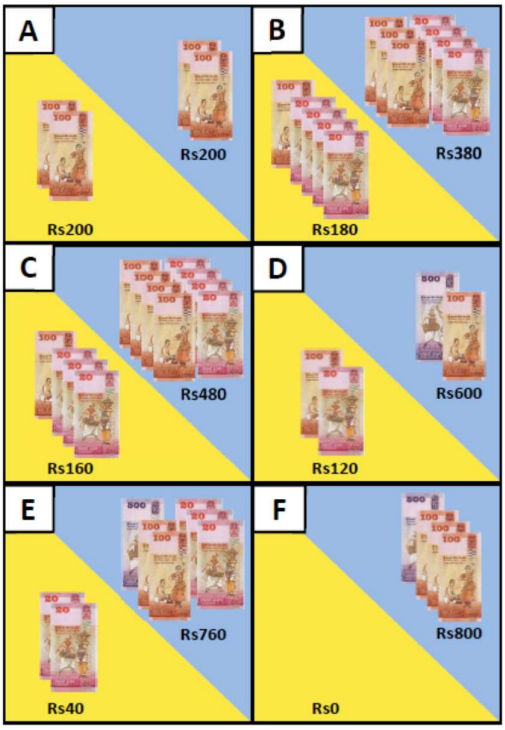


Table 3.2 shows the outcomes and expected payoffs for each of the gamble choices. The high payoff from Gamble F (Rs.800) is equivalent to one day's farm wage for a male farm labourer. A gamble choice reveals the chooser's risk-averse attitudes. Gambles E and F have the same expected payoff, but Gamble F's higher standard deviation renders it the riskiest. So, choosing Gamble F is consistent with risk seeking. Gamble A involves no risk (so, strictly, it is not a gamble).

Table 3.2: Gamble Choice Task Outcomes and Payoffs

Gamble Choice	Probability of event occurring	Payoff in each event (Sri Lankan Rupees)	Expected payoff	Standard deviation	Cole *et al.* (2013) measure of risk aversion
A	0.5 0.5	200 200	200	0	1.00
B	0.5 0.5	380 180	280	100	0.80
C	0.5 0.5	480 160	320	160	0.67
D	0.5 0.5	600 120	360	240	0.50
E	0.5 0.5	760 40	400	360	0.33
F	0.5 0.5	800 0	400	400	0.00

3.4.3 The Participants

By design, a random sample of 32 households was drawn from each of the 16 villages for engagement in the experiments in Wellawaya, Sri Lanka. Specifically, 32 heads of households from each village were randomly sampled from the 2012/13 Electoral Register for each of the six administrative areas which comprise the 16 villages under study. Each of these heads of households was invited to participate in a one-day workshop to be conducted in their village. Where the head of household was unable to attend the workshop, the next most important decision-maker in the family participated on their behalf. The field research team spent only one day running the experiments in each village in order to prevent within-village information contamination effects. Two experimental sessions were conducted in each village, with 16 subjects in each session and 32 experimental sessions in the entire study. The two sessions were conducted in a single workshop in each village (more on this below). Each game was played only once in the experimental session. Treatments were assigned at the session level. Different treatments were assigned to the two sessions in any one village.

Between July and August 2013, we worked together with both community facilitators at Artha Vida Intermediary (a national microfinance NGO operating in the Wellawaya area) and Wellawaya village officials, to identify 15 villages which are at high risk of the Human-Elephant Conflict (HEC). During this period, participatory village mapping exercises were carried out with a small group of farmers from each of the 15 villages in order to map village boundaries, potential HEC areas (e.g. reservoirs, lakes, rivers, wildlife sanctuaries, elephant migratory routes) and the location of households and farm plots. An additional village was mapped and included in the sample in April 2014.

Our final sample size was 467 subjects. On average 29 of an intended 32 subjects attended each village workshop. Sixty seven per cent of the sample was female.[24] Table 3.3 shows that, across treatments and sub-treatments, subjects' were between 40 and 46 years old, had between 8 and 9 years of schooling and belonged to households which earned between Rs.193,600-Rs.232,800 (to the nearest Rs.100) in 2013. Table 3.3 also shows that the number of subjects is broadly balanced across RSG treatments and sub-treatments.

[24] All workshop invites were addressed to each randomly selected household head. Where the household head was unable to attend, they were asked to arrange for their spouse or another decision-maker in the household to attend the workshop. Identities and ages were verified by checking subjects' national ID cards (subjects had to be aged 18 years or above).

Table 3.3: Descriptive Statistics by RSG Treatments and Sub-Treatments

Treatment	Assigned	Chosen	Negcorr chooser	Negcorr chosen-for	Poscorr chooser	Poscorr chosen-for
Sample size	84	79	74	80	77	73
Age	40.476[a] (12.675)	46.101 (12.423)	45.514 (13.310)	45.380[b] (13.622)	44.974 (14.635)	43.342 (14.496)
Female	0.714 (0.454)	0.620 (0.488)	0.743 (0.440)	0.638 (0.484)	0.597 (0.494)	0.712 (0.456)
Education (yrs. of schooling)	8.452 (3.857)	8.848 (3.581)	8.824 (3.574)	9.225 (0.383)	8.474[c] (3.971)	9.247 (3.807)
Total income (2013, Rs.)	204,347 (303,039)	219,880 (238,706)	232,795 (274,612)	209,059 (236,250)	197,596 (234,712)	193,607 (272,179)

Notes: except for sample size, the mean for each individual-level characteristic is shown on first line and the standard deviation in parentheses below; [a] contains two missing values; [b] contains one missing value; [c] contains one missing value.

3.4.4 Implementation

One of the researchers, a script reader and two research assistants (RAs) conducted the experimental sessions. Subjects randomly chose a badge on arrival for the workshop in their village – half of the badges were labelled "AM session" and the other "PM session", and each badge also bore an ID number. Prior to the sessions, ID numbers were assigned to pairs and, in the *poscorr* and *negcorr* treatments, to roles. Thus, badges determined which experimental session, and hence treatment, each subject participated in and each subject's role. In the morning, subjects in the AM session participated in the experiments, while those in the PM session participated in a household survey. In the afternoon, the two groups switched activities. Our team of RAs ensured that there was no interaction between participants during the experimental sessions and that all decisions were confidential. The team also ensured that the AM and PM participants did not interact with each other at all during the one-day workshop. In addition to their

earnings from the experimental sessions, subjects were paid a show-up fee of Rs.250 and were provided with lunch and refreshments.

The experimental protocol for the GC and RSG were similar. The subjects were seated in an area designated for the experiments. The script reader read the instructions for the GC game to the group of 16 participants from a pre-written script in Sinhala (the local language in all the villages). Visual aids were used to provide examples of how the GC task would be conducted. The GC instructions consisted of: a detailed description of the game using examples relating to each gamble choice; examples and questions about the game to test subjects' comprehension of the game; and, demonstrating how the "which-hand-is-it-in" game (*galamalahangana,* in Sinhala)[3] was played and how it would determine earnings in both the GC and in the RSG at the end of the day. Participants could ask questions from the script reader but the script reader answered using only the relevant part of the script. After the GC instructions had been read out to the group, each player met with one of the two RAs in private in an area separate from the other experimental subjects and chose one gamble out of the six gambles offered. Once the players made their gamble choice in private, they returned to the experimental area.

[3] In the "which-hand-is-it-in" game, the RA has a blue counter in one hand and a yellow counter in the other, places both fists behind his/her back and shakes the counters. (S)he presents both closed fists to the subject and the subject guesses which hand contains the blue counter. If the hand with the blue(yellow) counter is chosen, the subject earns the amount of money shown on the blue(yellow) side of the image which relates to the gamble which (s)he chose in the GC task.

The script reader then read the RSG instructions to the group of 16 participants from a pre-written script in Sinhala. Visual aids were used to provide examples of how the RSG would be conducted. Each player then met in private with one of the two experimental RAs in an area separate from the other subjects, and the RA reiterated the RSG instructions and read through a booklet which showed in pictorial form each scenario under which, given the player's role in the RSG, (s)he must decide to either "share" ex-post payoffs with his/her co-player or "leave" ex-post payoffs unequal (see Chapter 6 Sections 6.1-6.5). The RA recorded subjects' choices in each scenario. The subjects then returned to where the other subjects were seated. Outcomes were realised at the end of the day upon completion of both experimental sessions in the village. The first round of the "which-hand-is-it-in" game was played to realise outcomes in the GC, the second round to realise outcomes in the RSG.

Participants were paid for both games at the end of the workshop. Mean payoffs were Rs.341 and Rs.675 for the GC and RSG, respectively. These amounts correspond to just under half a day's farm labour wage and just under a full day's farm labour wage for a male farm labourer, respectively.[25]

[25] All subjects were paid a show-up fee of Rs.250. Information about the show-up fee was communicated in the written invitation which was sent to each subject prior to the one-day workshop in each village. After having participated in all activities during the one-day workshop, subjects were given a lump-sum payoff. Each subject's total payoff was the sum of the show-up fee and earnings from participating in the RSG, GC and a public goods game (the payoff structure of the public goods game will be described in Chapter 4).

3.5 Predictions for the Risk-and-Sharing Game

3.5.1 Theoretical Framework

Where Player *j* chooses both Player *j* and Player *i*'s risk exposure, Player *i*'s subsequent sharing decision may be influenced by the level of exposure which Player *j* has chosen for him/her. It follows that, when Player *j* chooses risk exposure for both players, *j*'s choice of risk exposure for Player *i*, and *j*'s subsequent sharing decision, may be influenced by what (s)he believes Player *i* will infer from *j*'s risk exposure decisions. This characterisation of the RSG evokes models of reciprocity and signalling and, this being the case, we adopt the spirit of Cox *et al*.'s (2007) tractable model of reciprocity and fairness, and signalling theory in the spirit of Spence (1973), in order to predict behaviour in the RSG.[4] [5]

Cox *et al*.'s (2007) model focuses on an individual's emotional state of mind when (s)he makes decisions which affect another's payoff: "If I think you have helped me in the past or want to help me in the future, I am more likely to value your welfare" (p.18).

[4] We are aware that reciprocity can be modelled in relation to *actions* (Dufwenberg and Kirchsteiger, 2004; Falk and Fischbacher, 2006; Fehr, Falk and Fischbacher, 2008) and *outcomes* (Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000).

[5] We refer to the "spirit" of Cox *et al*.'s (2007) model when making predictions based on the emotional state of the sharing player, but there are some differences: i) their model focuses on the assignment of amounts between players, whereas the RSG involves the assignment of *gambles* by one player to him/herself and another player, which implies more complicated utility functions; ii) we predict that some subjects in the RSG demonstrate "double reciprocity" behaviour, which is not captured in Cox *et al*. (2007); and, iii) the relative status variable in the emotional state parameter does not apply to the RSG, as anonymity in the RSG ensures that a high(low)-status player in a village does not know whether (s)he is playing with a relatively low(high)-status co-player in the village.

Cox *et al*. (2007) models two-player extensive form games where there is a first-mover and a second-mover. In the Cox *et al*. (2007) model, Player *i* maximises the following utility function:

$$U(m,y) = m + \theta y \quad (1)$$

where m is Player *i*'s own material payoff, y is Player *j*'s material payoff, and θ denotes Player *i*'s emotional state parameter. The utility function implies that we are dealing with downward-sloping indifference curves where there is a trade-off between Player *i*'s own payoff and Player *j*'s payoff, and that Player *i* is willing to sacrifice some of his/her own payoff to increase Player *j*'s payoff. Player *i*'s utility is increasing in his/her own payoff (m) but whether utility increases in his/her co-player's payoff (y) depends on whether θ is negative or positive. The emotional state parameter θ is a function of reciprocity (r) given Player *j*'s actions and relative status (s). In Cox *et al*. (2007), s refers to differences between players, for example in terms of age or gender, but we suppress this term in order to focus on reciprocity. Reciprocity (r) is expressed as:

$$r(x) = m(x) - m(x_0) \quad (2)$$

where $m(x)$ is the maximum payoff Player *i* can guarantee him/herself given Player *j*'s choice, x. Reciprocal behaviour by Player *i* is influenced by the extent to which (s)he perceives Player *j*'s choice, x, as being kind or unkind towards *i*. In Cox *et al*.'s (2007) model, the term $m(x_0)$ is Player *i*'s payoff when Player *j*'s choice (x_0) is "neutral in some appropriate sense" (Cox *et al.*, 2007, p.23). This term is relevant to our predictions when we compare sharing behaviour between treatments where *j* has agency over *i*'s risk exposure (*poscorr* and *negcorr*) and treatments where *j* has no agency over *i*'s risk exposure (*assigned* and *chosen*). Under *assigned* and *chosen*, *i* cannot infer kindness or unkindness on the part of *j* because *j* has no agency over *i*'s risk exposure and, so, *i*'s perception of *j*'s choice of risk exposure is "neutral". Put another way, we assume that

j's sharing levels under these treatments are equivalent to sharing levels under *poscorr* and *negcorr* if *j* were to act "neutrally".

Applying Cox *et al*. (2007) to the RSG, Player *j* is being kind to Player *i* when *j* assigns *i* the gamble which yields the maximal minimum payoff that *i* can guarantee him/herself. The minimum payoff which *i* can guarantee him/herself is Rs.80 if *i* faces the riskier gamble, and Rs.360 if (s)he faces the safer gamble. Therefore, all other things being equal, if *j* assigns *i* the safer (riskier) gamble to *i*, according to Cox *et al.* (2007), this signals to *i* that *j* is kind (unkind), and *i* is more (less) likely to reciprocate by sharing ex-post payoffs equally with *j* if *j* experiences a worse gamble outcome. [6] [7] Below, we assume that Player *j* knows that a Player *i* to whom (s)he assigns the safer gamble will perceive *j* as being kind. We also assume that this has non-negative value to *j*.

[6] We also know from the development literature that farmers tend to be risk averse and it would therefore seem natural that *i* may infer *j*'s kindness if *j* were to assign *i* the gamble that most individuals would choose for themselves. In the RSG, a risk-averse player is likely to choose the safer gamble (S), because (s)he places more weight on low variance than expected value and a risk-tolerant player is likely to choose the riskier gamble (H). If farmers in Sri Lanka are as risk averse as farmers in other developing countries (see Barr and Genicot, 2008; Attanasio *et al*. 2012, and others), then Player *j*'s assignment to Player *i* of the safer gamble S rather than H would be perceived as a kind act. We will revisit this issue in the results section.

[7] It is worth noting that while we argue that Player *i* perceives kindness in being assigned the safer gamble, the situation (and our predictions) would be different if *j* knew *i*'s risk preferences – specifically, a risk-tolerant *i* may not perceive assignment of the safer gamble as particularly kind because (s)he would receive higher expected utility from the riskier gamble. This not being the case, a sophisticated Player *i* in the RSG knows that Player *j* chooses the safer gamble for *i* because *j* believes this is the "kind" thing to do.

3.5.2 Effect on Player *i*'s Sharing Decision When *j* Has Agency Over *i*'s and *j*'s Risk Exposure

To generate preliminary predictions about *i*'s sharing behaviour in the *poscorr* and *negcorr* treatments relative to *i*'s sharing behaviour under the *assigned* treatment, we make use of one other aspect from Cox *et al*. (2007) – non-reciprocal altruism. Under the *assigned* treatment, Player *j* has no agency over *i* and, so, Player *i* perceives *j* as neither kind nor unkind, i.e., as neutral. Player *i*'s sharing behaviour will be motivated by what Cox *et al*. (2007) refer to as non-reciprocal altruism. This is equivalent to *i* making a neutral sharing decision when *j* has agency over *i*'s risk exposure under the *poscorr* and *negcorr* treatments and *j* behaves neither kindly nor unkindly. Our preliminary predictions are as follows:

1. (preliminary). All other things being equal, if Player *j* chooses the safer gamble for Player *i* under the *poscorr* or *negcorr* treatments, Player *i* will be more willing to share ex-post payoffs equally if *j* faces a worse outcome, relative to the *assigned* treatment.
2. (preliminary). All other things being equal, if Player *j* chooses the riskier gamble for Player *i* under the *poscorr* or *negcorr* treatments, Player *i* will be less willing to share ex-post payoffs equally if *j* faces a worse outcome, relative to the *assigned* treatment.

Our preliminary predictions regarding *i*'s sharing behaviour given *j*'s agency over *i*'s risk exposure assume that all other things are equal. However, all other things are not equal and this needs to be taken into account before finalising those predictions. Specifically, we must account for the fact that *j*'s decision about *i*'s risk exposure has

implications for *j*'s own risk exposure, that the precise nature of these implications depends on whether *i* and *j* are playing under the *poscorr* or *negcorr* treatment, and that *i* knows about these implications. Our reasoning here loosely follows Cox *et al*.'s (2007) analysis of Falk, Fehr and Fischbacher's (2003) mini-ultimatum games, in which the first-mover's choice set varied significantly across treatments.

First, note that Player *j*'s utility will depend on whether the gamble (s)he faces is consistent with his/her own risk preferences. A sufficiently risk-averse *j* will prefer to face the safer gamble because of its lower variance, while a risk-neutral or tolerant *j* will prefer to face the riskier gamble because of its higher expected value.

Now consider a Player *j* who assigns the safer gamble to a Player *i* under the *poscorr* treatment and, thereby, also faces the safer gamble. From this action, Player *i* could infer either that Player *j* is risk averse and acting in accordance with her own preferences ((s)he may be kind, but kindness is not needed to motivate his/her action) or that Player *j* is risk tolerant and acting kindly. Turning to a Player *j* who assigns the riskier gamble to a Player *i* under the *poscorr* treatment and thereby also faces the riskier gamble. From this action, Player *i* can only infer that Player *j* is risk tolerant and acting unkindly. This is because Player *i* knows that a risk-averse Player *j* would never choose the riskier gamble for both players as it is not in line with his/her own preferences. Moreover, if a risk-averse Player *j* places a non-negative value on being perceived as kind, (s)he would never choose the riskier gamble for both *i* and *j*.

Next, consider a Player *j* who assigns the safer gamble to a Player *i* under the *negcorr* treatment and, thereby, faces the riskier gamble. From this action, Player *i* could infer

either that Player *j* is risk tolerant and acting in accordance with his/her own preferences ((s)he may be kind, but kindness is not needed to motivate his/her action) or that Player *j* is risk averse and acting kindly. Turning to a Player *j* who assigns the riskier gamble to a Player *i* under the *negcorr* treatment and, thereby, faces the safer gamble. From this action, Player *i* can only infer that Player *j* is risk averse and acting unkindly. This is because a risk-tolerant Player *j* would favour the riskier gamble for him/herself and therefore assign *i* the safer gamble. Moreover, if a risk-tolerant Player *j* places a non-negative value on being perceived as kind, (s)he would never choose the riskier gamble for *i* and face the safer gamble him/herself.

The reasoning in the preceding two paragraphs does not directly contradict our preliminary predictions. However, it does reveal that kindness can never be unequivocally inferred by Player *i* when a Player *j* assigns *i* the safer gamble, whereas unkindness can always be inferred by a Player *i* who is assigned the riskier gamble. Thus, we refine our earlier predictions in the following way:

1. If Player *j* chooses the safer gamble for Player *i* under *poscorr* and *negcorr*, Player *i* will be *no less and possibly more* willing to share ex-post payoffs equally if *j* faces a worse outcome, compared to *i*'s sharing behaviour under the *assigned* treatment.
2. If Player *j* chooses the riskier gamble for Player *i* under *poscorr* and *negcorr*, Player *i* will be less willing to share ex-post payoffs equally if *j* faces a worse outcome, compared to *i*'s sharing behaviour under the *assigned* treatment.

3.5.3 Effect on Player *j*'s Sharing Decision When *j* Has Agency Over *i*'s and *j*'s Risk Exposure

In this section, we compare Player *j*'s sharing behaviour under the *poscorr* and *negcorr* treatments to *j*'s sharing behaviour under the *chosen* treatment. Under *poscorr* and *negcorr*, *j* has agency over both his/her own and *i*'s risk exposure and *i* may be able to infer kindness or unkindness from *j*'s decision regarding risk exposure. Under the *chosen* treatment, *j* has agency over his/her own but not *i*'s risk exposure.

Assume that Player *j* knows that allocating the safer gamble to *i* may make *i* more willing to share ex-post payoffs equally if *j* faces a worse outcome. Then, a risk-averse Player *j* values the safer gamble under the *poscorr* treatment because: choosing the safer gamble is consistent with *j*'s own risk preferences; *i* may interpret *j*'s choice as an act of kindness; and, *i* may reciprocate by sharing ex-post payoffs equally. Knowing this, a risk-averse *j* is highly likely to choose the safer gamble for both him/herself and *i* and is also likely to reciprocate by sharing ex-post payoffs equally with *i*, leading to the following two predictions:

3. A risk-averse Player *j* is more likely to choose the safer gamble for him/herself and Player *i* under the *poscorr* treatment compared to a risk-averse Player *j* under the *chosen* treatment.
4. A risk-averse Player *j* is more likely to share ex-post payoffs equally with Player *i* if (s)he chooses the safer gamble for him/herself and *i* under the *poscorr* treatment, compared to a risk-averse Player *j* who chooses the safer gamble under the *chosen* treatment.

Now consider a risk-tolerant Player *j* playing under *poscorr*. If (s)he chooses the riskier gamble for him/herself and co-player *i* under the *poscorr* treatment, *j* knows that *i* will infer that *j* is unkind and *i* is therefore less likely to share ex-post payoffs equally with *j* if *j* experiences a bad outcome. Knowing this, *j* may reciprocate by becoming less willing to share ex-post payoffs equally with *i* in the event that *i* experiences the bad outcome. Alternatively, if a risk-tolerant *j* acts inconsistently with his/her own preferences and chooses the safer gamble for both players, then *j* knows that this may be interpreted as a signal of kindness, and so *i* may be more likely to share ex-post payoffs equally if *j* suffers a worse outcome. Knowing this, *j* may reciprocate by sharing ex-post payoffs equally with *i*. So, conditional on his/her gamble assignment decision, we can make the following predictions about a risk-tolerant *j*'s sharing behaviour under *poscorr*:

5. A risk-tolerant Player *j* who chooses the safer gamble under *poscorr* is more likely to share ex-post payoffs compared to a risk-tolerant Player *j* who chooses the safer gamble under the *chosen* treatment.
6. A risk-tolerant Player *j* who chooses the riskier gamble under *poscorr* is less likely to share ex-post payoffs compared to a risk-tolerant Player *j* who chooses the riskier gamble under the *chosen* treatment.

We are unable to make theoretical predictions regarding the gamble assignments that a risk-tolerant *j* will make under *poscorr* because these depend on the extent to which *j* values being (or being perceived as) kind and this is not observed. That said, we may be able to infer something about how much risk-tolerant *j* values being (or being perceived as) kind from our data. This is because:

7. A risk-tolerant Player *j* is more likely to choose the safer gamble under *poscorr* compared to under the *chosen* treatment if (s)he values being (or being perceived as) kind by *i* more than (s)he values the higher expected payoff from the riskier gamble.

We now turn to the set of predictions for a risk-averse *j*'s sharing decision under the *negcorr* treatment. If a risk-averse *j* chooses the safer gamble for self so that *i* faces the riskier gamble, *i* will perceive *j*'s action as unkind and *i* will become less willing to share. Furthermore, if both players experience bad outcomes (Rs.80 for *i*, Rs.360 for *j*), *i* will be unable to assist *j* ex post because (s)he will be financially poorer than *j*. Knowing this, *j* may also be less likely to share ex-post payoffs with *i*. A risk-averse *j* who chooses the riskier gamble for him/herself, leaving the safer gamble for *i*, may be perceived as kind by *i* and *i* may then reciprocate with a greater likelihood of sharing ex-post payoffs with *j*. In financial terms, *i* can afford to assist *j* even if both face bad outcomes (Rs.360 for *i*, Rs.80 for *j*). Knowing that, *j* may also reciprocate by being more likely to share ex-post payoffs equally with *i*. Overall, it appears that Player *j* is more likely to share if *j* allocates the safer gamble to *i*, and is less likely to share if (s)he allocates the riskier gamble to *i*. Our prediction for a risk-averse Player *j* under *negcorr* is therefore:

8. A risk-averse Player *j* who chooses the riskier gamble for him/herself under *negcorr* is more likely to share ex-post payoffs compared to a risk-averse Player *j* who chooses the riskier gamble for him/herself under the *chosen* treatment.

Finally, as noted above, a risk-tolerant *j* under the *negcorr* treatment is highly likely to choose the riskier gamble for him/herself. Then, given that *j*'s decision results in *i* facing the safer gamble, *i* may be more likely to share payoffs equally with *j*. Knowing this, *j* may be more likely to reciprocate by sharing with *i*:

9. A risk-tolerant Player *j* is more likely to allocate him/herself the riskier gamble and allocate *i* the safer gamble under *negcorr*, and may be more likely to share ex-post payoffs equally with *i*, compared to a risk-tolerant Player *j* who chooses the riskier gamble under *chosen*.

3.6 Results and Empirical Analysis

We begin this section by analysing the balance of risk attitudes, indicated by the individual GC, across the RSG treatments and we analyse how individual GCs relate to risk exposure choices in the RSG. Then we present the mean treatment effects on sharing in the RSG. Using linear probability estimations and multinomial logit estimations, we then investigate conditional treatment effects in the RSG. Specifically, we investigate the effect of Player *j*'s agency over Player *i*'s risk exposure on Player *i*'s sharing behaviour; the effect of Player *j*'s agency over Player *i*'s risk exposure on Player *j*'s sharing behaviour; how the former interacts with *i*'s exposure in the first instance; and, how the latter interacts with *j*'s risk attitudes in the second.

3.6.1 Risk Exposure

In order to test our predictions regarding *i*'s and *j*'s sharing decisions, we first need to ascertain whether we have balance in risk attitudes across treatments. Knowing the distribution of risk attitudes within the sample of participants informs our interpretation

of Player *j*'s choice of risk exposure for self and *i*, and *i*'s and *j*'s sharing behaviour in the RSG. Table 3.4 shows the distribution of gamble choices in the GC task across RSG treatments. The modal gamble choice in each and every one of the RSG treatment sub-samples is Gamble D. Based on a Chi-squared test we cannot reject the null of balance in risk attitudes across the treatments in the RSG.

Table 3.4: Distribution of Gamble Choice Task Decisions Across RSG Treatments

	Frequency of Decisions in GC Task						
RSG Treatments	**A**	**B**	**C**	**D**	**E**	**F**	**Total No. of Subjects**
Assigned	10.71%	15.48%	15.48%	39.29%	8.33%	10.71%	84
Chosen	5.06%	11.39%	25.32%	45.57%	3.80%	8.86%	79
Poscorr chooser	6.49%	6.49%	18.18%	44.16%	14.29%	10.39%	77
Poscorr chosen for	10.96%	5.48%	9.59%	52.05%	9.59%	12.33%	73
Negcorr chooser	6.76%	10.81%	17.57%	44.59%	5.41%	14.86%	74
Negcorr chosen for	7.50%	12.50%	15.00%	50.00%	7.50%	7.50%	80
All	7.92%	10.49%	16.92%	45.82%	8.14%	10.71%	467

Table 3.5 shows the percentages of subjects choosing or being assigned the riskier gamble within each RSG treatment (percentages shown in parentheses). When subjects have agency over their own risk exposure, more choose the safer over the riskier gamble for themselves. In the *chosen* treatment, where subjects have agency over their own risk exposure but not others, 62 per cent of subjects prefer the safer gamble. In the *poscorr chooser* treatment, 56 per cent choose the safer gamble for themselves and their co-players. In the *negcorr chooser* treatment, 68 per cent choose the safer gamble for

themselves, thereby exposing their co-player to the riskier gamble. These results are consistent with our reasoning that Player *i* prefers facing the safer gamble in the RSG.

Table 3.5: Risk Exposure Across RSG Treatments

RSG Gamble	Assigned	Chosen	Poscorr Chooser	Poscorr Chosen-for	Negcorr Chooser	Negcorr Chosen-for	Total
Safer	40 (47.62)	49 (62.03)	43 (55.84)	40 (54.79)	50 (67.57)	26 (32.50)	248 (53.10)
Riskier	44 (52.38)	30 (37.97)	34 (44.16)	33 (45.21)	24 (32.43)	54 (67.50)	219 (46.90)
Total	86 (100.00)	79 (100.00)	77 (100.00)	73 (100.00)	74 (100.00)	80 (100.00)	467 (100.00)

Notes: Percentages are shown in parentheses. The number of subjects in the *poscorr chooser* and *chosen-for* treatments does not match because of no-shows in some experimental sessions. To facilitate payoff calculations, no-shows are entered as playing the modal RSG gamble choice or assignment for that particular experimental session. The same applies to the mismatch in the number of subjects in the *negcorr* treatment.

Table 3.6 shows that subjects who choose Gamble A (the safe gamble) in the GC task are relatively unlikely to choose the riskier gamble for themselves in the RSG and subjects who choose Gamble F (the riskiest gamble) in the GC task are relatively likely to choose the riskier gamble for themselves in the RSG.

Table 3.6: GC Task Risk Attitudes of Subjects Choosing Riskier Gamble in RSG Across Treatments

	Percentage choosing riskier gamble for self in Poscorr, Negcorr and Chosen treatments		
Gamble	**Poscorr**	**Negcorr**	**Chosen**
A	20.00%	20.00%	25.00%
B	40.00%	37.50%	44.44%
C	14.29%	23.08%	40.00%
D	52.94%	21.21%	33.33%
E	36.36%	75.00%	33.33%
F	87.50%	63.64%	57.14%
All	44.16%	32.43%	37.97%
χ^2 (p-value)	13.71 (0.018)	11.06 (0.05)	1.93 (0.86)

We find a positive correlation between GC decisions and risk exposure decisions in the RSG *poscorr chooser* (χ^2 (5, *N*=77)=13.714, p=0.018) and *negcorr chooser* (χ^2 squared (5, *N* =74)=11.057, p=0.050) treatments. There is a similar but not statistically significant pattern between GC risk attitudes and choice of risk exposure in the RSG

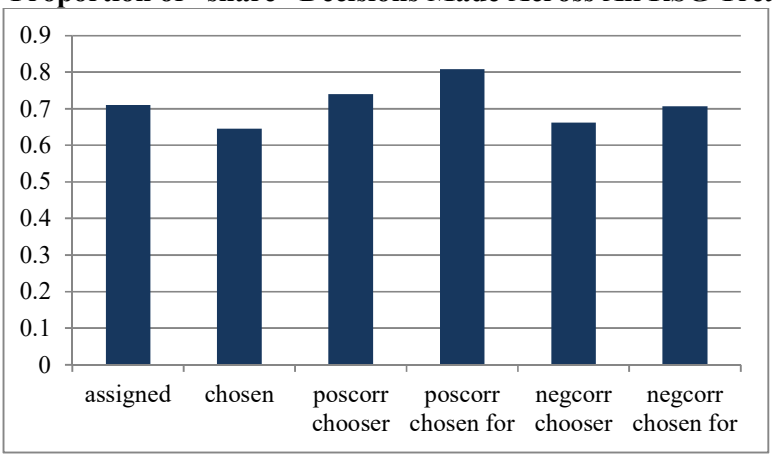
chosen treatment (χ^2 (5, N =79)=1.929, p=0.859). As expected, we find no statistically significant relationship between risk preferences in the GC task and the RSG *assigned* (χ^2 (5, N =84)=8.526, p=0.130), *poscorr chosen-for* (χ^2 (5, N =73)=7.097, p=0.214) or *negcorr chosen-for* (χ^2 (5, N =80)=3.381, p=0.641) treatments. These results show us that there is consistency in Player *j*'s choices about risk exposure across the two games, when *j* has agency over his/her own and *i*'s risk exposure.

The positive correlation between gamble choices under *poscorr chooser* and *negcorr chooser* also provides insight regarding Prediction 7, where we posit that a risk-tolerant Player *j* who chooses the riskier gamble in the RSG values being consistent with his/her own risk preferences more than being perceived as kind by *i*.

3.6.2 Mean Treatment Effects on Sharing in the RSG

This part of our analysis focuses on the frequency with which players choose to share payoffs ex post in the RSG across treatments. Recall that each subject plays the RSG under only one treatment and makes sharing decisions in a number of scenarios dependent on their treatment and the gamble they face (see Table 3.1). The data therefore resembles an unbalanced panel with a total of 947 observations which are decisions to either "share" or "leave" ex-post payoffs. Figure 3.3 displays the proportion of decisions to share made under each treatment and shows that there is a high level of sharing in all treatments. Sharing is lowest under the *chosen* treatment (65 per cent) and highest under the *poscorr chosen-for* treatment (80 per cent).

Figure 3.3: Proportion of "share" Decisions Made Across All RSG Treatments



In order to test for differences in sharing across treatments, we estimate a linear probability model (LPM) where we regress the dependent variable (*share*) on a set of treatment dummies (*assigned* is the omitted category). We cannot reject the null of no difference in sharing behaviour across treatments (χ^2 (5, N=947)=1.81, p=0.108). Controlling for village fixed effects leaves this result unchanged (χ^2 (5, N=947)=0.75, p=0.586). According to the same LPM, we also cannot reject the null hypothesis of no difference in sharing behaviour between pairs of treatments. Overall, Figure 3.7 shows that there is considerable solidarity amongst the villagers in our study; they share more often than not and, on average, sharing is robust to treatment.

3.6.3 Conditional Treatment Effects on Sharing in the RSG: The Effect of Player *j*'s Agency on Player *i*'s Sharing Behaviour

We make two predictions regarding Player *i*'s sharing behaviour when Player *j* has agency over *i*'s risk exposure. According to Prediction 1, Player *i* will be no less and possibly more willing to share ex-post payoffs with *j* if *j* chooses the safer gamble for *i* under both interdependence treatments, compared to under *assigned*. According to Prediction 2, *i* will be less willing to share if *j* chooses the riskier gamble for *i* under the

interdependence treatments, compared to under *assigned*. To test these two predictions, we restrict the sample of sharing decisions to those made under *assigned*, the *poscorr chosen-for* and the *negcorr chosen-for* treatments. In so doing, we keep *i*'s agency constant at zero and can focus exclusively on the effect of *j*'s agency over *i*'s risk exposure on *i*'s sharing behaviour. We estimate the following three linear probability models, the results of which are presented in Table 3.7.

$$share_i = \beta_0 + \beta_1 * poscorr\ chosen\text{-}for + \beta_2 * negcorr\ chosen\text{-}for + \beta_3 * risky_i + \beta_4 * poscorr\ chosen\text{-}for * risky_i + \beta_5 * negcorr\ chosen\text{-}for * risky_i + \varepsilon \quad (3)$$

$$share_i = \beta_0 + \beta_3 * risky_i + \beta_6 * agency_j + \beta_7 * agency_j * risky_i + \varepsilon \quad (4)$$

$$share_i = \beta_0 + \beta_3 * risky_i + \beta_6 * agency_j + \beta_7 * agency_j * risky_i + \beta_8 * age_i + \beta_9 * female_i + \beta_{10} * education_i + \beta_{11} * total\ hold\ income_i + \varepsilon \quad (5)$$

where $share_i$ denotes Player *i*'s decision of whether or not to share ex-post payoffs equally with *j* if *i* is better off once outcomes are realised; *poscorr chosen-for* and *negcorr chosen-for* denote the two RSG interdependence treatments; $risky_i$ denotes when Player *i* faces the riskier gamble exogenously; $poscorr\ chosen\text{-}for * risky_i$ and $negcorr\ chosen\text{-}for * risky_i$ denote when Player *i* faces the riskier gamble owing to Player *j*'s agency under each of the respective interdependence treatments; $agency_j$ denotes when Player *j* has agency over Player *i*'s level of risk exposure; $agency_j * risky_i$ denotes when Player *i* faces the riskier gamble owing to Player's *j*'s agency over Player *i*'s level of risk exposure; β_0 is the constant which in Model 1 equals the mean sharing rate when Player *i* faces the safer gamble exogenously; and ε denotes the error term.

In all models, the dependent variable, $share_i$, equals 1 if Player *i* chooses to share equally with Player *j* ex post, and zero otherwise. All the explanatory variables are also 0-1 dummy variables. In Model 1, which includes treatment dummies, the omitted category for comparison is the *assigned* treatment. In Model 2, we test Prediction 1 by collapsing the *negcorr chosen-for* and *poscorr chosen-for* treatment dummies into a single explanatory variable $Agency_j$. We are therefore testing the null hypothesis that $\beta_1=\beta_2$ – if we fail to reject the null, then we are able to move from Model 1 to Model 2. $Agency_j$ equals 1 when Player *j* has agency over Player *i*'s risk exposure, and zero otherwise. $Risky_i$ equals 1 if Player *i* faces the riskier gamble, and zero otherwise.

We estimate linear probability models (LPM) using the bootstrap method (5,000 replications) outlined in Cameron, Gelbach and Miller (2008) to control for possible interdependence in decisions within sessions and participants and to account for the small number of clusters (see Table 3.7). An observation in a regression is a sharing decision. Depending on the treatment group under which they play the RSG, subjects face between one and four sharing decisions. All estimations control for village fixed effects and, in all cases, the 16 village dummies are jointly significant at the 5 percent level. Model 3 is the same as Model 2 except for the inclusion of individual characteristics as controls. The sample remains constant over Models 1 and 2 and is only smaller in Model 3 owing to missing values in the household survey data.

In Model 1, which includes $risky_i$ and its interactions with *poscorr chosen-for* and *negcorr chosen-for*, the statistical significance of the coefficients on the interaction terms indicates that the treatment effects are conditional. That is, Player *i*'s sharing

behaviour under either interdependent risk treatment is conditional on whether or not (s)he faces the riskier gamble owing to Player *j*.

Table 3.7: Linear Probability Models – Sharing Behaviour Where Player *i* Has No Agency Over Own Risk Exposure

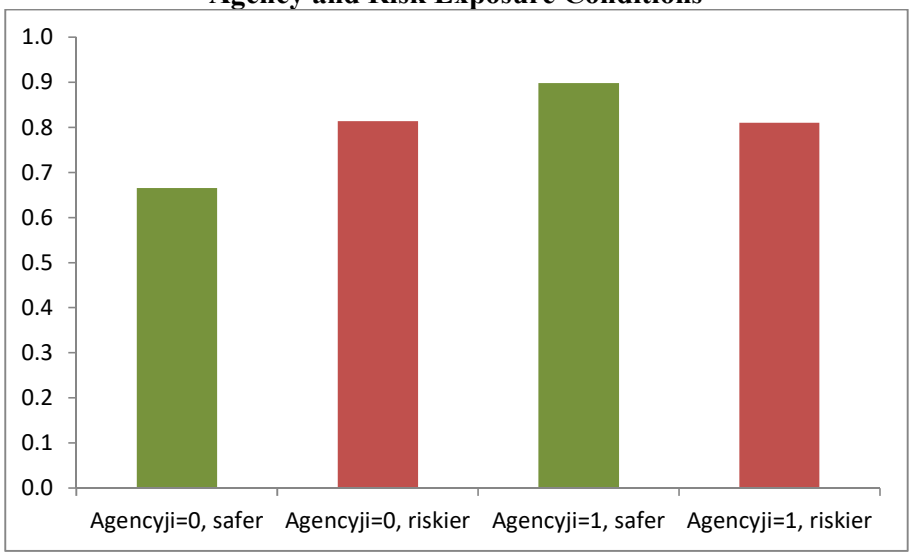
	Model 1 LPM	**Model 2** LPM	**Model 3** LPM
Poscorr chosen-for	0.286***	-	-
	(0.001)		
Negcorr chosen-for	0.213**	-	-
	(0.045)		
$Agency_j$	-	0.232**	0.200*
		(0.014)	(0.055)
$Risky_i$	0.148	0.148	0.145*
	(0.133)	(0.124)	(0.093)
Poscorr chosen-for*$risky_i$	-0.170	-	-
	(0.178)		
Negcorr chosen-for*$risky_i$	-0.243**	-	-
	(0.037)		
$Agency_j$*$risky_i$		-0.236**	-0.232**
		(0.038)	(0.038)
Age_i	-	-	$-5.224e^{-4}$
			(0.753)
$Female_i$	-	-	-0.112*
			(0.073)
$Education_i$	-	-	0.008
			(0.425)
Total hhold $income_i$	-	-	$7.632e^{-8}$
			(0.394)
Constant	0.672***	0.666***	0.649**
	(<0.001)	(<0.001)	(0.019)
Village dummies?	Yes	Yes	Yes
Village dummies jointly significant?	Yes***	Yes**	Yes**
R-squared	0.061	0.056	0.073
Observations	485	485	477

Notes: Dependent variable is Player *i*'s decision regarding whether or not to share ex-post payoffs equally with Player *j* in the RSG. We cluster at the session level on 26 sessions and correct standard errors for the small number of clusters by bootstrapping (Cameron, Gelbach and Miller (2008)) using 5,000 replications; p-values are shown in parentheses; *** p<0.01, ** p<0.05, * p<0.10; Models 1-3 control for village-level fixed effects; Model 3 additionally controls for individual-level characteristics and the reduced sample size is due to eight missing values in the survey data; results for Models 1-3 are only marginally affected by the exclusion of village dummies. A Wild bootstrap linear restriction test (Wu, 1986) with 5,000 replications allows us to test for the equality of coefficients between *poscorr chosen-for* and *negcorr chosen-for*, and *poscorr chosen-for*risky$_i$* and *negcorr chosen-for*risky$_i$*. We are unable to reject the joint null hypothesis that the two sets of coefficients are equal at the 10 per cent level (quasi-$\chi^2(2)$ =2.379, p=0.262), therefore we move from Model 1 to Model 2.

If our reasoning in Section 3.5.2 is correct, the data should not reject the restrictions associated with moving from Model 1 to Model 2, in which we do not distinguish between the *poscorr chosen-for* and *negcorr chosen-for* sub-treatments. A linear restriction test indicates that our data does not reject the restrictions (quasi-$\chi^2(2)=2.379$, $p=0.262$) and, so, we base our interpretations on Model 2.

According to Model 2, the sharing rate when no one has agency, and *i* exogenously faces the safer gamble and ends up richer (baseline for comparison), is 67 per cent. When Player *i* faces the safer gamble owing to Player *j*'s agency over Player *i*'s risk exposure, sharing is 23 percentage points greater compared to the baseline. However, this positive effect of Player *j*'s agency on Player *i*'s sharing is not present if, as a consequence of *j*'s agency, *i* faces the riskier gamble (0.232-0.236=-0.004). Figure 3.4 graphs the mean conditional effects identified in Model 2. The significant positive effect of *j* assigning *i* the safer gamble on *i*'s willingness to share is consistent with Prediction 1. The zero effect of *j* assigning *i* the riskier gamble on *i*'s willingness to share is not consistent with Prediction 2.

Figure 3.4: Proportion of "share" Decisions Made by Player *i* Under Different Agency and Risk Exposure Conditions



In Model 3, we control for the subjects' age, gender, level of education and level of household income. The inclusion of these controls has a marginal effect on the coefficients but the same overall patterns emerge. The coefficient on the variable $risky_i$ becomes significant at the 10 per cent level, suggesting that Player *i*'s sharing rate increases by 14.5 per cent if *i* exogenously faces the riskier gamble compared to exogenously facing the safer gamble. This may be owing to the fact that a sharing decision is made only in the scenario where *i* faces the riskier gamble *and* gets the higher payoff, i.e. the scenario in which *i* is most likely to be much richer than their co-player. Also, being female lowers the sharing rate by 11.2 per cent but none of the other controls have a significant effect on Player *i*'s sharing behaviour.

3.6.4 Conditional Treatment Effects on Sharing in the RSG: The Effect of Player *j*'s Agency on Player *j*'s Sharing Behaviour

We test our remaining predictions regarding how Player *j*'s agency over Player *i*'s risk exposure affects Player *j*'s gamble choice and sharing behaviour. In order to do this, we restrict the sample decisions made by Player *j* under the *poscorr chooser*, *negcorr chooser* and *chosen* treatments. In so doing, we hold *j*'s agency over *j*'s own risk exposure constant.

In contrast to Player *i*, Player *j* faces a two-part decision: first *j* decides on the level of risk exposure which (s)he and Player *i* face, and second *j* decides whether to share ex-post payoffs equally with *i* in the event that *j* ends up the richer. We capture these two stages simultaneously by estimating a multinomial logit model. Player *j* has to choose one of four possible options: the safer gamble for him/herself and share; the safer gamble for him/herself and not share; the riskier gamble for him/herself and share; or

the riskier gamble for him/herself and not share. Which of these Player *j* chooses is indicated by the dependent variable in the multinomial logit. The basis for comparison is that Player *j* chooses the safer gamble for him/herself and shares ex-post payoffs equally.

The explanatory variables are the treatment dummies *poscorr chooser* and *negcorr chooser,* Player *j*'s level of risk aversion and interaction terms. Player *j*'s level of risk aversion is included as a continuous variable, $RiskAverse_j$, derived using Cole *et al*.'s (2013) approach to Binswanger-type gamble choice tasks. This measure assigns a value of one to those who choose the safe gamble in the GC task (Gamble A) and zero for those who choose the riskiest gamble (F). For players who choose Gambles B, C, D and E, risk aversion is calculated as the change in the expected payoff between two consecutive gambles (e.g. Gamble B and C) divided by the change in the standard deviation between the two gambles. Intuitively, Cole *et al*. (2013) define this measure of subjects' risk aversion as "the maximum rate at which they are revealed to accept additional risk (standard deviation) in return for higher expected return". The omitted category for comparison is the *chosen* treatment.

Table 3.8: Coefficient Estimates for Multinomial Logit Model – Player *j*'s Decisions Regarding Risk Exposure and Sharing When Player *j* Has Agency Over Player *i*'s Risk Exposure

	Model 4		
	$Riskier_j$_share	$Safer_j$_noshare	$Riskier_j$_noshare
Poscorr chooser	1.384	0.585	3.156***
	(0.990)	(1.300)	(1.184)
Negcorr chooser	0.878	0.320	0.535
	(0.773)	(0.840)	(1.012)
$RiskAverse_j$	-1.140	-0.277	-0.211
	(0.774)	(0.845)	(0.846)
$RiskAverse_j$*poscorr chooser	-1.917	-2.537	-6.287***
	(1.695)	(2.224)	(2.201)
$RiskAverse_j$*negcorr chooser	-1.399	-0.602	-3.557**
	(1.201)	(1.222)	(1.631)
Constant	0.017	16.816	18.291
	(4,815.683)	(2,858.686)	(2,858.686)
Village dummies?		Yes	
Pseudo R-squared		0.114	
Observations		462	

Notes: Dependent variable is Player *j*'s decision regarding level of risk exposure for self and whether or not to share ex-post payoffs equally with Player *i* in the RSG; the baseline for comparison is the outcome where Player *j* chooses the safer gamble for self and shares ex-post payoffs equally with Player *i*; standard errors are shown in parentheses; *** $p<0.01$; ** $p<0.05$; * $p<0.10$; results are robust to the exclusion of village dummies and the results remain robust when we control for individual-level characteristics (see Appendix C, Table C.1).

We present the estimated multinomial logit model in Table 3.8. The model has a pseudo R-squared value of 0.114. Three of the fifteen coefficient estimates are statistically significant. These are all within the "*Riskier and no share*" outcome equation; the coefficient on *poscorr chooser* is positive and significant at the 1 per cent level; the coefficient on the interaction term $RiskAverse_j$*poscorr chooser* is negative and significant at the 1 per cent level; and the coefficient on $RiskAverse_j$*negcorr chooser* is negative and significant at the 5 per cent level.

To aid interpretation of the multinomial logits, in Figure 3.5 we graph the mean predicted probabilities with which a Player *j* makes each of the four possible choices under each of the treatments. In each panel of the figure, the predicted probabilities of a Player *j* making each of the four possible choices are plotted for each possible level of Player *j*'s risk aversion, as measured in the GC task.

The differences between the graphs in panels **a** and **b** are consistent with Predictions 3 and 4: the likelihood of a highly risk-averse Player *j* (i.e. one who chooses Gamble A in the GC task) choosing the safer gamble for him/herself (and *i*) under *poscorr* is 87 per cent, compared to 68 per cent under *chosen*; of the 87 per cent who choose the safer gamble for him/herself (and *i*) under *poscorr*, 94 (82/87) per cent are likely to share ex post, compared to 72 (49/68) per cent under *chosen*.

Prediction 5 is not supported; the likelihood of a risk-tolerant Player *j* (i.e. one who chooses Gamble E or F in the GC task) choosing the safer gamble for him/herself (and *i*) under *poscorr* is 18 per cent, compared to 50 per cent under *chosen*. Of those who are likely to choose the safer gamble, the likelihood of sharing ex post is only 56 (10/18) per cent under *poscorr*, compared to 68 (34/50) per cent under *chosen*. Prediction 6 is supported; the likelihood of a risk-tolerant Player *j* choosing the riskier gamble under *poscorr* is 82 per cent, compared to 50 per cent under *chosen*. Among the 82 per cent under *poscorr*, the likelihood of not sharing ex post is 61 (50/82) per cent, compared to 36 (18/50) per cent under *chosen*.

Finally, with regards to the *poscorr* treatment, note that the likelihood of a risk-tolerant *j* choosing the safer gamble for him/herself (and *i*) is 18 per cent in the *poscorr* treatment

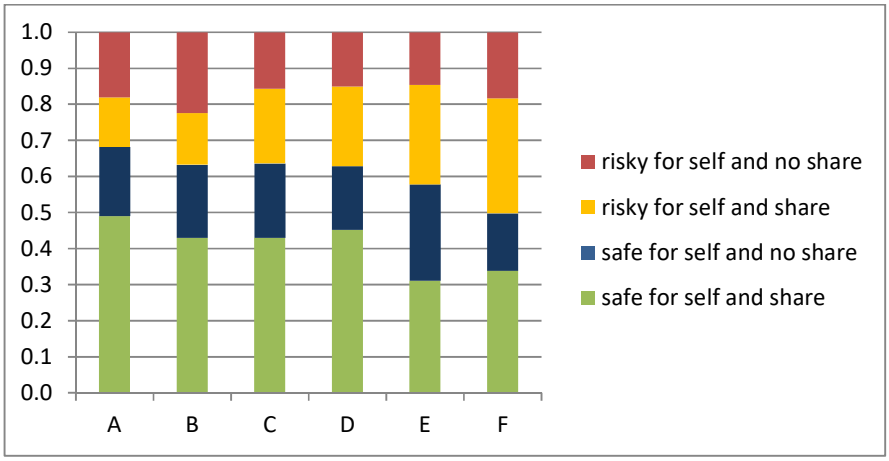
and 50 per cent in the *chosen* treatment. This suggests that, on average, a risk-tolerant *j* values the higher expected payoff from the riskier gamble more than being or being perceived as kind.

We now turn our attention towards the differences in *j*'s decisions between the *negcorr* (graph **c**) and *chosen* treatments (graph **a**). Prediction 8 is supported; the likelihood of a risk-averse Player *j* choosing the riskier gamble for self (and thereby the safer gamble for *i*) is 13 per cent under *negcorr*, compared to 32 per cent under *chosen*. However, of the 13 per cent, 92 (12/13) per cent are likely to share ex post, compared to only 44 (14/32) per cent under *chosen*.

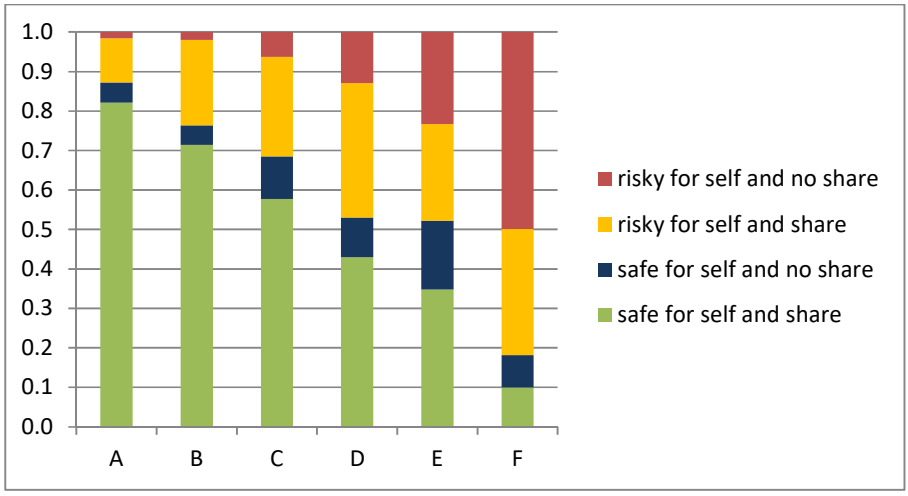
Finally, Prediction 9 is not supported: the likelihood of a risk-tolerant Player *j* choosing the riskier gamble for him/herself is 58 per cent under *negcorr*, compared to 50 per cent under *chosen*. Of the 58 per cent, 62 (36/58) per cent are likely to share under *negcorr*, compared to 64 (32/50) per cent under *chosen*. While risk-tolerant players are more likely to choose the riskier gamble for themselves under *negcorr*, they are likely to share less under *negcorr* than under *chosen*.

Figure 3.5: Predicted Likelihoods of a Player *j* Making Each of the Four Possible Choices

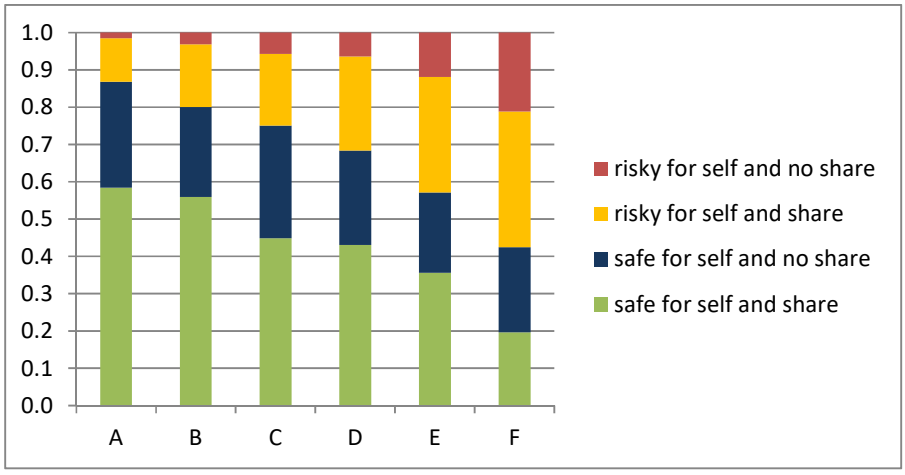
a. Under Chosen Treatment



b. Under Poscorr Treatment



c. Under Negcorr Treatment



Wald tests confirm what we observe in the graphs and help to sharpen our insights. We cannot reject the null hypothesis that the coefficients in the outcome equation for "Safer for self and no share" are all zero ($\chi^2(20)=27.38$, $p=0.125$, basis for comparison "Safer for self and share"). However, we can reject the null hypothesis that the coefficients between the outcomes "Riskier for self and share" and "Riskier for self and no share" are equal at the 10 per cent level ($\chi^2(20)=28.78$, $p=0.092$). The difference in these two test results could be explained by the fact that a Player *j* who chooses the riskier gamble for him/herself and wins and then decides to share ex post, is transferring more to their playing partner than a Player *j* who chooses the safer gamble for him/herself, ends up the richer and then decides to share.

Finally, a test for the violation of the independence of irrelevant alternatives (IIA) provides no evidence that we should be estimating a nested logit model rather than a multinomial logit model. This is consistent with all of the Players *j* bundling their gamble and sharing decisions rather than first choosing their gambles and then deciding whether to share. To sum up, the multinomial logit models fitted to our data are significant and generate predictions that are, more often than not, consistent with the theoretical predictions.

3.7 Summary

Overall, the results display consistent patterns in terms of sharing behaviour. Player *i* is more likely to share ex post when *j*'s agency over *i*'s risk exposure leads *i* to face the safer gamble compared to when *i* is randomly allocated the safer gamble under the *assigned* treatment. This suggests that Player *i* perceives Player *j*'s decision to choose lower risk exposure for *i* as a kind act, and Player *i* positively reciprocates this kindness

by sharing ex-post payoffs equally with *j*. In contrast, we find zero change in Player *i*'s sharing behaviour when *j* has agency over *i*'s risk exposure and *j* assigns *i* the riskier gamble, compared to *i*'s sharing behaviour when *i* exogenously faces the riskier gamble.

Turning to the players who have agency over their own and others' risk exposure, the risk averse who choose the safer gamble for themselves under *poscorr* or either gamble under *negcorr* are more likely to share compared to if they have no agency over the risk faced by another. The risk-tolerant who choose the riskier gamble for themselves under *poscorr* or either gamble under *negcorr*, are less likely to share than if they have no agency over the risk faced by another. In particular, we find that risk-tolerant individuals (i.e. those who choose either Gamble E or F in the GC task) choose the riskier gamble for both themselves and others and are highly likely to not share payoffs ex post. At approximately 20 per cent (8 per cent choose Gamble E, 11 per cent choose Gamble F – see Table 3.4), risk-tolerant individuals make up a non-negligible proportion of our sample. Individuals with risk-tolerant attitudes are therefore potentially harmful to the sustainability of collective coping, and should be carefully considered in the design of interventions aimed at promoting collective responses to interdependent and heterogeneous environmental risks.

One aspect of our theoretical framework, which we drew directly from Cox *et al.* (2007), but that is worthy of further discussion, is the perception of the "kind" act by both Player *j* and Player *i*: the kind act is defined as one which maximises the second-mover's minimum payoff. In the RSG, assignment of the safer gamble to Player *i* by *j* ensures *i* receives the maximal minimum payoff, as facing the low outcome under the

safer gamble (Rs.360) yields a higher payoff than facing the low outcome under the riskier gamble (Rs.80). At the design stage of our study, we took this characterisation of what is kind within the context of the RSG as given. However, it is worth noting that our data supports the characterisation; 62 per cent of players who have agency over their own level of risk exposure under the *chosen* treatment choose the safer gamble (see Table 3.5). On reflection, however, a more direct approach would have been to collect data on subjects' non-strategic choices between the safer and the riskier gamble without the option to share, or to ask subjects what a kind person would do, providing more insight into how Player *i* interprets Player *j*'s intentions when *j* has agency over *i*'s level of risk exposure.

Finally, it is worth noting that there are other theoretical frameworks which we could have used. In future research, intentions-focused theoretical frameworks such as Charness and Rabin (2002) and Ellingsen and Johannesson (2008) would be worth considering.

3.8 Conclusions

This analysis shows that there is a high degree of pro-sociality among rural subjects in Wellawaya, Sri Lanka. In aggregate, sharing is considerable and appears stable across the different contexts presented in the RSG. We provide empirical evidence which, on the whole, supports the predictions about sharing behaviour which we make in the spirit of Cox *et al*. (2007) and Spence (1973). We find significant conditional treatment effects on sharing in the RSG; our results suggest that interdependence in risk exposure significantly affects ex-post sharing behaviour. Crucially, we find that an individual is more willing to share ex-post payoffs equally when (s)he faces lower risk exposure

owing to another's agency over both individuals' levels of risk exposure, and the other individual experiences a relatively worse outcome. This is consistent with the subjects being inclined towards positive reciprocity. However, subjects are neither more nor less willing to share if they face *higher* risk exposure owing to another's agency over his/her level of risk exposure and the other individual faces a worse outcome. This is consistent with subjects not being inclined towards negative reciprocity. The finding of positive but not negative reciprocity is consistent with Falk *et al.* (2015), who show that Sri Lankan subjects exhibit high levels of positive reciprocity and altruism, but fairly low levels of negative reciprocity, compared to the global average. Furthermore, the vast majority of our sample population are practicing Buddhists and Falk *et al.* (2015) also found that Buddhists, as well as subjects from other faiths, tend to be less negatively reciprocal than secular subjects. These findings bode well for the sustainability of collective coping when risk exposure is interdependent.

When we investigate the sharing behaviour of an individual who has agency over another's level of risk exposure, we find that a risk-averse individual who has agency over the other's risk exposure is more likely to share ex-post payoffs. In contrast, the sharing behaviour of a relatively risk-tolerant individual who has agency over another's risk exposure is conditional on whether they behave consistently with their own risk preferences. This result highlights the possible weak point in collective coping. When individuals face interdependent risk exposure we find that the risk tolerant could be a danger to the more commonplace risk averse.

Appendix C: Additional Estimations

Table C.1: Coefficient Estimates for Multinomial Logit Model – Player *j*'s Decisions Regarding Risk Exposure and Sharing When Player *j* Has Agency Over Player *i*'s Risk Exposure

	Model 1		
	$Safer_j$_noshare	$Riskier_j$_share	$Riskier_j$_noshare
Poscorr chooser	1.326	0.303	3.147**
	(0.999)	(1.310)	(1.247)
Negcorr chooser	1.072	0.127	0.436
	(0.802)	(0.879)	(1.080)
$RiskAverse_j$	-0.962	-0.483	-0.450
	(0.798)	(0.889)	(0.912)
$RiskAverse_j$*poscorr chooser	-1.791	-2.145	-6.661***
	(1.699)	(2.230)	(2.327)
$RiskAverse_j$*negcorr chooser	-1.466	-0.244	-3.351*
	(1.232)	(1.285)	(1.750)
Age_j	-0.011	$1.160e^{-5}$	-0.011
	(0.011)	(0.013)	(0.015)
$Female_j$	-0.491*	-0.039	-0.354
	(0.294)	(0.323)	(0.382)
$Education_j$	-0.083*	-0.053	-0.021
	(0.042)	(0.046)	(0.055)
Total household $income_j$	$4.800e^{-8}$	$-2.630e^{-7}$	$-1.740e^{-6}$**
	($5.790e^{-7}$)	($5.950e^{-7}$)	($8.390e^{-7}$)
Constant	1.159	17.562	19.686
	(4,817.352)	(2,920.436)	(2,920.436)
Village dummies?		Yes	
Pseudo R-squared		0.128	
Observations		461	

Notes: Dependent variable is Player *j*'s decision regarding level of risk exposure for self and whether or not to share ex-post payoffs equally with Player *i* in the RSG; the baseline for comparison is the outcome where Player *j* chooses the safer gamble for self and shares ex-post payoffs equally with Player *i*; standard errors are shown in parentheses; *** $p<0.01$; ** $p<0.05$; * $p<0.10$; there is one missing observation in the education variable.

Chapter Four: Collective Action When Public Good Returns and Risk Attitudes are Heterogeneous – A Mixed Methods Approach

4.1 Introduction

In this chapter, we investigate whether heterogeneity in returns from a public good and beneficiaries/contributors' risk attitudes have an effect on contributions to that public good. We answer the following research questions: 1) At the group-level, is local public goods provision compromised when the returns from the public good vary across group members; 2) Does an individual's willingness to contribute to the public good depend on his/her return from the public good; and 3) What role does heterogeneity in risk aversion play in decision-making regarding public good contributions? The contribution of this chapter is that we examine these research questions using both a behavioural experimental and a survey approach and we contribute to the existing literature on contribution behaviour in different decision-making contexts.

We examine the research questions in the context of Sri Lanka's Human-Elephant Conflict where small-scale, dry-zone farmers suffer from elephant-related crop- or house damage. The local public good is a hypothetical electric fence which is proposed to each of sixteen rural communities in Wellawaya, south-east Sri Lanka. The communities are highly exposed to the HEC and the hypothetical community-wide electric fence would mitigate exposure to HEC risk for all community members by deterring elephants from encroaching on farmland. The fence is a non-excludable and non-rival local public good as it is designed to encompass an entire village and its surrounding cultivated lands. Provision and maintenance of the fence is subject to the free-rider problem which is well-documented in the microeconomics, environmental economics and development economics literature: egoists in the community may not

contribute to either its maintenance or construction but still enjoy the benefit of lower risk exposure arising from others' contributions. Assuming everyone derives equal benefits from the fence, the social optimum is for all individuals to contribute to the public good and for benefits to accrue equally to all. However, egoists could choose not to contribute to fence maintenance or construction and instead free-ride on others' contributions. If everyone behaves egoistically, the fence will not be provided.

Our three research questions are motivated by the fact that many development interventions rely on public goods provision, be it the building of a road, a bridge, a school, a medical clinic, or an electric fence to mitigate wildlife risk across farming communities. Community involvement is now an important component in the generation and maintenance of public goods interventions, and multilateral organisations consider the level of community involvement to be a key project evaluation criterion. Indeed, Mansuri and Rao (2004) note that the World Bank in 2003 funded approximately US$7 billion worth of community-based development (CBD) and community-driven development (CDD) initiatives. The Bank asserts that giving communities more agency through CBD and CDD projects is an important vehicle for inclusive growth, empowerment, social capital mobilisation, better governance and poverty reduction (World Bank, 2001).

There is merit to the arguments in favour of community involvement in public goods provision. However, a little-researched, but nonetheless important, issue in public goods provision is that returns from the public good can vary across individuals. Some individuals benefit from the public good more than others. The concern is that individuals who benefit relatively little from the public good may be disinclined to

contribute and, knowing this, individuals who benefit relatively more may, as a consequence, also be disinclined to contribute. If the positive effect of their higher return from the good on their willingness to contribute to the good is outweighed by the negative effect of their concerns about others (those who will benefit less) free-riding on their efforts, the heterogeneity in returns could undermine the success and sustainability of public goods provision.

Most of the studies concerning willingness-to-pay (WTP) for the provision of a public good focus on heterogeneity in individual preferences, wealth and social capital. The WTP literature addresses heterogeneity in user preferences, but very few studies, if any, proxy for variations in returns from the public good. A small number of lab-based studies involving public goods experiments show that heterogeneity in individual returns from the public good leads to reductions in average contributions (Tan, 2008; Fisher *et al.*, 1995). On the other hand, some studies also show that heterogeneity in returns can increase average contributions (Reuben and Riedl, 2013; Marwell and Ames, 1981). Policymakers who wish to improve the effectiveness, targeting and sustainability of public goods-based development interventions may be interested in knowing how subjects respond to heterogeneous returns to prospective public goods and how that response varies depending on whether the heterogeneity is owing to real-life circumstances or is exogenously imposed within a lab-in-the-field environment.

In addition, many public goods involve technologies that are new to the communities and, when this is the case, investment in the public goods may be perceived by the community members as a risky prospect. Indeed, the existing literature provides evidence of the negative effect of risk aversion on technology adoption in developing

countries (Fafchamps, 2003; Foster and Rosenzweig, 2010; Rosenzweig and Binswanger, 1993).

We take a mixed methods approach to answering the three research questions. We conduct a one-shot, lab-in-the-field, public goods experiment (PGG) which reveals subjects' preferences for behaving cooperatively in an environment of exogenously-imposed asymmetric returns from the public good. We also conduct a survey-based analysis of responses to a hypothetical contribution question (HCQ) where subjects state time contributions to the construction of a public good. The benefits of the PGG are that it ensures experimental control so that we can exogenously manipulate returns to the public good and observe the effect of heterogeneity in returns on PGG contributions. Moreover, the PGG is incentivised so that the strategic component of decision-making about public good contributions is rendered highly salient to the subjects. The main weaknesses of the PGG are that the decision-making scenario may appear abstract and many steps removed from the reality of everyday life to the subjects. The experimental stakes are small relative to the cost of the public good and the strategic component may carry too high a cognitive weight in subjects' minds – the strategic component could potentially distract subjects from the novel, expensive and risky aspects of the public good.

The main strength of the HCQ is that it is less abstract, it is more context-specific and it measures subjects' willingness to contribute time to the generation of the public good. However, the HCQ is associated with less control and provides no opportunity to exogenously vary public good returns. It is also unincentivised, so more likely to suffer

from hypothetical bias and the subjects are likely to place less, possibly too little, cognitive weight on the strategic component of provision.

The very different strengths and weaknesses of the two methods render them complementary. The PGG provides the control and incentives necessary but lacking in the HCQ. The HCQ provides context around the contribution decision. The framing of the HCQ decision in terms of time contribution is in line with the design of community development projects where individuals provide time and manual labour in place of financial resources. This mixed methods approach allows us to maximise the contribution we make to both research and policy debates regarding the effect of heterogeneous returns from the public good on contribution behaviour.

We adopt an electric fence frame in both the PGG and in the HCQ as returns from the fence are synonymous with the type of heterogeneity which we aim to explore. In the PGG, we focus the frame on fence maintenance as the electric fence is a big-budget item which would be difficult to capture in a small-stakes PGG. In the HCQ, we focus on subjects' time contributions to fence construction as this is a common feature of national and international public goods interventions in rural development: an external facilitator, such as a non-governmental organisation (NGO), provides the financial resources and materials for construction of the public good conditional on community members' time contributions.

The chapter is organised as follows: in Section 4.2, we review the literature on heterogeneity in public goods experiments and in willingness-to-pay studies, which have some methodological elements in common with the PGG and the HCQ, and on

risk attitudes and technology adoption; in Section 4.3, we compare the PGG and HCQ methods; in Section 4.4, we present our experimental design; in Section 4.5, we detail our survey design; in Section 4.6, we outline our hypotheses; in Section 4.7, we discuss our empirical results; and in Section 4.8, we discuss our key findings before concluding remarks in Section 4.9.

4.2 Literature Review

4.2.1 Local Public Goods Provision as a Development Intervention

Our first two research questions relate to group-level participation in public goods provision. In this sub-section, we provide some examples from the existing literature relating to how community participation has been incorporated into public goods provision-oriented development interventions at their inception. Examples abound in relation to community participation in water, education and healthcare projects. One example which demonstrates how community participation aids public goods provision is Bjorkman and Svensson's (2007) randomized field experiment regarding community-based monitoring of health service delivery in Uganda. The intervention is a health service-delivery report card system which is rolled out to healthcare users across 25 communities (the treatment). Users in the treated communities contribute time to monitoring providers and the result is that the intervention increases accountability of healthcare providers towards their users. This led to increased quality of care and weight in infants and decreased infant mortality, user waiting times and worker absenteeism in treated villages.

In a critical and comprehensive review of the literature on community-based (CBD) and community-driven development (CDD) initiatives, Mansuri and Rao (2004)

acknowledge the widespread use of community involvement in local public goods provision as a key part of development interventions. However, the same authors draw on numerous studies to demonstrate that, while community participation induces better community infrastructure, participation in itself does not always directly translate to improvements in development outcomes. More recently, in a project comprising data from 230 projects across 80 villages in Pakistan, Mansuri and Rao (2013) provides mixed evidence regarding the premise that community participation-oriented infrastructure projects perform better than government-backed ones. The author finds that community-based projects have a higher quality in their design, construction and maintenance, but that there is evidence of capture (theft and corruption) during the construction phase.

Heterogeneity features in both the CBD and CDD literature and in willingness-to-pay studies. A World Bank Policy Research Report on "Localizing Development" (2013) cites numerous studies relating to the role of heterogeneity in development outcomes. However, discussion is constrained to economic heterogeneity, in terms of differences in income and wealth; and social heterogeneity, in terms of leadership versus marginalised community members. Within-community heterogeneity in returns from public goods provision does not feature heavily in research regarding community-based public goods provision, and this is where we aim to make a significant contribution to the literature.

4.2.2 Heterogeneous Preferences in Surveys

Heterogeneity features in willingness-to-pay (WTP) studies in terms of user preferences. Moreno-Sanchez *et al.* (2012) use contingent valuation methods (CVM), to measure smallholder farming households' and recreational households' WTP for incremental changes in the current flat rate water usage fee to manage a watershed system in the Colombian Andes. Heterogeneity in user preferences is present among smallholder and recreational households with respect to socioeconomic and demographic patterns as well as levels of water consumption and spatial characteristics. Most respondents prefer a fee differentiated according to water consumption levels but this does not have a statistically significant effect on WTP. Moreover, respondents state that even if fees were differentiated according to water usage, the associated additional administrative constraints would outstrip the benefits of equitable sharing of management costs. Elsewhere, Loomis and White (1996) conduct a meta-analysis of WTP studies regarding preservation of threatened and endangered wildlife species in the USA. They find that WTP for preservation is greater for respondents who are visitors than non-visitors. This may be due to the fact that visitors benefit more than non-visitors from preserving species.

On the whole, the aforementioned studies suggest that individuals who derive a higher return from an often non-marketed, publicly-provided good, or specific attributes relating to that good, have a higher willingness to pay for the good. However, this is not equivalent to within-group heterogeneity in returns from the public good and again, this is where we intend for the analysis of the PGG and the HCQ to add to the existing literature.

4.2.3 Heterogeneity in Public Goods Games

We focus on public goods games where there is heterogeneity in the marginal per capita return (MPCR) and whether and how subjects' contributions to the public good are influenced by asymmetries in returns from that public good. Fisher *et al*. (1995) conduct a repeated PGG with heterogeneous marginal per capita returns as a treatment. They find that subjects in heterogeneous MPCR groups who are assigned a higher MPCR contribute more than those assigned a lower MPCR. Average group contributions are lower under heterogeneity, compared to the baseline, although the difference is not statistically significant.[1]

More recently, Tan (2008) studies the effect of costly punishment in a repeated public goods game with heterogeneous marginal per capita returns from the public good. He shows that, in the absence of sanctions, average contribution levels under heterogeneous MPCRs are consistently lower than under homogeneous MPCRs over all rounds – heterogeneity lowers cooperation. Low-return subjects in heterogeneous

[1] Subjects are endowed with ten tokens which they contribute to or withhold from the public account. Subjects' payoffs are determined by the number of tokens remaining plus the MPCR and the number of tokens contributed by all subjects to the public goods account. Subjects are assigned to groups of four, where two subjects are assigned a MPCR of 0.75 and two subjects are assigned a MPCR of 0.30. In Rounds 1 to 10, subjects are assigned either the high- or the low-return and play the PGG, and in Rounds 11 to 20, they are assigned the alternative MPCR. Information about MPCR assignment is private to the subject and subjects are informed that MPCRs within groups are not necessarily the same. The key findings are that subjects assigned a higher MPCR contribute more than those assigned a lower one (the effect is most significant between Rounds 11-20). Second, average group contributions are "intermediate" between average contributions of homogenous high-MPCR groups and those of homogeneous low-MPCR groups. Moreover, average contributions are lower in heterogeneous groups compared to the baseline (a pooled average of contribution levels in homogeneous groups of low-MPCRs and in homogeneous groups of high-MPCRs), but the difference is statistically insignificant.

groups free-ride to a greater extent compared to low-return subjects in homogeneous groups. According to Tan (2008), the insignificant increase in contributions among high-return subjects in heterogeneous groups may be due to information regarding MPCRs, contributions and payoffs being revealed at the end of each round. Therefore, knowledge of low-types' free-riding behaviour deters high-types from increasing their contributions.[2]

Finally, Fischbacher *et al*. (2014) provide more evidence in support of heterogeneity lowering contributions. They use a one-shot, lab-based public goods game to investigate the effect of heterogeneous MPCRs and uncertainty about one's own MPCR assignment on public good contributions. We focus on the results of subjects' unconditional contributions (i.e. a subject's contribution independent of others' contributions) under certainty. Fischbacher *et al*., (2014) find that subjects contribute significantly less in the heterogeneous MPCR treatment (two assigned MPCR of 0.3, two assigned MPCR of 0.5) than in the homogeneous treatment (all subjects assigned MPCR of 0.4, the average expected return).

Elsewhere, some studies show that heterogeneous returns positively affect contributions. Reuben and Riedl (2013) show in a repeated public goods game that, excluding punishment, average contributions under the heterogeneous returns treatment are greater than under homogeneous returns. Reuben and Riedl (2013) are also concerned with other forms of heterogeneity and, as with Tan (2008), the role of

[2] Two treatments are particularly relevant to our study: in T1, subjects are allocated to groups of four and are assigned a MPCR of 0.6; in T2, subjects are allocated to groups of four, with two subjects assigned MPCR of 0.9 and two subjects assigned MPCR of 0.3 (the average MPCR equates to 0.6. the same MPCR as in T1). All subjects play the PGG for 15 rounds.

sanctioning on public good contributions. In terms of heterogeneous MPCRs, their design differs from both Tan (2008) and Fisher *et al*. (1995) as each group in their experiment comprises only three subjects, so that only one subject has a different MPCR from the other two subjects. This may raise concerns regarding attribution of responsibility. In an earlier study, Marwell and Ames (1981) report that mean contributions are greater within experiments where resources and/or marginal per capita returns are unequal, compared to the homogeneous baseline treatment.[3] However, the authors do not distinguish mean contributions for the sub-treatment where within-group returns vary. Furthermore, the experimental design differs from the other studies regarding heterogeneous MPCRs, in that Marwell and Ames (1981) focus on whether group contributions are sufficient to reach a minimum threshold for the good to be provided, and their PGG contains a discontinuous payoff function.

Overall, we observe that the public good experiments which are most similar in design to the PGG in this chapter suggest that heterogeneity in returns from the public good lowers average contributions. The results of these studies (Tan, 2008; Fisher *et al.*, 1995) motivate our hypotheses.

4.2.4 Barriers to Technology Adoption in Developing Countries

Adoption of a proposed electric fence may not be automatic within the communities that make up our study. Indeed, preferences for contributing time and other resources to an electric fence which mitigates the risk of the Human-Elephant Conflict may be

[3] In the baseline, subjects participate in groups and are endowed with 225 tokens which can be invested in either an "individual" or a "group" exchange. In the heterogeneous treatment, a sub-set of individuals are aware that some co-players receive 2.25 per cent of returns from contributing to the public good, while others receive 0.92 per cent.

influenced by similar factors affecting other forms of technology adoption in developing countries. Numerous studies investigate the factors affecting the proliferation of new technologies in the rural context, such as agricultural inputs (e.g. hybrid seed varieties, fertilizers). Here, technological adoption can be influenced by households' perceptions regarding the riskiness of adopting new technologies and it is for this reason that we focus on the role which risk attitudes play in contribution decisions within the PGG and HCQ contexts. The existing literature supports the idea that take-up of new technologies is lower among farmers who are more exposed to risk, predominantly climate risk, and where the new technology, be it fertilizers or high-yielding seed varieties (HYVs), requires a sunk cost investment (Rosenzweig and Binswanger, 1993; Dercon and Christiaensen, 2011; Foster and Rosenzweig, 2010). This results in low-risk, low-return cultivation.

Take-up of products which are designed to mitigate risks associated with climate variability is low among risk-averse individuals. In a randomized field experiment comprising 800 Malawian maize and groundnut farmers, Giné and Yang (2009) show that take-up of an uninsured loan to cultivate high-yielding seed varieties (HYVs) is greater than that of a rainfall index-insured loan to cultivate HYVs. Risk-averse farmers who are offered the uninsured-loan package for higher-risk HYVs are significantly less likely to accept it and instead prefer to cultivate traditional varieties, even if HYVs provide average higher yields. This finding shows that use of incumbent measures may prevent new technology adoption.

Fafchamps (2003) attributes risk aversion in technology adoption to technological indivisibility and technological uncertainty. Indivisible technology, such as an electric

fence spanning the perimeter of a whole community, requires fixed costs and a reallocation of resources. Reallocation of resources includes time reallocation away from cultivation and existing HEC prevention methods, and towards fence construction. Technological uncertainty represents individuals' scepticism regarding effectiveness of new technologies (Fafchamps, 2003). In the HCQ, perceptions of the fence being unsuccessful or that its delivery is unfeasible may negatively affect risk-averse subjects' HCQ contributions. Only 10 per cent of our sample currently owns a small-scale electric fence around the perimeter of their farms, and so a lack of experience with the technology may also contribute to risk-averse subjects' scepticism.

Indeed, scepticism over and trust in the effectiveness of a new technology is a concern. For example, Cole *et al.* (2013) examine different barriers to Indian farmers' adoption of a weather index-insurance policy designed to reduce their exposure to weather risk. They observe low uptake even if these policies provide insurance against downside risks. Price sensitivity is one factor but this alone does not explain low insurance uptake: trust in the product and its providers, and in the educators who promote the insurance product, are crucial to influencing insurance uptake.

4.3 Comparing the Public Goods Game (PGG) and the Hypothetical Contribution Question (HCQ)

We draw on the main strengths of the PGG and the HCQ in order to answer the research questions regarding the effect of asymmetric returns to the public good and of heterogeneous risk attitudes on contributions. Eckel and Gintis (2010) note that subjects respond to the framing of certain social situations using a "specific, context-dependent, preference ordering" (p.113). Given this, we may expect subjects to consider and

approach the contribution decision in the HCQ differently to the contribution decision in the PGG, where own decisions have monetary consequences for self and others. Carlsson (2010) reviews key articles relating to the importance of context-dependence and cites Bertrand and Mullainathan (2001) who provide evidence that the difference in behaviour between making a hypothetical but realistic choice (the HCQ decision) and making a choice that results in actual payment (the PGG decision), is large. Importantly, Carlsson (2010) asserts that issues regarding decision-making context-dependence prevail in stated preference measures (the HCQ) as well as in revealed preference measures (the PGG), although the size of the difference between the two is unknown. Table 4.1 provides a comparison between the PGG and the HCQ in terms of: the subject pool, the contribution decision, monetary payoffs, individual and asymmetric returns, risk attitudes and belief elicitation.

Table 4.1: Comparison Between Experimental and Survey Methods

	PGG – Experimental Method	HCQ – Survey Method
Subjects	468 randomly-sampled rural subjects from sixteen communities in Wellawaya, Sri Lanka	
Decision Context	Framed PGG, frame as follows: An electric fence is installed around a community and relies on community members for its maintenance. Unanimous contributions ensure its maintenance while partial contributions mean that community members who do not contribute will still benefit from others' contributions towards maintenance. If an insufficient number of members contribute, then the fence will not be maintained.	Framed HCQ, frame as follows: An NGO provides resources to build a community-wide electric fence conditional on the community's labour force engaging in its construction. Community members are invited to state how many hours they are willing to contribute to fence construction.
Contribution Decision	Incentivised: monetary payoffs depend on individual return, own contribution decision and others' contribution decisions.	Un-incentivised
	Contribution decision is a binary choice (contribute or withhold from the public account); a logit modelling framework is appropriate.	Contribution decision is a cardinal choice (zero to 20+ hours); a truncated Tobit modelling framework is appropriate due to the latent nature of any observations where willingness to provide time to electric fence construction exceeds 20 hours.

	PGG – Experimental Method	HCQ – Survey Method
	Contribution decision affects own and others' payoffs	Contribution decision does not directly affect others
Payoffs	Individual monetary payoffs affected by individual returns, own contribution decision and others' contribution decisions	No monetary payoffs
Individual Returns	Exogenous assignment of individual returns from the public good which can take values 40/60/80 depending on random assignment to the treatment group	Individual returns from the public good measured by: 1) four-year average number of monthly instances of crop damage, and 2) proportion of total household income derived from farming
Asymmetric Returns	Exogenous assignment of asymmetric returns from the public good which can take values 40/80 depending on random assignment to either a high- or low-return role within the asymmetric treatment	Asymmetric returns from the public good measured by the variances of: 1) four-year average number of monthly instances of crop damage, and 2) proportion of income derived from farming
Risk Aversion	Measured by subjects' responses within a Binswanger-type gamble choice task	
Beliefs	Elicit subjects' beliefs about others' contribution decisions	No belief elicitation

The factual differences between the PGG and the HCQ measures are likely to affect the cognitive processes leading to individual decisions. First, the PGG experimental design may focus subjects on the strategically risky element of the contribution decision. Subjects' contribution decisions affect not only their own payoffs but also the payoffs of co-players in their group. In turn, subjects' payoffs are also affected by the PGG decisions of their co-players. Put another way, the PGG presents the decision-maker with a clearly defined dilemma between acting in the group's interest or acting according to one's self-interest. This aspect of the PGG decision is likely to have a higher cognitive weight in subjects' PGG decision-making than would technology risk associated with the feasibility of the electric fence.

In comparison, subjects are likely to place a lower cognitive weight on strategic risk in the HCQ as the time contribution decision does not directly affect others and vice versa. This being the case, technology risk is more likely to weigh on subjects' minds when making the HCQ contribution decision, potentially in terms of whether the electric fence would be effective for HEC management and whether it would be more effective than pre-existing methods of HEC management.

4.4 Experimental and Survey Designs

4.4.1 The Public Goods Game (PGG)

The public goods game (PGG) is designed to be played in groups of 16 individuals each of whom have to decide to either contribute or not contribute. There are two experimental sessions per community and sixteen subjects, randomly drawn from the adult population of the community in each experimental session. Subjects participate

in only one session and know that they are playing with members of their own community. The payoff in Sri Lankan Rupees for each subject from the PGG is:

$$\pi_i = 400(1 - x_i) + m_i(x_i + \sum_{j \neq i} x_j) \quad (1)$$

where $x_{i,j} \in (0,1)$ and $m_i \in (40,60,80)$. Subject *i*'s payoff is determined by his/her contribution decision (x_i), the contribution decisions of his/her co-players ($x_{j \neq i}$) and his/her exogenously-assigned individual return from the public good (m_i). The individual return m_i varies according to the PGG treatment. Subject *i*'s decision (x_i) takes the value of 1 if *i* contributes to the group account, and zero if *i* does not contribute. The summation of $x_{j \neq i}$ is a count of how many of the other 15 subjects in the experimental session contribute to the group account in the PGG.

4.4.2 The Treatments

We conducted three symmetric treatments (*sym40*, *sym60*, *sym80*) and one asymmetric treatment (*asymmetry*). The subjects' individual returns (m_i) from contributing to the group account vary depending on the treatment. Under the symmetric treatments, all subjects in a session face the same m_i. Under the *sym40* treatment, m_i =40. Under *sym60* and *sym80*, m_i =60 and m_i =80, respectively, for all subjects. Under *sym40*, the social optimum is for all subjects to contribute to the group account and earn 640 each while a unanimous decision to not contribute yields 400 per subject.[4] The *sym60* treatment is included as it is the expected average return which lies between the *sym40* and the *sym80* treatments.

[4]Appendix E shows the payoff structure for each subject depending on their treatment assignment, theirs and other subjects' decisions to contribute to the group account, and the individual return on contributions to the group account.

Under the *asymmetry* treatment, we vary the individual return from the public good across subjects within an experimental session: Half of the subjects in the session are assigned a low individual return (m_i =40) and half are assigned a high return (m_i =80). A subject learns whether (s)he derives a high or low individual return from the public good from the token upon which (s)he also indicates his/her decision (see Appendix D). Subjects know that they are playing the PGG with other subjects, some of whom have different individual returns to their own. However, subjects do not know the proportion of subjects who have been assigned high(low) returns in their session.

We framed the PGG as a situation where a farming community which borders a nature reserve has an electric fence installed around it to protect the community's crops from elephants. Farmers in that community must decide whether or not to contribute to maintenance of the electric fence. If the fence is poorly maintained, then it is more likely to break down and all the farmers are likely to incur elephant-related crop damage. If the fence breaks down, the farmers are responsible for its upkeep and no external or government assistance will be provided. If all farmers contribute their time and effort to maintaining the fence, then it will be maintained easily, but if one farmer decides not to contribute time or effort, (s)he will still benefit from the contributions of others in maintaining the fence. The dilemma is that if most of the farmers decide not to contribute to maintenance, all farmers will "suffer the consequences of being less well protected" (see Chapter 6.2 for the complete set of instructions for each of the treatments).[5]

[5] A second frame regarding contributions to a communal water pump is also implemented for two experimental sessions but we abandoned this frame early on in our fieldwork and omitted these two sessions from our analysis as the dilemma is not relevant to our sample population.

4.4.3 Beliefs

To investigate whether the potentially lower contributions of low-return subjects make high-return subjects disinclined to contribute, we elicited subjects' beliefs about others' contribution decisions. After all contribution decisions are made, each subject predicts how many of the other subjects in their group contribute to the public good. The belief elicitation is not incentivised. Gaechter and Renner (2005) show that incentivising belief elicitation in a repeated PGG does not significantly alter the observed relationship between beliefs and contributing behaviour.

4.4.4 The Participants

We conducted 30 sessions across 16 communities in which subjects played PGGs under the electric fence frame.[6] Some sessions involved fewer than 16 subjects. Four sessions were so poorly attended that the PGG no longer represented a social dilemma.[7] The average number of participants in the remaining 26 sessions was 15.5 (404 observations in total). We present the descriptive statistics for this final sample of 404 observations in Section 4.5. Table 4.2 shows the total number of subjects included in our analysis.

[6] Table E.1 in Appendix E shows the PGG treatment assignment and session sizes. In terms of treatment assignment, a list of communities and experimental sessions within those communities was drawn up and treatments were allocated to each session in no particular order. Moreover, two experimental sessions were conducted in each community and no community conducted both experimental sessions under the same PGG treatment assignment.

[7] For example, due to an insufficient number of subjects in Community 9 Session 2, subjects earn more when no one contributes to the public good (Rs.400) compared to unanimous contributions to the public good (Rs.360).

Table 4.2: Total Number of Treatments, Sessions and Subjects Included in the Analysis

	Intended no. of Sessions	No. of Sessions in Analysis	No. of Subjects in Each Treatment
Sym40	7	6	96
Sym60	6	6	92
Sym80	7	7	105
Asymmetry	10	7	111

4.4.5 Implementation

The PGG begins with the script-reader reading out the instructions to the group of subjects. Under the *asymmetry* treatment, the payoff structure is explained by the script-reader to high-return subjects and low-return subjects simultaneously using several examples to ensure comprehension of the task by both subject types. Each subject is given a token and faces an either-or choice: either to contribute the token to the group account or, not to contribute to the group account. Subjects make their decision by circling their choice on their token (shown in Appendix D, Figure D.1). Once contribution decisions are made, subjects state how many subjects in their session they *believe* contributed to the group account. Subjects report their beliefs by circling a number between 0 and 15 on the back of the same token on which they made their PGG contribution decision (shown in Appendix D, Figure D.2). PGG earnings are calculated at the end of the workshop and are paid in Sri Lankan Rupees. The average payoff in the PGG is Rs.624, which is equivalent to almost one day's farm wage in early 2014.[26]

[26] All subjects were paid a show-up fee of Rs.250. Information about the show-up fee was communicated in the written invitation which was sent to each subject prior to the one-day workshop in each village. After having participated in all activities during the one-day workshop, subjects were given a lump-sum payoff. Each subject's total payoff was the sum of the show-up fee and earnings from participating in the PGG, GC and the risk and sharing game (the payoff structure of the risk and sharing game is described in Chapter 3).

4.4.6 The Gamble Choice Task

Immediately after the PGG, we elicit subjects' risk attitudes by engaging them in an individual, Binswanger-type (1980) gamble choice (GC) task. This is the same gamble choice task described in Chapter 3, Section 3.4.2 (pg.60-63). There are numerous risk preference elicitation methods which we could have used (see Charness *et al.* (2013) for a summary of alternative methods including the Balloon Analogue Risk Task (BART), questionnaires, the Gneezy and Potters (1997) method, and the Holt and Laury (2002) multiple price list.) However, following Barr and Genicot (2008) and Attanasio *et al.*, (2012) we choose the Binswanger-type GC task because of: its ability to provide a summary measure of individual risk attitudes; the practicality of its implementation in developing countries when engaging with semi-literate or illiterate subjects; the relative ease with which participants understand the GC task compared to other methods; and its usefulness in capturing treatment effects (not so relevant here).

Each subject is presented with a visual aid displaying six gambles (A, B, C, D, E and F, shown in Appendix F, Figure F.1). The gambles differ with respect to expected payoffs and increase in riskiness from A to F. Each gamble has a 0.5 probability of a high and a low payoff. The gambles are similar, but not identical to those in Binswanger (1980) and are adjusted to the Sri Lankan currency (Sri Lankan Rupee). Table F.1 in Appendix F shows the outcomes and expected payoffs for each of the gamble choices. The high payoff of Rs.800 from Gamble F is equivalent to one day's farm wage for a male farm labourer. Gambles E and F have the same expected payoff, but Gamble F's higher standard deviation renders it the riskiest gamble. So, choosing Gamble F is consistent with risk seeking. Gamble A involves no risk (so strictly it is not a gamble).

4.5 The Survey

4.5.1 The Hypothetical Contribution Question (HCQ)

In the individual-level survey, we ask a hypothetical contribution question (HCQ) regarding subjects' willingness to contribute time (in hours) to the construction of an electric fence. The HCQ is different from contingent valuation-style (CVM) and willingness-to-pay (WTP) questions as we focus on potential time spent in exerting effort. Focusing on time spent is more salient in the HEC scenario, given previous community-level interventions via NGOs in Wellawaya, and is relevant to the literature relating to community-driven development. In this hypothetical scenario, a NGO provides the subject's community with the financial resources, construction materials and technical assistance necessary to construct an electric fence. Subjects decide how much time they are willing to provide to construct the fence. Subjects are given approximately five minutes to reflect on the scenario and to choose their time contribution from a menu of choices ranging from zero hours to more than twenty hours in two-hour intervals (see Appendix G, Figure G.1).[8] [9]

[8] Following this, we ask subjects how many hours per week they are willing to spend maintaining the electric fence after it has been constructed – here, they choose from a menu of number of hours ranging from zero hours to more than ten hours per week in one-hour intervals (see Appendix G, Figure G.1). We exclude the responses relating to willingness to provide hours to maintenance of the electric fence as, given that the order of the two HCQs were not randomised, responses regarding maintenance may be subject to embedding effects (Kahneman and Knetsch, 1992), i.e. subjects' willingness to maintain the fence may be determined by how much time they were willing to spend constructing the fence.

[9] The HCQs originate from the individual-level household survey which includes sections relating to: the household roster; land tenure and property rights; frequency and estimated cost of house-, crop- and personal damage owing to the Human-Elephant Conflict (HEC); HEC damage prevention methods; membership in community-based organisations; agricultural and non-agricultural income; remittances and transfers; agricultural and household assets;

4.5.2 Proxies for Individual Returns and Asymmetric Returns in the HCQ

In the HCQ analysis, we proxy for individual returns from the collectively-owned electric fence using two survey variables. The first is *crop damage*, a four-year average of instances per month of HEC-related crop damage over the period 2011-14. The rationale here is that those who have experienced more damage in the past will experience a greater reduction in damage once the fence is in place. The second variable is *proportion of income from farming*, which is the proportion of total annual household income in 2013/14 generated from agricultural activities. The rationale in this case is that those who rely more heavily on farming are, ceteris paribus, more exposed to the risks associated with the HEC and will therefore benefit more from the fence. We proxy for asymmetric returns from the electric fence using the variance of *crop damage* and the variance of *proportion of income from farming* within village, across households. These are denoted *var*(*crop damage)* and *var*(*proportion of income from farming),* respectively.

4.5.3 Other Controls in the HCQ Analysis

We capture HEC prevention effort using the variable *watch-huts*, which is the total number of watch-huts owned by a household. Inclusion of *watch-huts* allows us to investigate whether households who are more invested in the time-consuming, perilous, established approach of surveying their farmlands from watch-huts respond to the provision of the electric fence, which represents a potentially newer and more innovative approach to HEC management. We also control for each subject's age,

household construction characteristics; and, the household's credit and savings history. See Chapter 6, Section 6.6.

gender, marital status, years of schooling, household size, total household income, whether the subject is a household head and whether (s)he is a farming household head. Descriptive statistics for the HCQ and PGG sample are presented in Table 4.3.

4.5.4 The Participant Sample

The HCQ subject sample is the same as in the PGG. The sample is drawn from sixteen communities which are spread across six administrative areas of Wellawaya Divisional Secretariat, Moneragala District, Sri Lanka. The entire study comprises 468 households randomly sampled from the Electoral Registers 2011/12 and 2012/13 (the most recent register for each community is used to conduct the random sample). However, for consistency, when analysing the HCQ, we restrict the sample to match that used for the PGG analysis. Our sampling frame is adults aged 18 or over who reside in the community where the one-day workshop is conducted. The experiments and survey were written in English and translated to Sinhala (the local language). They were administered in Sinhala using local enumerators in the Wellawaya area. Semi-structured interviews with key members from each of the sixteen communities were also undertaken in order to corroborate information gathered.

4.5.5 Descriptive Statistics

Table 4.3 presents descriptive statistics for the sample. The dependent variable in the HCQ analysis is the number of hours which subjects are willing to contribute to construction of the electric fence (*HCQ contribution*). Willingness to provide more hours implies more cooperative behaviour. In terms of contribution behaviour, 48.3 per cent of subjects were willing to provide at least 20 hours to constructing the electric fence (see Appendix G, Figure G.2). On average, respondents were willing to contribute

14.24 hours. The dependent variable in the PGG analysis, *contribute in PGG*, is the subject's decision regarding whether or not to contribute the token to the group account. The decision to contribute to the group account signals cooperative behaviour. In the PGG, 41 per cent of subjects chose to put their voucher in the group account.

During the period 2011-2014, the average household experienced 0.77 instances of crop damage per month (*crop damage*). The within-village variance of crop damage instances across households varies from 0.09 to 9.17, which is sufficient for my analytical purposes. The average proportion of income from farming is 57 per cent and, again, there is sufficient variation in the within-village variance of *proportion of income from farming*. Subjects in this sample are on average 44 years old, have 9 years of schooling, and live in households with 4 members. Two-thirds of the sample comprises females and 87 percent of subjects are married. The majority are household heads (96 percent) with farming as the main activity for 76 percent of the sample. On average, they earn 57 per cent of their household income from agricultural activities and occupy 1.64 farm plots (*number of plots*).

Table 4.3: Variable Description and Descriptive Statistics from the PGG and HCQ Sample

Variable Name	Variable Description	Obs.	Mean (s.d.)	Min	Max
PGG contribution	1 if subject contributed to the "group" account, 0 otherwise	404	0.413(0.493)	0	1
HCQ contribution	Willingness to provide time (in hours, 0-20+) to the construction of an electric fence (20+ coded as 21)	404	14.238(6.423)	0	21
Individual return	Individual return on the group account (=40, 60 or 80 depending on treatment)	404	60.495(17.591)	40	80
Asymmetry	1 if subject is in the *asymmetry* treatment, 0 otherwise	404	0.275(0.447)	0	1
Belief	Belief of Subject *i* regarding how many of other 15 subjects in the session (0-15) contribute to the group account	404	6.671(4.581)	0	15
Crop damage	Average frequency of monthly crop damage instances between 2011 and 2014	404	0.768(1.754)	0	16.099
Proportion of income from farming	Household's agricultural income as a proportion of total household income in 2013/2014 (multiplied by 10)[10]	398	5.700(4.117)	0	10
Var(crop damage)	Within-village variance of average frequency of monthly crop damage instances between 2011 and 2014 across households	404	3.048(3.291)	0.086	9.167

[10] The actual figures for proportion of income from farming lie between 0 and 1 but we multiply each figure by 10 to ensure the magnitudes for the *proportion of income from farming* and *crop damage* and *HCQ contribution* are comparable.

Var(proportion of income from farming)	Within-village variance of agricultural income as a proportion of total household income in 2013/2014 (multiplied by 10) across households	404	15.687(2.353)	12.109	22.688
Total household income	Log of sum of agricultural income from maha season 2013/14, yala season 2013, non-agricultural income in 2013 and remittances in 2013; annual figure	404	11.525(1.845)	0	14.691
Watch-huts	Total number of watch-huts (at and above ground) located across total number of plots occupied by each household	404	0.688(0.706)	0	4
Risk aversion	1 if subject chooses Gambles A/B in GC task (risk averse) 0 if subject chooses Gambles C,D, E or F in GC task	404	0.188(0.391)	0	1
Age	Subject's age in years	403	43.801(13.717)	19	77
Age squared	Subject's age squared	403	2106.258(1264.154)	361	5929
Female	1 if subject is female, 0 otherwise	404	0.6756(0.469)	0	1
Married	1 if subject is married, 0 otherwise	404	0.876(0.330)	0	1
Years of schooling	Subject's total number of years of schooling	403	8.861(3.724)	0	17
Household head	1 if subject is the household head, 0 otherwise	404	0.963(0.189)	0	1
Farming household head	1 if household head's main activity is farming, 0 otherwise	404	0.760(0.428)	0	1
Household size	Total number of members in the household	404	3.864(1.342)	1	8
Number of plots	Total number of farm plots occupied by each household	404	1.636(0.735)	1	5

4.6 Hypotheses

Based on existing literature, we form the following four hypotheses about subjects' contribution decisions in the PGG and in the HCQ.

Hypothesis 1.1: Contributions to the public good will be lower in the asymmetric PGG treatment compared to the symmetric PGG treatment.

The empirical justification for this is that in the lab experiments which are most similar in design to the PGG in this paper (Fisher *et al.*, 1995; Tan, 2008; Fischbacher *et al.*, 2014) heterogeneity in returns from the public good lowers cooperation.

Hypothesis 1.2: Contributions to the PGG will be higher when the individual returns from the PGG are higher.

Hypothesis 2.1: Contributions to the fence in the HCQ will be lower in villages where the cross-household variance in crop damage and reliance on farming for income is greater.

This follows by extrapolation from Hypothesis 1.1.

Hypothesis 2.2: Contributions to the fence in the HCQ will be higher when the individual returns from the fence are higher.

Hypothesis 3: The more risk averse is a subject, the less (s)he contributes in the PGG.

Contributing is the strategically risky option because co-players have the opportunity to free-ride by not contributing but still benefiting from public goods provision owing

to the contribution of others. Hence, we expect more risk-averse individuals to be less inclined to contribute in the PGG.

Hypothesis 4: The more risk averse is a subject, the less (s)he contributes in the HCQ.

Contributing in the HCQ is an investment in a new technology and the literature on risk attitudes and technology adoption which we previously cited also suggests that risk averse individuals are less likely to adopt new technologies. We also expect perceived technological risk to influence HCQ decisions more than strategic risk. Taken together, we expect more risk-averse individuals to contribute less in the HCQ.

4.7 Results

We begin this section by presenting mean treatment effects on PGG contribution decisions. Then, by estimating logit and truncated Tobit models, we analyse whether individual and asymmetric returns from the electric fence and individual risk attitudes affect contribution decisions in both the PGG and HCQ contexts.

4.7.1 Contributions in the PGG

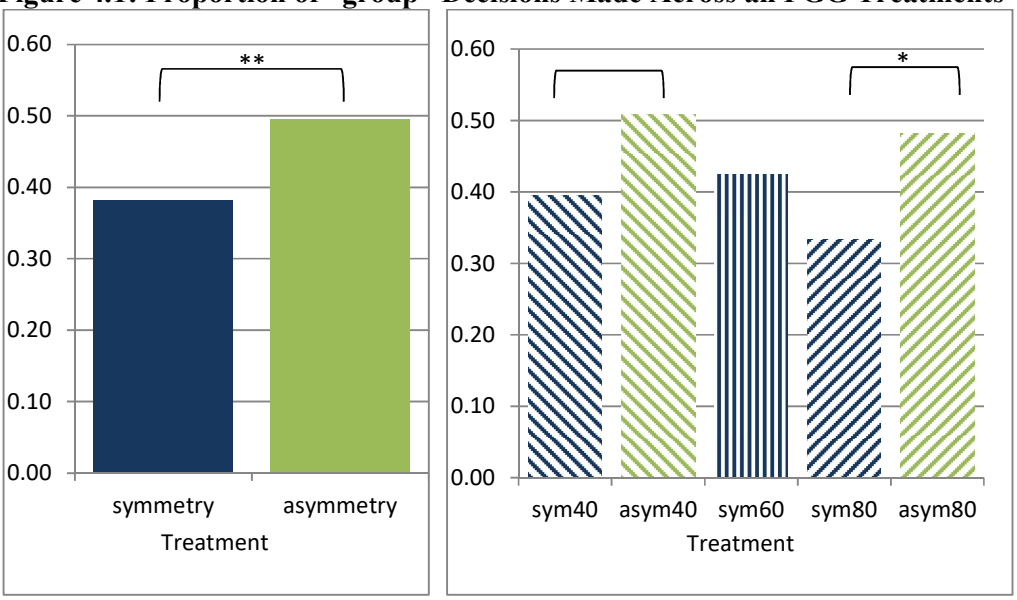
On average, 41 per cent of participants in the PGG chose to put their token in the group account. The proportions across treatments lie in the range 0.33 to 0.51 (see Figure 4.1).

Result 1.1: Mean PGG group contribution rates are higher under asymmetry than symmetry

Two-sample independent t-tests and Mann-Whitney tests show that the difference in mean group contributions between *symmetry* (38.2 per cent) and *asymmetry* (49.5) is

significant at the 5 per cent level (t=2.069(p=0.039); z=2.061(p=0.039)). If we exclude *sym60* from the sample and compare mean contribution rates between *symmetry* (comprising *sym80* and *sym40*) and *asymmetry* (comprising of the *asym80* and *asym40* sub-treatments), we are still able to reject the null of no difference, but at the 10 per cent level. This is contrary to our first hypothesis that heterogeneity in returns from the public good decreases contributions.

Figure 4.1: Proportion of "group" Decisions Made Across all PGG Treatments



Notes: Blue-striped bars denote treatments where individual returns are symmetric within-session, i.e. the same for all subjects in that treatment. Green-striped bars denote treatments where individual returns are asymmetric within-session, i.e. subjects who play the PGG with others who do not necessarily derive the same individual returns from the public good. Downwards and diagonal stripes indicate treatments where the individual return is Rs.40 and upwards and diagonal stripes indicate treatments where the individual return is Rs.80. Vertical stripes denote treatments where the individual return in Rs.60. ** denotes statistically significant differences at the 5 per cent level. * denotes statistically significant differences at the 10 per cent level.

Table 4.4: Two-sample Independent t-tests and Mann-Whitney-U Tests for PGG Contributions

	Sym40	Sym60	Sym80	Asym40	Asym80
Sym40		t=0.389 (p=0.697) z=0.390 (p=0.696)	t=0.918 (p=0.360) z=0.918 (p=0.359)	t=1.349 (p=0.179) z=1.346 (p=0.178)	t=1.034 (p=0.303) z=1.034 (p=0.301)
Sym60			t=1.309 (p=0.192) z=1.306 (p=0.191)	t=1.000 (p=0.319) z=1.000 (p=0.317)	t=0.688 (p=0.493) z=0.689 (p=.0491)
Sym80				t=2.180** (p=0.031) z=2.154** (p=0.031)	t=1.856* (p=0.065) z=1.842* (p=0.065)
Asym40					t=0.281 (p=0.779) z=0.283 (p=0.778)
Asym80					

Notes: t-statistics for two-sample independent tests and z-statistics for Mann-Whitney-U tests; ** denotes significance at the 5 per cent level; * denotes significance at the 10 per cent level.

In Table 4.4, we compare mean group contribution rates between the symmetric treatments and we cannot reject the null hypothesis of no statistically significant difference. We compare the difference in mean group contribution rates between symmetric and asymmetric treatments where the individual return on the public good is the same. We cannot reject the null hypothesis of no difference in mean contribution rates between *sym40* and *asym40*. The difference in mean contributions between *sym80*

and *asym40* is statistically significant at the 5 per cent. However, here, both the symmetry and returns differ between treatments.

We can reject the null hypothesis of no difference in mean contribution rates between *sym80* and *asym80* at the 10 per cent level (see Figure 4.1). This shows us that subjects who derive higher returns and know that they are playing the PGG with those who derive lower returns under *asymmetry* contribute more compared to those who derive higher returns and are playing with subjects who face the same higher return.

4.7.2 Multivariate Analysis of Contributions in the PGG

Table 4.5 presents the marginal effects derived from four logit models each taking the PGG decision as the dependent variable. (see Appendix H, Table H.1 for the logit coefficient estimates). The dependent variable *PGG contribution* is equal to one if the subject put the token in the group account, and zero otherwise. In all estimations, non-independence within sessions is accounted for by adjusting the standard errors for clustering at the session level.

Result 1.1 continued: After controlling for individual-level returns and characteristics, PGG asymmetry has a positive but insignificant effect on PGG decisions;

Result 1.2: Individual returns have an insignificant effect on PGG decisions

Hypothesis 1.1 states that contributions to the public good in the asymmetric PGG treatment will be lower than in the symmetric PGG treatment. In Model 1, the only explanatory variables are *asymmetry* and *individual return*. We find that exogenous assignment to the asymmetric treatment has a positive but statistically insignificant effect on subjects' PGG decisions, compared to the baseline of exogenous assignment

to the symmetric treatments (*sym40*, *sym60*, *sym80*). Individual returns also have an insignificant effect on PGG contribution decisions in Model 1. The coefficients on *asymmetry* and *individual return* continue to be insignificant in all PGG models and the result is robust to alternative model specifications.[11]

In PGG Model 2, we control for HEC-related crop damage (*crop damage*), exposure to risks associated with HEC (*prop of farm income*), and HEC prevention (*watch-huts*). We also include a standard set of controls for household characteristics.

[11] The coefficient on *individual return* is robustly close to zero and insignificant in alternative model specifications, including: when the sample is restricted to subjects who derive the low individual return from the public good; when the sample is restricted to subjects who derive the high individual return from the public good; when we construct and use an alternative variable to *individual return*, namely *deviation from mean individual return*.

Table 4.5: Marginal Effects for PGG Logit Models
(DV "contribute" is 1 if contributed to group account, 0 otherwise)

	PGG Model 1 Logit	**PGG Model 2** Logit	**PGG Model 3** Logit	**PGG Model 4** Logit
Asymmetry	0.113	0.081	0.032	0.002
	(0.076)	(0.084)	(0.045)	(0.028)
Individual return	-0.001	-0.001	$-2.396e^{-4}$	0.001
	(0.001)	(0.002)	(0.001)	(0.001)
Belief				0.051***
				(0.007)
Crop damage		-0.010	-0.015	-0.012
		(0.011)	(0.012)	(0.015)
Proportion of farming income		-0.001	-0.007	-0.005
		(0.006)	(0.007)	(0.008)
Watch-huts		0.022	0.024	0.001
		(0.037)	(0.036)	(0.044)
Risk aversion		0.089	0.120*	0.139*
		(0.056)	(0.069)	(0.079)
Age		0.023	0.022	0.023
		(0.019)	(0.020)	(0.019)
Age squared		$-2.634e^{-4}$	$-2.442e^{-4}$	$-2.482e^{-4}$
		(<0.001)	(<0.001)	(<0.001)
Female		-0.167***	-0.208***	-0.283***
		(0.052)	(0.053)	(0.060)
Married		-0.053	-0.062	-0.107
		(0.072)	(0.086)	(0.101)
Years of schooling		0.005	0.009	0.015
		(0.006)	(0.007)	(0.010)
Household head		0.040	0.027	0.050
		(0.182)	(0.188)	(0.168)
Farming household head		0.061	0.070	0.061
		(0.074)	(0.075)	(0.073)
Household size		0.023	0.035	0.059**
		(0.020)	(0.025)	(0.025)
Total household income (log)		-0.012	-0.024	-0.024
		(0.016)	(0.021)	(0.023)
Number of plots		0.036	0.031	0.018
		(0.043)	(0.048)	(0.061)
Community dummies?	No	No	Yes	Yes
Community dummies jointly significant?	-	-	Yes***	Yes***
Wald statistic (for regression)	2.84	47.78	-	-
Observations	404	397	397	397

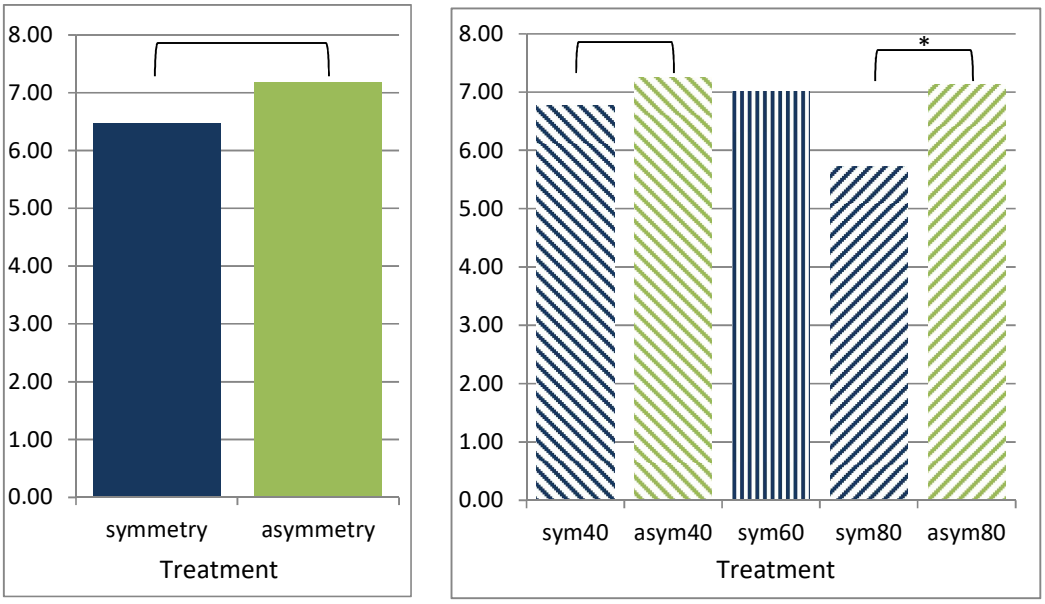
Notes: Robust standard errors in parentheses, clustered at the session level; *** p<0.01, ** p<0.05, * p<0.1; 7 missing observations in Models 2-4 (6 due to income, 1 due to age). On the whole, the results are robust to a linear probability model specification (see Appendix H, Table H.2 Models 1-4).

None of the HEC-related variables have a significant effect on PGG contributions. This suggests that subjects do not bring their real-life HEC context into the lab environment and into their PGG decision-making. All three variables are positively and significantly correlated with each other (see Appendix G, Table G.1), giving credence to our data on HEC damage, exposure and prevention being consistent. However, this raises concerns about multicollinearity. Therefore, we test for the joint significance of all three HEC-related variables in Model 2 and in the other PGG models, and we find that they are jointly insignificant (for Model 2, χ^2=1.18, p=0.757). Therefore, multicollinearity is not the cause of the insignificance.

In Model 3, we additionally control for community dummies. A test for joint significance shows that the communities are significantly different at the 1 per cent level, suggesting that communities vary in terms of their capacity to cooperate. Risk aversion appears to have a positive and significant effect on PGG decisions, which we will discuss further below.

In Model 4, we also control for Subject *i*'s beliefs about others' PGG contributions. Recall that the variable *belief* is coded from zero to 15: if *belief* equals zero, then Subject *i* believes that none of the other members in the group contributed to the group account. If *belief* equals 15, Subject *i* believes that all other group members contributed to the group account. There is a strong, positive and significant correlation between an individual's *PGG contribution* and their *belief* about how many others contribute (rho=0.372, p<0.001). Furthermore, when we compare mean beliefs across treatments (see Figure 4.2) we find a qualitatively similar pattern to that observed for PGG contributions (see Figure 4.1).

Figure 4.2: Mean Beliefs About "group" Contributions Across All PGG Treatments



Notes: Blue-striped bars denote treatments where individual returns are symmetric within-session, i.e. the same for all subjects in that treatment. Green-striped bars denote treatments where individual returns are asymmetric within-session, i.e. subjects who play the PGG with others who do not necessarily derive the same individual returns from the public good. Downwards and diagonal stripes indicate treatments where the individual return is Rs.40 and upwards and diagonal stripes indicate treatments where the individual return is Rs.80. Vertical stripes denote treatments where the individual return in Rs.60. *denotes statistically significant differences at the 10 per cent level.

The difference in mean beliefs between *symmetry* and *asymmetry* is statistically insignificant as is the difference in beliefs between the sub-treatment groups of *sym40* and *asym40*. However, we can reject the null hypothesis of no difference in beliefs between *sym80* and *asym80* at the 10 per cent level using both parametric and non-parametric t-tests. This suggests that those who derive higher returns and know that they are playing the PGG with people deriving lower returns are more optimistic about others' PGG decisions, compared to those who derive higher returns and play the PGG with subjects facing the same return.

Moving onto interpretation of Model 4 in Table 4.5, we find that, after controlling for other factors, at the mean, a one-unit increase in the number of subjects *believed* to have contributed in the PGG increases the likelihood of a subject contributing by 5.1 percentage points. This result is significant at the 1 per cent level and controlling for beliefs changes neither the sign nor significance of the coefficients on *asymmetry, risk averse* or *female.* The marginal effect of being female is a decrease in PGG contributions by 28.3 percentage points. When we control for beliefs, the positive coefficient on household size becomes significant at the 5 per cent level and suggests that a one-unit increase in household size increases the likelihood of contributing to the public good by 5.9 percentage points.

Crucially, PGG Models 1-4 show that asymmetric returns do not have a negative effect on PGG contributions. This result contrasts with Hypothesis 1.1 and the findings of similar lab-based experiments involving students.

4.7.3 Results from the HCQ

Recall that the dependent variable in the HCQ analysis (*HCQ contribution*) is the number of hours which subjects are hypothetically willing to contribute to construction of the electric fence. We analyse the same sample as in the PGG and estimate a Tobit model of contribution behaviour measured by the HCQ. The Tobit model is used because the dependent variable is the individual's willingness to contribute time to construct the electric fence, taking values from 0 to 20 in two-hour intervals and the option to indicate willingness to contribute more than 20 hours. We code the category "greater than 20" as 21 and then treat the dependent variable as truncated. This needs

to be accounted for in the analysis because 48.3 per cent of respondents indicated that they would contribute greater than 20 hours.

Result 2.1: Cross-household variance in both crop damage and in reliance on farming has a positive but insignificant effect on HCQ decisions;

Result 2.2: Individual returns have a positive effect on HCQ decisions

Hypothesis 2.1 states that, by extrapolation from Hypothesis 1.1, the variance in crop damage and in reliance on farming income will lead to lower HCQ contributions to the electric fence. Hypothesis 2.2 states that higher individual returns will lead to higher HCQ contributions. Our results provide support for the latter, but not the former. Table 4.6 shows the marginal effects on each of the coefficients of the truncated Tobit estimations evaluated at the mean (see Appendix H, Table H.3 for coefficient estimates). In Model 1, we include the two proxies for individual returns to the fence, *crop damage* and *proportion of income from farming,* and the community-level variances in these two variables to proxy for asymmetry in individual returns. The coefficients on both proxies for asymmetry on HCQ contributions are positive but insignificant. We find positive and highly significant effects of *crop damage* and *proportion of income from farming* on HCQ contributions. The positive and significant relationship between each of these two proxies for real-life expected individual returns to the electric fence and HCQ decisions is robust across HCQ Models 1-3.

In Model 2, we also include *watch-huts* (HEC prevention). This variable has a positive and highly significant effect. We also control for other important individual characteristics. We find that *risk aversion* has a negative effect on HCQ contributions, as does *female*, *age squared* and *number of plots*.

Table 4.6: Marginal Effects for Truncated Tobit Models (DV=willingness to contribute to construction (in hours))

	HCQ Model 1	HCQ Model 2	HCQ Model 3
Var (crop damage)	0.184	0.140	
	(0.114)	(0.133)	
Var (proportion of income from farming)	0.210	0.204	
	(0.138)	(0.157)	
Crop damage	1.158***	1.325***	1.320***
	(0.427)	(0.466)	(0.480)
Proportion of income from farming	0.388***	0.420***	0.404***
	(0.111)	(0.122)	(0.126)
Watch-huts		2.834***	2.926***
		(1.068)	(1.018)
Risk aversion		-2.285*	-2.372
		(1.369)	(1.461)
Age		0.188	0.221
		(0.172)	(0.178)
Age squared		-0.003	-0.003
		(0.002)	(0.002)
Female		-2.519**	-2.445**
		(0.999)	(1.136)
Married		-0.640	-0.767
		(1.270)	(1.287)
Years of schooling		-0.085	-0.117
		(0.163)	(0.169)
Household head		-2.673	-4.250
		(3.137)	(3.183)
Farming household head		-0.916	-0.711
		(1.467)	(1.574)
Household size		-0.375	-0.385
		(0.305)	(0.318)
Total household income (log)		0.047	0.214
		(0.576)	(0.537)
Number of plots		-4.462***	-4.634***
		(0.869)	(0.878)
Community dummies?	No	No	Yes
Community dummies jointly significant?	-	-	Yes***
Variances jointly significant?	No	No	-
R-squared	0.014	0.039	0.045
Observations	398	397	397

Notes: Robust standard errors in parentheses, clustered at the session level; *** p<0.01, ** p<0.05, * p<0.1; Tobit upper limit truncated at 21 hours; 6 missing observations in Model 1 due to income; 7 missing observations in Models 2-3 (6 due to income, 1 due to age). On the whole, the results are robust to an OLS specification (see Appendix H, Table H.4 Models 1-3). Inferences about returns and risk aversion are robust to the exclusion of the *watch-huts* variable.

The two variance measures are insignificant in Models 1 and 2. We find that the two measures are negatively and significantly correlated with each other at the 1 per cent level (rho=-0.256, $p<0.001$). An F-test for joint significance shows that the variance measures are jointly insignificant in both models. Including each variance measure separately in the regressions yields no substantial changes in the magnitude or significance of the coefficients on *var(crop damage)* or *var(proportion of income from farming*), which suggests that multicollinearity is not the cause of the insignificance.

In HCQ Model 3 we replace the variance measures with a full set of community dummies. These dummies are jointly highly significant and, so, this is our preferred model for the purposes of interpretation. A one-unit increase in average crop damage per month increases the HCQ time contribution by 1.32 hours. A one-unit increase in the proportion of income generated through farming increases the time contribution by 0.40 hours. Watch-hut ownership has a large, positive and significant effect on HCQ contributions to the electric fence: each additional watch-hut owned increases the HCQ time contributions by 2.93 hours. Each additional plot occupied by a household leads to a 4.63 hours reduction (at the mean) in the HCQ time contribution.

In sum, the HCQ models show us that variances in crop damage and in reliance on farm income, both of which proxy for real-life asymmetric returns from the electric fence, have no significant effect on HCQ contributions. Crop damage and reliance on farming income, which proxy for individual returns from the electric fence, have a positive and significant effect on HCQ contributions, as does ownership of HEC-preventative watch-huts.

4.7.4 Results Regarding Risk Aversion

Result 3: Risk aversion increases the likelihood of PGG cooperation

We find evidence contrary to Hypothesis 3. Once we control for community dummies in PGG Models 3 and 4 (Table 4.5), we find that risk aversion, has a positive and significant effect on the likelihood of an individual contributing in the PGG. Specifically, subjects who choose Gambles A or B in the GC task are 12.3-14.3 per cent more likely to contribute to the group account. One possible explanation for this is that subjects who are more risk averse are more interested in the maintenance of the community-wide electric fence, albeit hypothetical. A more compelling explanation is that risk-averse subjects are accustomed to coping with HEC and other real-life risks collectively and, so, behave cooperatively in the PGG out of habit.

Result 4: Risk aversion has a negative but insignificant effect on HCQ contributions

Hypothesis 4 states that the more risk averse a subject is, the less (s)he contributes in the HCQ. The Tobit results in Table 4.6 show that, once we control for community-level dummies in Model 3, our preferred model for interpretation, risk aversion has a negative but insignificant effect on HCQ contributions. Although statistically

insignificant, the sign on the coefficient is consistent with what we observe in the prior literature and the HCQ result lies in stark contrast to the PGG results. [12] [13] [14]

4.8 Discussion

Results 1.1 and 1.2

A simple comparison of mean PGG contributions suggests that asymmetry in returns has a positive effect on PGG contributions. However, when we control for other factors, neither asymmetry nor higher individual returns have a significant effect on PGG contributions.

There are several reasons to believe that the strategic aspect of the task looms large in subjects' PGG decisions as mentioned in Section 4.3. First, subjects' beliefs about others' PGG contributions (*belief*) in PGG Model 4 has a positive and highly significant effect on PGG contributions. Moreover, given the qualitative similarities between Figures 4.1 and 4.2, it is possible that subjects display "self-similarity", which Rubinstein and Salant (2016) define as where "a player tends to believe that other players will choose the same action that he does to a greater extent than players who

[12] We control for ordering effects between attending the survey session and attending the experimental session and find that the order in which subjects participate in the PGG and in the survey has no significant effect on their contribution behaviour in either context.

[13] If we transform the HCQ dependent variable to equal 1 if subjects are willing to contribute at least 20 hours to construction of the electric fence and zero otherwise, the results are effectively unchanged.

[14] We construct an alternative crop damage variable using the same data, setting all observations greater than zero and less than 1 to 1. This has no effect on our results and we continue to use *crop damage* in the analysis.

choose any other action"; and/or "strategic justification", where "the chosen action is optimal with respect to his beliefs". However, since we do not randomise the ordering of belief elicitation, we can only speculate on what may motivate subjects' beliefs. That the coefficients on the family of HEC-related variables (*crop damage*, *proportion of income from farming* and *watch-huts*) are insignificant in PGG Model 4, is consistent with subjects focusing on the strategic aspect of the task and not on the framing of the task and its relevance to their real-life experience of exposure to the HEC

Results 2.1 and 2.2

The Tobit analysis of the HCQ indicates that real-life proxies for asymmetric returns from the public good (*var(crop damage)* and *var(proportion of income from farming)*) have a positive but statistically insignificant effect on HCQ contributions. However, two proxies for expected individual returns from the electric fence have a positive and highly significant effect on HCQ contributions. The positive and significant coefficient on *watch-huts*, after controlling for exposure, is particularly interesting. It indicates that households who are more invested in an established approach to HEC management are more willing to invest in the new higher tech approach. This is consistent with these households perceiving the fence as a potentially less time-consuming and perilous approach to HEC management.

Results 3 and 4

Our analysis shows that being risk averse has differing effects on PGG and HCQ contributions. In the PGG, being risk averse increases the likelihood of contributing. In the HCQ, being risk averse has a negative but insignificant effect on time contributions.

We consider this behavioural difference to be linked to differences in the PGG and HCQ decision-making environments.

In the PGG, we speculated that the strategic risk associated with contributing to public good provision would receive a relatively high cognitive weight and hypothesised that the more risk averse would be less likely to contribute as a consequence. That we find the opposite is consistent with the risk averse being used to coping with risk collectively and, so, choosing to contribute to the group account in the PGG, framed as contributing to a risk-mitigating public good, out of habit. Note that this explanation is also consistent with a high cognitive weight being placed on the strategic, interactive aspect of public goods provision. By contrast, we speculated that in the HCQ decision-making process, a lower cognitive weight would be placed on the interactive aspect of the public good provision and a higher weight on technology risk. Our results do not confirm Hypothesis 4 but the sign on the coefficient of risk aversion is nevertheless consistent with the existing literature which abounds with examples of resistance to technological innovation by risk-averse individuals in developing countries, farmers in particular.

4.9 Conclusions

In conclusion, the results indicate that: asymmetry in individual returns to local public goods does not have a negative effect on provision; individuals who are likely to gain higher individual returns from provision are, if anything, more likely to contribute to the provision of local public goods; and risk aversion, in this context, motivates people to engage in collective risk mitigation, but it does not have a statistically significant effect on their engagement with new technologies.

From a policy-making perspective, the results from this chapter are encouraging for external bodies, such as NGOs, who aim to engage Sri Lankan communities in the construction of electric fences to mitigate the risk of the Human-Elephant Conflict. From a methodological point of view, we find that mixing methods can sometimes corroborate findings but can also yield different insights. Overall, the approach provides a more balanced account of communities' potential engagement in HEC-mitigating public goods provision.

Appendix D: PGG Tokens

Figure D.1: Front of Token Used in Symmetric PGG Treatment (abbreviation for "individual" in Sinhala on left, "group" in Sinhala on right)

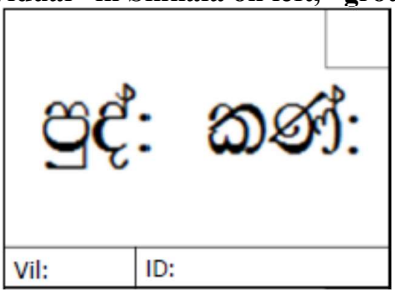


Figure D.2: Back of Token Used to Elicit Beliefs About Others' Contributions in Symmetric and Asymmetric PGG Treatments

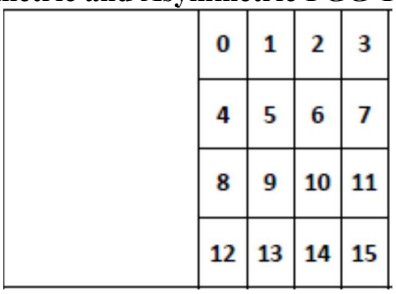
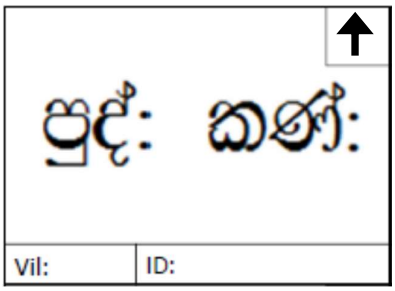
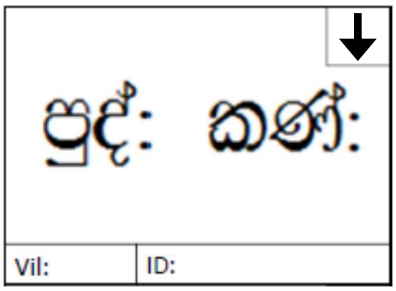


Figure D.3: Front of High- and Low-return Tokens Used in Asymmetric PGG Treatment





Appendix E: PGG Treatments and Payoff Tables

Table E.1: Treatments, Session Size and Sample Size

Comm.	No. of subjects	Session 1 treatment	No. of Session 1 subjects	Session 2 treatment	No. of Session 2 subjects
1	26	Sym60	16	Asymmetry	10
2	23	Asymmetry	10	Symwater 60	13
3	28	Symwater 60	12	Sym60	16
4	31	Asymmetry	15	Sym60	16
5	32	Sym40	16	Asymmetry	16
6	32	Sym80	16	Sym40	16
7	26	Sym60	16	Asymmetry	10
8	32	Asymmetry	16	Sym80	16
9	25	Sym80	16	Sym40	9
10	32	Asymmetry	16	Sym40	16
11	32	Sym80	16	Asymmetry	16
12	31	Sym60	16	Sym80	15
13	32	Sym80	16	Asymmetry	16
14	32	Asymmetry	16	Sym40	16
15	28	Sym40	16	Sym60	12
16	26	Sym40	16	Sym80	10

Table E.2: Payoffs from Contribution and Non-contribution to the "group" Account – Symmetric PGG

		Sym40		Sym60		Sym80	
No. of Contrib.	**No. of Non- contrib.**	**Contrib.**	**Non-Contrib.**	**Contrib.**	**Non-Contrib.**	**Contrib.**	**Non-Contrib.**
16	0	640	-	960	-	1280	-
15	1	600	1000	900	1300	1200	1600
14	2	560	960	840	1240	1120	1520
13	3	520	920	780	1180	1040	1440
12	4	480	880	720	1120	960	1360
11	5	440	840	660	1060	880	1280
10	6	400	800	600	1000	800	1200
9	7	360	760	540	940	720	1120
8	8	320	720	480	880	640	1040
7	9	280	680	420	820	560	960
6	10	240	640	360	760	480	880
5	11	200	600	300	700	400	800
4	12	160	560	240	640	320	720
3	13	120	520	180	580	240	640
2	14	80	480	120	520	160	560
1	15	40	440	60	460	80	480
0	16	-	400	-	400	-	400

Table E.3: Payoffs from Contribution and Non-contribution to the "group" Account – Asymmetric PGG

		Payoffs to Contributors and Non-contributors Under Asymmetric Treatments			
		Asym40		Asym80	
No. of Contrib.	No. of Non-contrib.	Contrib.	Non-contrib.	Contrib.	Non-contrib.
16	0	640	-	1280	-
15	1	600	1000	1200	1600
14	2	560	960	1120	1520
13	3	520	920	1040	1440
12	4	480	880	960	1360
11	5	440	840	880	1280
10	6	400	800	800	1200
9	7	360	760	720	1120
8	8	320	720	640	1040
7	9	280	680	560	960
6	10	240	640	480	880
5	11	200	600	400	800
4	12	160	560	320	720
3	13	120	520	240	640
2	14	80	480	160	560
1	15	40	440	80	480
0	16	-	400	-	400

Appendix F: Gamble Choice Task Decision Card and Payoffs Table

Figure F.1: Gamble Choice Task Decision Card

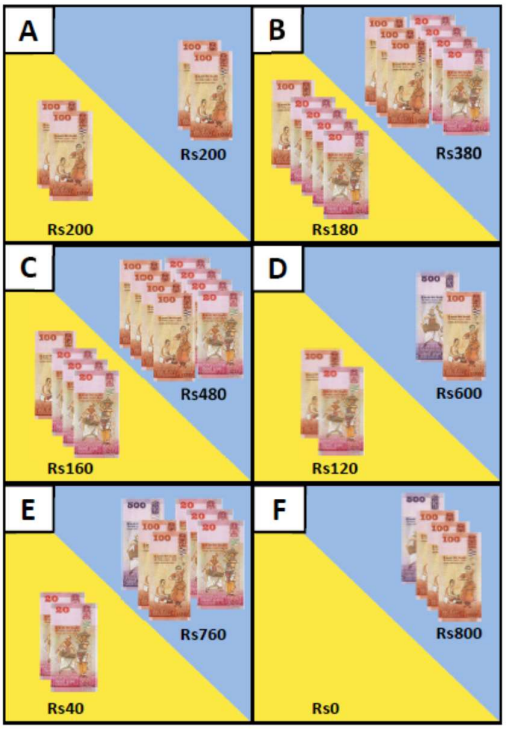


Table F.1: Gamble Choice Task Outcomes and Payoffs

Gamble Choice	Probability of Event Occurring	Payoff in Each Event (Rs.)	Expected Payoff (standard deviation in parentheses)	Cole *et al.* (2013) Measure of Risk Aversion
A	0.5 0.5	200 200	200 (0)	1.00
B	0.5 0.5	380 180	280 (100)	0.80
C	0.5 0.5	480 160	320 (160)	0.67
D	0.5 0.5	600 120	360 (240)	0.50
E	0.5 0.5	760 40	400 (360)	0.33
F	0.5 0.5	800 0	400 (400)	0.00

Appendix G: Hypothetical Contribution Question and Correlations Between HEC-related Variables

Figure G.1: Extract from Survey Section E Showing HCQs for Construction and Maintenance of the Electric Fence

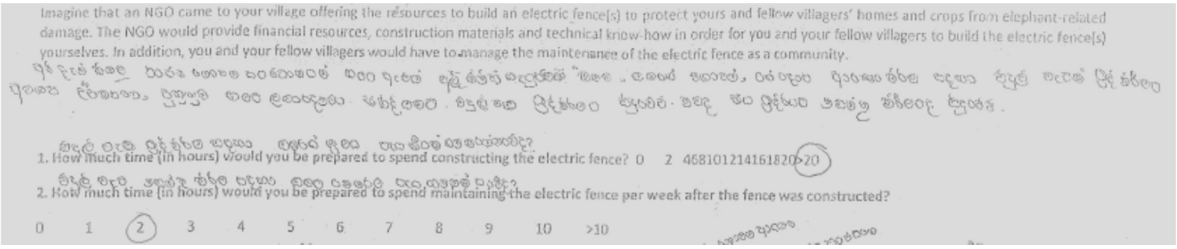


Figure G.2: Distribution of Subjects' Willingness to Contribute Time in Hours to Construct the Electric Fence

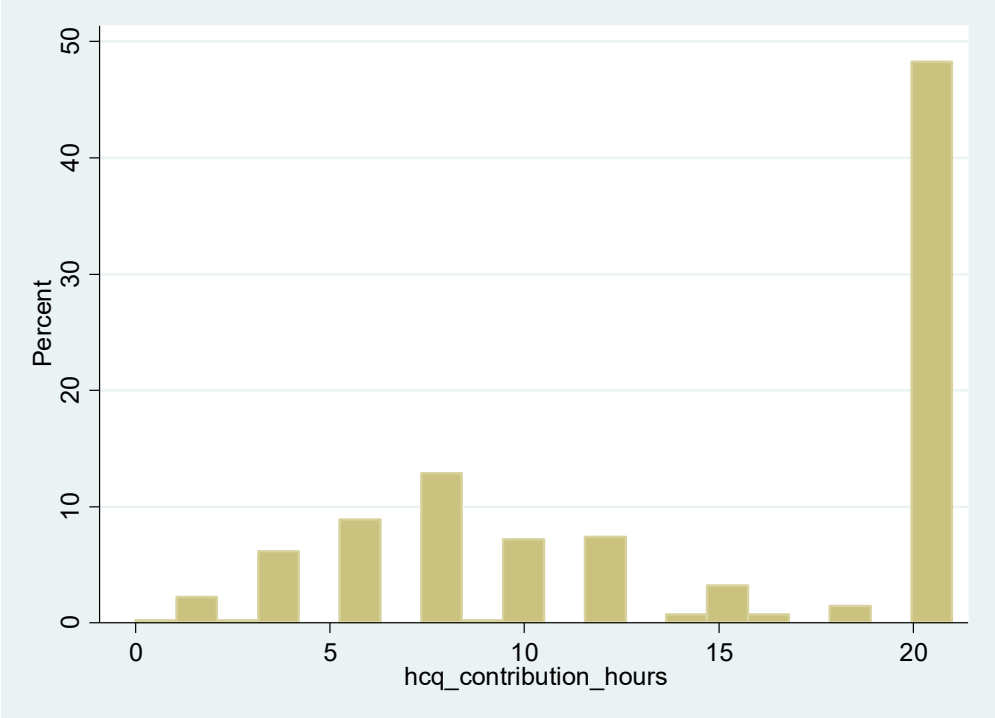


Table G.1: Correlation Between HEC-related Variables

	Crop Damage	Reliance on Farm Income	Watch-huts
Crop damage	**1.000**		
Reliance on Farm Income	**0.200*** **	**1.000**	
Watch-huts	**0.202*** **	**0.237*** **	**1.000**

Notes: *** denotes statistical significance at the 1 per cent level

Appendix H: Additional Estimations

Table H.1: PGG Logit Model Coefficient Estimates
(DV "contribute" is 1 if contributed to group account, 0 otherwise)

	Model 1 Logit	**Model 2** Logit	**Model 3** Logit	**Model 4** Logit
Asymmetry	0.461	0.333	0.133	0.007
	(0.309)	(0.341)	(0.184)	(0.121)
Individual return	-0.005	-0.003	-0.001	0.005
	(0.006)	(0.006)	(0.004)	(0.005)
Belief				0.217***
				(0.031)
Risk aversion		0.363	0.490*	0.575*
		(0.229)	(0.279)	(0.323)
Crop damage		-0.041	-0.064	-0.052
		(0.047)	(0.050)	(0.063)
Proportion of income from farming		-0.005	-0.031	-0.022
		(0.027)	(0.031)	(0.033)
Watch-huts		0.093	0.100	0.005
		(0.156)	(0.149)	(0.186)
Age		0.095	0.092	0.097
		(0.080)	(0.084)	(0.083)
Age squared		-0.001	-0.001	-0.001
		(0.001)	(0.001)	(0.001)
Female		-0.686***	-0.862***	-1.191***
		(0.212)	(0.222)	(0.260)
Married		-0.218	-0.254	-0.441
		(0.293)	(0.348)	(0.408)
Years of schooling		0.022	0.039	0.064
		(0.026)	(0.031)	(0.041)
Household head		0.169	0.116	0.219
		(0.782)	(0.809)	(0.760)
Farming household head		0.256	0.300	0.266
		(0.320)	(0.325)	(0.321)
Household size		0.096	0.146	0.251**
		(0.083)	(0.103)	(0.107)
Total household income (log)		-0.051	-0.102	-0.104
		(0.066)	(0.087)	(0.098)
Number of plots		0.152	0.132	0.076
		(0.178)	(0.201)	(0.259)
Constant	-0.161	-2.154	-0.569	-2.917
	(0.324)	(2.058)	(2.552)	(2.409)
Community dummies?	No	No	Yes	Yes
Community dummies jointly significant?	-	-	Yes***	Yes***
Wald statistic (for regression)	2.84	47.78	-	-
Observations	404	397	397	397

Notes: Robust standard errors in parentheses, clustered at the session level; *** p<0.01, ** p<0.05, * p<0.1; 7 missing observations in Models 2-4 (6 due to income, 1 due to age).

Table H.2: PGG Linear Probability Models
(DV "contribute" is 1 if contributed to group account, 0 otherwise)

	Model 1 LPM	Model 2 LPM	Model 3 LPM	Model 4 LPM
Asymmetry	0.113	0.076	0.028	0.003
	(0.194)	(0.418)	(0.645)	(0.917)
Individual return	-0.001	-0.001	$-1.615e^{-4}$	0.001
	(0.374)	(0.699)	(0.872)	(0.424)
Belief				0.040***
				(<0.001)
Risk aversion		0.083	0.099	0.098*
		(0.135)	(0.102)	(0.094)
Crop damage		-0.009	-0.013	-0.010
		(0.414)	(0.179)	(0.378)
Proportion of income from farming		-0.001	-0.007	-0.003
		(0.839)	(0.328)	(0.539)
Watch-huts		0.020	0.021	0.007
		(0.590)	(0.519)	(0.820)
Age		0.021	0.019	0.018
		(0.257)	(0.272)	(0.238)
Age squared		$-2.368e^{-4}$	$-2.128e^{-4}$	$-1.969e^{-4}$
		(0.221)	(0.232)	(0.207)
Female		-0.160***	-0.180***	-0.214***
		(0.007)	(0.001)	(<0.001)
Married		-0.049	-0.051	-0.087
		(0.480)	(0.502)	(0.281)
Years of schooling		0.005	0.008	0.012
		(0.462)	(0.230)	(0.135)
Household head		0.036	0.009	0.062
		(0.834)	(0.950)	(0.632)
Farming household head		0.056	0.061	0.035
		(0.443)	(0.362)	(0.535)
Household size		0.022	0.030	0.042**
		(0.290)	(0.168)	(0.028)
Total household income (log)		-0.012	-0.022	-0.023
		(0.429)	(0.239)	(0.181)
Number of plots		0.036	0.029	0.012
		(0.392)	(0.479)	(0.797)
Constant	0.459***	0.041	0.408	0.006
	(<0.001)	(0.919)	(0.440)	(0.982)
Community dummies?	No	No	Yes	Yes
Community dummies jointly significant?	-	-	Yes**	Yes**
Observations	404	397	397	397
R-squared	0.013	0.061	0.157	0.277

Notes: standard errors are cluster bootstrapped at the session level (26 sessions and 5,000 replications) and p-values are shown in parentheses; *** p<0.01, ** p<0.05, * p<0.1; 7 missing observations in Models 2-4 (6 due to income, 1 due to age).

Table H.3: HCQ Truncated Tobit Model Coefficient Estimates (DV=willingness to contribute to construction (in hours))

	Model 1 Tobit	Model 2 Tobit	Model 3 Tobit
Var(crop damage)	0.223	0.165	
	(0.138)	(0.156)	
Var(proportion of income from farming)	0.255	0.240	
	(0.167)	(0.185)	
Crop damage	1.404***	1.558***	1.541***
	(0.508)	(0.540)	(0.552)
Proportion of income from farming	0.471***	0.494***	0.471***
	(0.132)	(0.142)	(0.145)
Watch-huts		3.334***	3.416***
		(1.237)	(1.166)
Risk aversion		-2.688*	-2.770[a]
		(1.621)	(1.717)
Age		0.221	0.258
		(0.201)	(0.208)
Age squared		-0.004*	-0.004*
		(0.002)	(0.002)
Female		-2.963**	-2.854**
		(1.169)	(1.312)
Married		-0.753	-0.896
		(1.495)	(1.502)
Years of schooling		-0.100	-0.136
		(0.192)	(0.198)
Household head		-3.144	-4.962
		(3.680)	(3.707)
Farming household head		-1.077	-0.831
		(1.722)	(1.836)
Household size		-0.441	-0.449
		(0.356)	(0.369)
Total household income (log)		0.055	0.249
		(0.677)	(0.627)
Number of plots		-5.248***	-5.410***
		(0.998)	(1.009)
Constant	9.691***	22.991**	25.703***
	(3.298)	(9.528)	(9.085)
Sigma	10.624***	10.030***	9.864***
	(0.436)	(0.409)	(0.425)
Community dummies?	No	No	Yes
Community dummies jointly significant?	-	-	Yes***
Variances jointly significant?	No	No	-
R-squared	0.014	0.039	0.045
Observations	398	397	397

Notes: Robust standard errors in parentheses, clustered at the session level; *** p<0.01, ** p<0.05, * p<0.1; [a] p<0.15; Tobit upper limit truncated at 21 hours; 6 missing observations in Model 1 due to income; 7 missing observations in Models 2-4 (6 due to income, 1 due to age).

Table H.4: HCQ OLS Estimations
(DV=willingness to contribute to construction (in hours))

	Model 1 OLS	**Model 2** OLS	**Model 3** OLS
Var(crop damage)	0.108	0.073	
	(0.177)	(0.376)	
Var(proportion of income from farming)	0.083	0.050	
	(0.450)	(0.682)	
Crop damage	0.379***	0.353**	0.341**
	(<0.001)	(0.030)	(0.022)
Proportion of income from farming	0.257***	0.285***	0.263***
	(0.002)	(0.001)	(0.004)
Watch-huts		1.504**	1.588**
		(0.027)	(0.014)
Risk aversion		-1.456	-1.529
		(0.124)	(0.118)
Age		0.134	0.147
		(0.264)	(0.233)
Age squared		-0.002*	-0.002*
		(0.088)	(0.070)
Female		-1.473**	-1.415*
		(0.023)	(0.057)
Married		-0.714	-0.747
		(0.403)	(0.378)
Years of schooling		-0.035	-0.058
		(0.761)	(0.624)
Household head		-0.627	-1.544
		(0.740)	(0.396)
Farming household head		-0.643	-0.535
		(0.480)	(0.585)
Household size		-0.164	-0.176
		(0.408)	(0.385)
Total household income (log)		0.011	0.093
		(0.992)	(0.801)
Number of plots		-2.466***	-2.506***
		(<0.001)	(<0.001)
Constant	10.843***	16.597***	17.514***
	(<0.001)	(<0.001)	(<0.001)
Community dummies?	No	No	Yes
Community dummies jointly significant?	-	-	No
Observations	398	397	397
R-squared	0.050	0.133	0.157

Notes: standard errors are cluster bootstrapped at the session level (26 sessions and 5,000 replications) and p-values are shown in parentheses; *** p<0.01, ** p<0.05, * p<0.1; 6 missing observations in Model 1 due to income; 7 missing observations in Models 2-4 (6 due to income, 1 due to age).

Chapter Five: Thesis Conclusion

The overall aim of the thesis was to further our understanding about how small-scale farming communities cope with environmental risk. Using a range of empirical methods, we investigated this research problem by analysing field data collected from a household survey, a risk-and-sharing game, a one-shot public goods game and a gamble-choice task. In Chapter 2, we learnt that small-scale, dry-zone farmers in south-east Sri Lanka who are more exposed to the HEC engage in mixed livelihoods, have children who are more likely to be in non-farm employment, and cultivate less of their land in the main cropping season. We acknowledge that more data is needed in order to identify a direction of causality between exposure to HEC-related crop damage and these livelihoods choices. Nevertheless, whether increasing HEC-related crop damage is driving farmers out of agriculture, or farmers are independently opting out of farming and into non-farm activities of their own accord, the underlying message of the descriptive analysis is that the elephants appear to be regaining their territory. In sum, our first research contribution is that we provide evidence that exposure to HEC-related risk is heterogeneous, that households affect or are affected by (or both) their exposure to the HEC-related risk, and that economic development and environmental degradation do not always go hand in hand.

In Chapter 3, we presented the design of and findings from a novel risk-and-sharing game (RSG) which captures and explores the behavioural effects of interdependent and heterogeneous risk exposure, similar to that experienced by the Wellawaya communities with regards to their exposure to the HEC. From this we learnt, first, that there is a high degree of solidarity within these communities, regardless of the agency conditions imposed within the experiment: on average, over 60 per cent of decisions in

the RSG are to share ex-post payoffs equally. This is promising and should encourage policymakers that there is scope for harnessing social capital at the community-level in order to facilitate collectively coping with the HEC.

A second policy-relevant finding from the RSG was that individuals whose level of risk exposure was chosen for them were likely to engage in positive but not negative reciprocity when making ex-post sharing decisions, i.e. they were more likely to share when faced with the safer gamble owing to another's agency over both players' level of risk exposure, but were neither more nor less likely to share if faced with the riskier gamble owing to another's agency over both players' level of risk exposure. This is crucial for the sustainability of any potential community-based coping mechanisms. However, risk preferences loom large in the sharing decisions of individuals who have agency over another's level of risk exposure: risk-averse individuals whose decisions affect others behave more "kindly" and are more likely to assist others, while risk-tolerant individuals whose decisions affect others behave less "kindly" and are less likely to assist others. This indicates that policymakers need to consider the balance of power within communities, as well as the risk attitudes of individuals with agency over others, when designing and calibrating community-based programmes aimed at helping communities to cope with HEC-related risk. For example, let us consider an externally-funded community-driven development (CDD) intervention which requires the participation of the whole-community. In such a scenario, there would be scarce opportunity for assortative matching or self-selection into groups. In this instance, knowledge of individuals' risk attitudes and propensity to mutually assist one another would be advantageous to the external organisation in order to ensure the sustainability of the CDD intervention.

Chapter 4 also yielded several policy-relevant insights. We used a mixed methods approach to ascertain the effect of heterogeneous returns from a public good on contributions to that public good. The finding that heterogeneity in public good returns has a positive (albeit statistically insignificant) effect on public good contributions under both the public goods game (PGG) and hypothetical contribution question (HCQ) measures should be an encouraging sign to policymakers interested in community-wide risk-mitigating interventions. Moreover, we find that those who would benefit more from notional provision of the good in real life are also willing to contribute more to the good in the HCQ, which bodes well for the sustainability of such a project. That risk aversion had a positive and significant effect on PGG contributions is also encouraging. The positive effect of risk aversion on PGG contributions came as a surprise, but is consistent with the findings from Chapter 3: just as more cautious individuals are more likely to mutually assist in the RSG, so too are more cautious individuals more likely to contribute in the PGG.

In conclusion, the overarching message conveyed by this thesis is that dry-zone communities in this region of Sri Lanka are currently adopting a variety of strategies to cope with the HEC, an environmental risk which they face in their everyday lives. Some of these strategies involve livelihood adjustments. Most encouragingly, this thesis provides evidence that these communities exhibit a high degree of solidarity despite individuals' varied exposure to the HEC. Not only are community members willing to mutually assist each other following adverse shocks, but they are also willing to act collectively to facilitate their mitigation.

Chapter Six: Experimental Protocols and Household Survey

All scripts, instructions and decision cards were translated from English to Sinhala.

6.1 Welcome Script

Presentation to be read out loud by the script-reader

Thank you for agreeing to take part in today's workshop. This workshop is part of a research project conducted by researchers at the University of Nottingham (United Kingdom) and Arthacharya/ Artha Vida Foundation (Sri Lanka). The research project is called Collective responses to environmental risk in Sri Lanka. The aim of the project is to investigate the impact of risk on your lives in Sri Lanka. This research will take into account your exposure to risk, the effects it has on you, your families and your livelihoods, and how you relate to one another.

During the workshop each of you will complete a survey and play some games.

Your responses to the survey questions are entirely voluntary and you may refuse to complete any part or all of the survey.

Your involvement in the games is also voluntary. If, during the games, we ask you to do something or make a decision that you are uncomfortable with, you can withdraw from the game.

You will each play three games. The game will be played with money. We will supply the money and the money you have at the end of each game will be yours to take home. The amount of money you have at the end of each game will depend on the decision you make, the decisions other people make, and on luck.

Your answers to the questions in the survey and the decisions you make in the games will be confidential; your answers and decisions will not be shared with anyone other than the researchers involved in the project. Once we have finished the survey and games, we will store your answers and decisions anonymously. In other words, your names and personal contact details will be kept separate from your answers and decisions.

In registering for this workshop you affirm you are at least 18 years old and that you give consent for the lead researcher and her team to use your answers and decisions in their research. If you have any questions about this research, please feel free to ask at any point.

We greatly appreciate your time and willingness to be part of our research project.

When you arrived today, each of you pick a badge, like this one, have a look at your badge. In the bottom right corner you will see either "AM" or "PM". If you see "AM" on your badge, you will play the games in the morning and do the survey in the afternoon. If you see "PM" on your badge, you will do the survey in the morning and play the games in the afternoon.

In a few minutes, <NAME> will invite the "PM" people to go with her to <LOCATION>. The "AM" people will stay here for their games. But first we would like to engage you all in an activity together.

[Do subjective ranking task. Then send "PM"s off. Then say…]

OK. So, we are now going to play three different games. It is important for our research that, during the games, each of you makes your own decision. So, we ask that you do not talk to one another and that you do not try to see what other people are doing.

As far as we are concerned, there are no “right” and “wrong” decisions in the games. It is up to each of you to make the decisions that you feel are right for you.

Remember, each of the games will be played with money and each of you will take home the money you get in the games. Here is the money we will be handing out to you *[Show them the money].* We will be paying you at the end of the day, once all of the games and surveys are complete. In the meantime, Ashira will be keeping careful accounts of how much each of you get in each of the games.

OK, I think we are ready to start the first game.

[Play the PGG]

6.2 Public Goods Game Scripts

6.2.1 Symmetric PGG With Electric Fence Frame

Presentation to the group to be given by the script-reader

We are now ready to begin the second game. This game is designed to simulate a type of dilemma that many of us find ourselves in from time to time.

Consider, for example, a farming village bordering a "nature reserve" that has an **electric fence** all the way around its edge to protect the crops from elephants. If the fence is poorly maintained, it is more likely to breakdown and ALL of the farmers' crops are more likely to be damaged by the elephants. Imagine that there is no government or external assistance if the fence breaks down and that the farmers are responsible for the maintenance of the fence. If all the farmers contribute time, effort, and materials, the fence can be maintained easily. However, each farmer knows that, if HE DOES NOT CONTRIBUTE, the other farmers' contributions will be enough to keep the fence in good order. So, he could benefit from the fence without spending any personal resources. The problem is that if most of the farmers think this way and decide NOT TO CONTRIBUTE they all suffer the consequences of being less well protected.

So, the dilemma for each farmer is:-

1. Contribute to maintaining the fence and benefit all farmers, bearing in mind that others may not contribute and therefore be taking advantage of him, or

2. Do not contribute to maintaining the fence in the hope that others will, bearing in mind that if most of the farmers decide not to contribute, both he and everyone else could end up with damaged crops.

OK. So, now I am going to describe the game. [*Assistants hand out PGG vouchers being very careful to match the ID numbers on the vouchers to the ID numbers on the participant's badges.*]

This game involves all of you. Each of you is going to make a decision which is a bit like the decision the farmers in the electric fence example faced. Each of you will earn between Rs.60 and Rs.1300 from this game. The exact amount that each of you will earn depends on the decisions that you and everyone else make in the game.

Your decisions in this game will be strictly confidential. In order to guarantee confidentiality we ask you not to communicate with each other at any time during the game. If you talk to each other we will have to stop the game and nobody will earn any money.

By now, you should all have a voucher [*hold up an example of a voucher*] that looks like this on one side [*point to the enlarged image of a voucher on the first poster for the game (PGG poster 1)*]. This voucher is worth money and you are going to use it to play the game.

Each of you has to decide whether to put your voucher in:

- your **INDIVIDUAL** account

  [*"draw" a circle around the I on the poster using your finger*]

or

- a **GROUP** account

  [*"draw" a circle around the G on the poster using your finger*]

If you put your voucher in the GROUP account you will receive **Rs.60** for each and every voucher that you and the other participants put in the GROUP account.

If you put your voucher in your INDIVIDUAL account you will receive a fixed private return of **Rs.400** from YOUR voucher **PLUS Rs.60** for each and every voucher that the other participants put in the GROUP account.

In the middle of your voucher [*hold up the example voucher again and, at the same time, point to the poster*] you will see two big letters: a letter **I** and a letter **G** ["*draw" a circle around each letter on the poster using your finger as you mention it*]. The letter I, on the left, stands for "INDIVIDUAL account"; the letter G, on the right, stands for "GROUP account". If you want to put your voucher in your INDIVIDUAL account you must to draw a circle around the letter I. If you want to put your voucher in the GROUP account you must draw a circle around the letter G.

We will now go through some examples. [*At the top of the flip chart, write the letter "I" on the left and the letter "G" to its right*].

1. Suppose that you put your voucher in the GROUP account, which means that you circled the letter G on your voucher. [*Circle the letter G at the top of the flip chart*]. And suppose that **everyone** [*make a wide circling gesture around all of the participants*], all 16 of you, put your vouchers in the GROUP account. *[Write 16 below the letter G and 0 below the letter I*].

Then you and each of the other participants would receive 60x16=Rs.960 from this game.*[Write 60x16=960 in a box just to the right of or below the number 16, below the*

letter G. Link the number 16 and the box with an arrow. Make sure that you leave around half of the flip chart page for example 2].

Here is another example:

2. Suppose that you put your voucher in the GROUP account, which means that you circled the letter G on your voucher. [*Point the letter G on the board that you have circled before]* And suppose that, in total, **two** people put their vouchers in their INDIVIDUAL accounts and **14 people**, you and 13 others, put their vouchers in the GROUP account. *[Write the number 2 below the letter I and the number 14 below the letter G]*.

Then YOU and the other participants who put their vouchers in the GROUP account would each receive 60x14=Rs.840 *[write 840 in a box just to the right of the number 14*]. And each of the participants who put their vouchers in their INDIVIDUAL accounts would each receive Rs.840 from the GROUP account PLUS Rs.400 from their INDIVIDUAL account, making a total of Rs.1240 [*write 1240 in a box just to the left of the number 2*].

Here is another example [*Start a new page on the flip chart. At the top, write the letter "I" on the left and the letter "G" to its right*]:

3. Suppose that you put your voucher in your INDIVIDUAL account, which means that you circled the letter I on your voucher. *[Circle the letter I on the flip chart]*. And suppose that, in total, **10 people**, you and 9 others, put their vouchers in their INDIVIDUAL accounts *[write 10 under the letter I*] and **6 people** put their vouchers in the GROUP account [*write 6 under the letter G*].

Then, each of the participants who put their vouchers in the GROUP account would receive 60x6=Rs.360 [*write 360 in a box to the right of the number 6*]. And you and each of the other people who put their vouchers in their INDIVIDUAL accounts would each receive Rs.360 from the GROUP account PLUS Rs.400 from their INDIVIDUAL account, making a total of Rs.760 [*write 760 in a box to the left of the number 10. Make sure that you leave around half of the flip chart page for example 4*].

Here is another example:

4. Suppose that you put your voucher in your INDIVIDUAL account, which means that you circled the letter I on your voucher. And suppose that everyone put their vouchers in their INDIVIDUAL accounts. Then, since nobody put their vouchers in the GROUP account, nobody gets anything from that account and everybody goes home with the Rs.400 from their INDIVIDUAL account.

Is everybody beginning to understand the game?

Putting your voucher in the GROUP account [*point to the letter G on the poster*] is like contributing to the maintenance of the **electric fence**. It benefits everyone, even those who put their vouchers in their INDIVIDUAL accounts. Putting your voucher in your INDIVIDUAL account [*point to the letter I on the poster*] is like choosing NOT to contribute to the maintenance of the **electric fence –** you benefit from the contributions of others but without having made a contribution yourself.

Let's go through a few more examples together.

5. Suppose that in total, 6 people put their vouchers in their INDIVIDUAL accounts [*write the number 6 below the letter I*]. Can anyone tell me how many people put their vouchers in the GROUP account? *(10) [After people answer the question, write the*

number 10 below the letter G]. Then, how much did the people who put their vouchers in the GROUP account get? (60 x 10 = 600) *[After people answer the question, write this amount in a box to the right of the number 10, as before]*. And how much did the people who put their vouchers in the INDIVIDUAL account get? (600 + 400 = 1000) *[After people answer this question, write this amount in a box to the left of the number 6*].

6. Suppose that in total, 8 people put their vouchers in their INDIVIDUAL accounts [*write the number 8 below the letter I*]. Can you tell me how many people put their voucher in the GROUP account? *(8) [After people answer the question, write the number 8 below the letter G]*. Then, how much did the people who put their vouchers in the GROUP account get? (60 x 8 = 480) *[After people answer the question, write this amount in a box to the right of the number 8 below the G]*. And how much did the people who put their vouchers in their INDIVIDUAL accounts get? (400 + 480 = 880) *[After people answer this question, write this amount to the left of the number 8 below the I*].

7. Suppose that in total, 1 person put their vouchers in the GROUP account [*write the number 1 below the letter G*]. Can you tell me how many people put in their vouchers in their INDIVIDUAL accounts? *(15) [After people answer the question, write the number 15 below the letter I*]. Then, how much did the person who put his voucher in the GROUP account get? (60 x 1 = 60) [*After people answer the question, write this amount in a box to the right of the number 1*]. And how much did the people who put their vouchers in their INDIVIDUAL accounts get? (400 + 60 = 460) *[After people answer this question, write this amount in a box to the left of the number 15*].

Does everyone now understand how the game works?

Are you sure? (ask the people who have been quiet if they understood)

Remember that the decisions each of you make in this game are confidential. Each of you can be confident that the other 15 participants in the game will never be told your decision, unless, of course, you choose to tell them.

We are now going to give you each a pen so that you can make your decisions [*assistants hand out the pens. Script reader wait until everyone has a pen*]. If you want to put your voucher in your INDIVIDUAL account, you must draw a circle around the letter I [*point to I on poster*]. If you want to put your voucher in the GROUP account, you must draw a circle around the letter G [*point to G on poster*].

If you have any questions about how to play this game, raise your hand. [*Assistants go to participants who raise their hand. Responses to participants questions must be in line with script. If participants want to be told what is the "right" thing to do, the appropriate response is "that is entirely up to you."*]

Once you have made your decision, fold your voucher in half so that no one can see which letter you circled.

[*Wait until you think all or most of the participants have made their decisions then…*] Has everyone made their decision? Please raise your hand if you have made your decision. [*Assistants note who has not raised their hand, go to them and help, bearing in mind that the decision has to be had by the participant. Ashira makes a note of the IDs of participants needing extra assistance. Once all the participants have made their decisions…*]

Now, on one side of your folded voucher you will find a table of numbers like this [*point to the enlarged image of the table of numbers on the second poster for the game (PGG*

poster 2)] Notice that numbers start at zero [*point at the 0 on the poster*] and end at 15 [*point at the 15 on the poster*].

Before we collect in your vouchers and work out your earnings from this game, we would like you to do one more thing. We would like you to try and imagine what the other 15 participants, i.e., all the participants EXCLUDING YOURSELF, chose to do in the game. Then, we would like you to indicate the number of other participants that you believe chose to put their voucher in the GROUP account by circling that number on your voucher.

For example, if you believe that no one among the 15 other participants put their voucher in the GROUP ACCOUNT, circle 0 [*"draw" a circle around the 0 on the poster with your finger*]. If you believe that all of the other 15 put their vouchers in the GROUP ACCOUNT, circle 15 [*"draw" a circle around the 15 on the poster with your finger*]. If you believe that 7 out of the other 15 participants put their voucher in the GROUP ACCOUNT, circle 7 [*"draw" a circle around the 7 on the poster with your finger*].

When you are done please raise your hand and one of our assistants will come and collect your voucher [a*ssistants should move among the participants with boxes into which the participants can drop/post their completed vouchers*].

Payment

[The research assistant(s) will collect up all the vouchers and take them to Ashira, who will enter the participants' decisions into the spreadsheet that computes their payoffs.]

6.2.2 Asymmetric PGG With Electric Fence Frame

Presentation to the group to be given by script-reader

We are now ready to begin the second game. This game is designed to simulate a type of dilemma that many of us find ourselves in from time to time.

Consider, for example, a farming village bordering a "nature reserve" that has an **electric fence** all the way around its edge to protect the crops from elephants. The fence is of greatest importance to farmers with fields right next to the "nature reserve" or close to a water source, as the elephants are most likely to encroach on these. However, there is no telling exactly where the elephants will do their damage. If the fence is poorly maintained, it is more likely to breakdown. Then, ALL of the farmers' crops are more likely to be damaged by the elephants, although the farmers with fields next to the "nature reserve" or close to a water source are MOST vulnerable. If all the farmers contribute time, effort, and materials, the fence can be maintained easily. However, each farmer knows that, if HE DOES NOT CONTRIBUTE, the other farmers' contributions will be enough to keep the fence in good order. So, he could benefit from the fence without spending any personal resources. The problem is that if most of the farmers think this way and decide NOT TO CONTRIBUTE they all suffer the consequences of being less well protected.

So, the dilemma for each farmer is:-

1. Contribute to maintaining the fence and benefit all farmers – both those for whom the fence is really important and those for whom it is less important – bearing in mind that others may not contribute and therefore be taking advantage of him, or

2. Do not contribute to maintaining the fence in the hope that others will, bearing in mind that if most of the farmers decide not to contribute, both he and everyone else could end up with damaged crops.

OK. So, now I am going to describe the game. [*Assistants hand out PGG vouchers being very careful to match the ID numbers on the vouchers to the ID numbers on the participant's badges.*]

This game involves all of you. Each of you is going to make a decision which is a bit like the decision the farmers in the electric fence example faced. Each of you will earn between Rs.40 and Rs.1600 from this game. The exact amount that each of you will earn depends on:

- the type of game participant you are; and
- the decisions that you and everyone else make during the game.

Your decisions in this game will be strictly confidential. In order to guarantee confidentiality we ask you not to communicate with each other at any time during the game. If you talk to each other we will have to stop the game and nobody will earn any money.

By now, you should all have a voucher [*hold up an example of a voucher*] that looks like this on one side [*point to the enlarged image of a voucher on the first poster for the game (PGG poster 1)*]. This voucher is worth money and you are going to use it to play the game.

First, I want you to look at the box in the top right-hand corner of your voucher [*point to the box in the top right-hand corner of the voucher on the first poster*]. If, when you arrived today, you picked a badge [*wave conference badge at them*] with an EVEN ID number on it, this box on your voucher will contain "↑" [*briefly, hold the "↑" card up to the box on the poster*]. This means that in the game you are like the farmers in the example for whom the electric fence was very important. When talking about the game, I am going to call you "HIGH-RISK TYPE PARTICIPANTS".

If, when you arrived today, you picked a badge with an ODD ID number on it, this box on your voucher will contain "↓" [*briefly, hold the "↓" card up to the box on the poster*]. This means that in the game you are like the farmers in the example for whom the electric fence was less important. When talking about the game, I am going to call you "LOW-RISK TYPE PARTICIPANTS".

Take a close look at your voucher and make sure that you know whether you are an HR-TYPE PARTICIPANT [*hold "↑" card up*] or an LR-TYPE PARTICIPANT [*hold "↓" card up.*] This is one of the things that will affect your earnings from the game.

OK. Now I am going to talk about the decision you are each going to make in the game and how your decisions affect everyone's earnings. Each of you has to decide whether to put your voucher in:

your **INDIVIDUAL** account

[*"draw" a circle around the I on the poster using your finger*]

or

- a **GROUP** account

[*"draw" a circle around the G on the poster using your finger*]

If you put your voucher in the GROUP account [*circle the G again using your finger*] and you are an HR-TYPE PARTICIPANT you will receive **Rs.80** for each and every voucher that you and the other participants put in the GROUP account.

If you put your voucher in the GROUP account [*circle the G again using your finger*] and you are an LR-TYPE PARTICIPANT you will receive **Rs.40** for each and every voucher that you and the other participants put in the GROUP account.

If you put your voucher in your INDIVIDUAL account [*circle the I again using your finger*] and you are an HR-TYPE PARTICIPANT you will receive a fixed private return of **Rs.400** from YOUR voucher **PLUS Rs.80** for each and every voucher that the other participants put in the GROUP account.

If you put your voucher in your INDIVIDUAL account [*circle the I again using your finger*] and you are an LR-TYPE PARTICIPANT you will receive a fixed private return of **Rs.400** from YOUR voucher **PLUS Rs.40** for each and every voucher that the other participants put in the GROUP account.

In the middle of your voucher [*hold up the example voucher again and, at the same time, point to the poster*] you will see two big letters: a letter **I** and a letter **G** ["*draw" a circle around each letter on the poster using your finger as you mention it*]. The letter I, on the left, stands for "INDIVIDUAL account"; the letter G, on the right, stands for "GROUP account". If you want to put your voucher in your INDIVIDUAL account you

must to draw a circle around the letter I. If you want to put your voucher in the GROUP account you must draw a circle around the letter G.

We will now go through some examples. [*At the top of the flip chart, write the letter "I" on the left and the letter "G" to its right*].

1a. Suppose that you are an **HR**-TYPE PARTICIPANT [*blue-tac the "↑" card into the box in the top right-hand corner of the poster*] and put your voucher in the GROUP account, which means that you circled the letter G on your voucher. [*Circle the letter G at the top of the flip chart*]. And suppose that **everyone** [*make a wide circling gesture around all of the participants*], all 16 of you, put your vouchers in the GROUP account. *[Write 16 below the letter G and 0 below the letter I*].

Then you and each of the other **HR**-TYPE PARTICIPANTs would receive 80x16=Rs.1280 from this game.[*Write HR: 80x16=1280 in a box just to the right of or below the number 16, below the letter G. Link the number 16 and the box with an arrow. Make sure that the box is larger enough to take another line of calculation.*] And each of the **LR**-TYPE PARTICIPANTs would receive 40x16=Rs.640. [*Write LR: 40x16=640 in the box. Make sure that you leave around half of the flip chart page for example 2*].

1b. Now, suppose that you are an **LR**-TYPE PARTICIPANT [*replace the "↑" card with the "↓" card in the box in the top right-hand corner of the poster*] and you and everyone else put their vouchers in the GROUP account [c*ircle the letter G at the top of the flip chart*]. Then you would earn Rs.640 [*point to where you have written LR: 40x16=640*].

Here is another example:

2a. Suppose that you are an **LR**-TYPE PARTICIPANT and you put your voucher in the GROUP account, which means that you circled the letter G on your voucher. [*Point the letter G on the board that you have circled before]* And suppose that, in total, **two** people put their vouchers in their INDIVIDUAL accounts and **14 people**, you and 13 others, put their vouchers in the GROUP account. *[Write the number 2 below the letter I and the number 14 below the letter G]*.

Then, YOU and each of the other **LR**-TYPE PARTICIPANTs who put their vouchers in the GROUP account would each receive 40x14=Rs.560 *[write LR: 560 in a box just to the right of the number 14*].

The **HR**-TYPE PARTICIPANTs who put their vouchers in the GROUP account would each receive 80x14=Rs.1120 *[write HR: 1120 in the same box*].

The **LR**-TYPE PARTICIPANTs who put their vouchers in the INDIVIDUAL account would each receive Rs.560 from the GROUP account PLUS Rs.400 from their INDIVIDUAL account, making a total of Rs.960 [*write LR: 960 in a box just to the left of the number 2*]

The **HR**-TYPE PARTICIPANTs who put their vouchers in the INDIVIDUAL account would each receive Rs.1120 from the GROUP account [*point to where you have just written 1120*] PLUS Rs.400 from their INDIVIDUAL account, making a total of Rs.1520 [*write HR: 1520 in the same box as the LR: 960*].

2b. Suppose that you are an **HR**-TYPE PARTICIPANT [*replace the "↓" card with the "↑" card in the box in the top right-hand corner of the poster*] and you and 13 others, so 14 in total, put their vouchers in the GROUP account [c*ircle the letter G*] and two

people put their vouchers in their INDIVIDUAL accounts [*circle the letter I*]. Then you would earn Rs.1120 [*point to where you have written HR: 1120*].

Here is another example [*Start a new page on the flip chart. At the top, write the letter "I" on the left and the letter "G" to its right*]:

3a. Suppose that you are an **HR**-TYPE PARTICIPANT and you put your voucher in your INDIVIDUAL account, which means that you circled the letter I on your voucher. *[Circle the letter I on the flip chart]*. And suppose that, in total, **10 people**, you and 9 others, put their vouchers in their INDIVIDUAL accounts *[write 10 under the letter I*] and **6 people** put their vouchers in the GROUP account [*write 6 under the letter G*].

Then, each of the **HR**-TYPE PARTICIPANTs who put their vouchers in the GROUP account would receive 80x6=Rs.480 [*write HR: 480 in a box to the right of the number 6*].

YOU and the other **HR**-TYPE PARTICIPANTs who put their vouchers in their INDIVIDUAL accounts would receive Rs.480 from the GROUP account PLUS Rs.400 from their INDIVIDUAL account, making a total of Rs.880 [*write HR: 880 in a box to the left of the number 10.*

Each of the **LR**-TYPE PARTICIPANTs who put their vouchers in the GROUP account would receive 40x6=Rs.240 [*write LR: 240 in a box to the right of the number 6*].

Make sure that you leave around half of the flip chart page for example 4].

3b. Suppose that you are an **LR**-TYPE PARTICIPANT [*replace the HR card with the LR card in the box in the top right-hand corner of the poster*] and you and 9 others, so

10 in total, put their vouchers in their INDIVIDUAL accounts [c*ircle the letter I*] and 6 people put their vouchers in their GROUP accounts [*circle the letter I*]. Then you would earn Rs.240 PLUS Rs.400 from their INDIVIDUAL account, making a total of Rs.440 [*point to where you have written LR: 440*].

Here is another example:

4. Suppose that you put your voucher in your INDIVIDUAL account, which means that you circled the letter I on your voucher. And suppose that everyone put their vouchers in their INDIVIDUAL accounts. Then, since nobody put their vouchers in the GROUP account, nobody gets anything from that account and everybody goes home with the Rs.400 from their INDIVIDUAL account.

Is everybody beginning to understand the game?

Putting your voucher in the GROUP account [*point to the letter G on the poster*] is like contributing to the maintenance of the **electric fence**. It benefits everyone, even those who put their vouchers in their INDIVIDUAL accounts. Although it benefits the HR-TYPEs twice as much as it benefits the LR-TYPEs. Putting your voucher in your INDIVIDUAL account [*point to the letter I on the poster*] is like choosing NOT to contribute to the maintenance of the **electric fence –** you benefit from the contributions of others but without having made a contribution yourself.

Let's go through a few more examples together.

5. Suppose that in total, 6 people put their vouchers in their INDIVIDUAL accounts [*write the number 6 below the letter I*]. Can anyone tell me how many people put their vouchers in the GROUP account? *(10)* [*After people answer the question, write the*

number 10 below the letter G]. Then, how much did the HR-TYPEs who put their vouchers in the GROUP account get? (80 x 10 = 800) [*After people answer the question, write HR: 800 in a box to the right of the number 10, as before*]. And how much did the LR-TYPEs who put their vouchers in the GROUP account get? (40 x 10 = 400) [*After people answer the question, write LR: 400 in the same box*]. And how much did the HR-TYPEs who put their vouchers in the INDIVIDUAL account get? (800 + 400 = 1200) [*After people answer this question, write HR: 1200 in a box to the left of the number 6*]. And, finally, how much did the LR-TYPEs who put their vouchers in the INDIVIDUAL account get? (400 + 400 = 800) *[After people answer this question, write LR: 800 in the same box*].

6. Suppose that in total, 8 people put their vouchers in their INDIVIDUAL accounts [*write the number 8 below the letter I*]. Can you tell me how many people put their voucher in the GROUP account? *(8) [After people answer the question, write the number 8 below the letter G]*. Then, how much did the HR-TYPEs who put their vouchers in the GROUP account get? (80 x 8 = 640) [*After people answer the question, write HR: 640 in a box to the right of the number 8 below the G*]. And how much did the LR-TYPEs who put their vouchers in the GROUP account get? (40 x 8 = 320) [*After people answer the question, write LR: 320*]. And how much did the HR-TYPEs who put their vouchers in their INDIVIDUAL accounts get? (400 + 640 = 1040) [*After people answer this question, write HR: 1040 to the left of the number 8 below the I*]. And, finally, how much did the LR-TYPEs who put their vouchers in their INDIVIDUAL accounts get? (400 + 320 = 720) [*After people answer this question, write LR: 720*].

7. Suppose that in total, 1 person puts their voucher in the GROUP account [*write the number 1 below the letter G*]. Can you tell me how many people put in their vouchers

in their INDIVIDUAL accounts? *(15) [After people answer the question, write the number 15 below the letter I*]. Then, how much would the person who put his voucher in the GROUP account get if he was an LR-TYPE? (40 x 1 = 40) [*After people answer the question, write LR: 40 to the right of the number 1*]. And if he was an HR-TYPE? (80 x 1 = 80) [*After people answer this question, write HR: 80*]. And how much would the other LR-TYPES, the ones who put their vouchers in their INDIVIDUAL accounts get? (400 + 40 = 440) *[After people answer this question, write LR: 440 to the left of the number 15*]. And how much would the HR-TYPES who put their vouchers in their INDIVIDUAL accounts get? (400 + 80 = 480) *[After people answer this question, write HR: 480*].

Does everyone now understand how the game works?

Are you sure? (ask the people who have been quiet if they understood)

Remember that the decisions each of you make in this game are confidential. Each of you can be confident that the other 15 participants in the game will never be told your decision, unless, of course, you choose to tell them.

We are now going to give you each a pen so that you can make your decisions [*assistants hand out the pens. Script reader wait until everyone has a pen*]. If you want to put your voucher in your INDIVIDUAL account, you must draw a circle around the letter I [*point to I on poster*]. If you want to put your voucher in the GROUP account, you must draw a circle around the letter G [*point to G on poster*].

If you have any questions about how to play this game, raise your hand. [*Assistants go to participants who raise their hand. Responses to participants questions must be in line*

with script. If participants want to be told what is the "right" thing to do, the appropriate response is "that is entirely up to you."]

Once you have made your decision, fold your voucher in half so that no one can see which letter you circled.

[*Wait until you think all or most of the participants have made their decisions then…*] Has everyone made their decision? Please raise your hand if you have made your decision. [*Assistants note who has not raised their hand, go to them and help, bearing in mind that the decision has to be had by the participant. Ashira makes a note of the IDs of participants needing extra assistance. Once all the participants have made their decisions…*]

Now, on one side of your folded voucher you will find a table of numbers like this [*point to the enlarged image of the table of numbers on the second poster for the game (PGG poster 2)*] Notice that numbers start at zero [*point at the 0 on the poster*] and end at 15 [*point at the 15 on the poster*].

Before we collect in your vouchers and work out your earnings from this game, we would like you to do one more thing. We would like you to try and imagine what the other 15 participants, i.e., all the participants EXCLUDING YOURSELF, chose to do in the game. Then, we would like you to indicate the number of other participants that you believe chose to put their voucher in the GROUP account by circling that number on your voucher.

For example, if you believe that no one among the 15 other participants put their voucher in the GROUP ACCOUNT, circle 0 [*"draw" a circle around the 0 on the poster with your finger*]. If you believe that all of the other 15 put their vouchers in the

GROUP ACCOUNT, circle 15 [*"draw" a circle around the 15 on the poster with your finger*]. If you believe that 7 out of the other 15 participants put their voucher in the GROUP ACCOUNT, circle 7 [*"draw" a circle around the 7 on the poster with your finger*].

When you are done please raise your hand and one of our assistants will come and collect your voucher [a*ssistants should move among the participants with boxes into which the participants can drop/post their completed vouchers*].

Payment

[The research assistant(s) will collect up all the vouchers and take them to Ashira, who will enter the participants' decisions into the spreadsheet that computes their payoffs.]

6.3 Gamble Choice Task Script

Script to be read out by script reader to all the subjects attending a particular experimental session

We are now ready to talk about the first game. In this game each of you is going to make a decision. The decision you make will affect how much you are likely to earn from the game. So, please listen carefully. This is what we are going to do.

1. First, I am going to describe six options to you.
2. Second, we are going to work through some examples together.
3. Third, you are each going to choose the option that you want in private with one of our assistants who will be seated over there [*point to area where research assistants will be*]. Your choice will be recorded on a piece of paper.
4. And finally, later on, each of you will meet with Ashira Miss. She will know the option that you picked and will work through it with you. She will then record the outcome and calculate and tell you how much you have earned. You will receive your earnings at the end of the session.

Take a look at this card [*point to poster*]. It shows the six options that you have to choose between [*point and count, 1, 2, 3, 4, 5, 6*]. Whichever option you choose, your earnings are going to be decided by the outcome of playing a game which I will describe to you and that you will each play with Ashira Miss. I am going to put this blue counter and this yellow counter in my hand like this. Then I am going to put my hands together behind my back and shake the counters like this. Then I am going to make sure that there is one counter in each hand and put them in front of you like this. Then you have to pick one. If you pick the hand with the blue counter in, you earn the amount of money

shown on the blue side of the picture. If you pick the hand with the yellow counter in, you earn the amount of money shown on the yellow side of the picture.

Before we go any further, which do you think is more likely, that you find the blue counter or the yellow counter? [*Correct answer – neither, they are equally likely. Record their answer. If they got it wrong, explain correct answer to them*.]

[*While teaching the game refer to the card all the time. Point to the appropriate images on the card and make sure that the player is looking, seeing, and concentrating.*]

If you choose option A and then pick the hand with the blue counter in it you earn Rs.200. If you choose option A and then pick the hand with the yellow counter in it you earn Rs.200. So, in option A you earn Rs.200 whatever happens.

If you choose option B and then pick the hand with the blue counter in it you earn Rs.380. If you choose option B and then pick the hand with the yellow counter in it you earn Rs.180.

If you choose option C and then pick the hand with the blue counter in it you earn Rs.480. If you choose option C and then pick the hand with the yellow counter in it you earn Rs.160.

If you choose option D and then pick the hand with the blue counter in it you earn Rs.600. If you choose option D and then pick the hand with the yellow counter in it you earn Rs.120.

If you choose option E and then pick the hand with the blue counter in it you earn Rs.760. If you choose option E and then pick the hand with the yellow counter in it you earn Rs.40.

If you choose option F and then pick the hand with the blue counter in it you earn Rs.800. If you choose option F and then pick the hand with the yellow counter in it you earn nothing.

So, now let us work through some examples together.

1. First, imagine that you choose D. Then we play the game [*play with them*]. You picked the hand with the yellow (blue) counter in so you earn how much? [*Correct answer is Rs.120 (Rs.600).*] And what if you had picked the hand with the blue (yellow) counter in, how much would you earn then? [*Correct answer is Rs.600 (Rs.120).*]

2. Now, imagine that you choose F. Then we play the game [*play with them*]. You picked the hand with the yellow (blue) counter in so you earn how much? [*Correct answer is nothing (Rs.800).*] And what if you had picked the hand with the blue (yellow) counter in, how much would you earn then? [*Correct answer is Rs.800 (nothing).*]

3. Now, imagine that you choose A. Then we play the game [*play with them*]. You picked the hand with the yellow (blue) counter in so you earn how much? [*Correct answer is Rs.200.*] And what if you had picked the hand with the blue (yellow) counter in, how much would you earn then? [*Correct answer is Rs.200.*]

4. Now, imagine that you choose C. Then we play the game [*play with them*]. You picked the hand with the yellow (blue) counter in so you earn how much? [*Correct answer is Rs.160 (Rs.480).*] And what if you had picked the hand with the blue (yellow) counter in, how much would you earn then? [*Correct answer is Rs.480 (Rs.160).*]

5. Now, imagine that you choose E. Then we play the game [*play with them*]. You picked the hand with the yellow (blue) counter in so you earn how much? [*Correct answer is Rs.40 (Rs.760).*] And what if you had picked the hand with the blue (yellow) counter in, how much would you earn then? [*Correct answer is Rs.760 (Rs.40).*]

6. Now, imagine that you choose B. Then we play the game [*play with them*]. You picked the hand with the yellow (blue) counter in so you earn how much? [*Correct answer is Rs.180 (Rs.380).*] And what if you had picked the hand with the blue (yellow) counter in, how much would you earn then? [*Correct answer is Rs.380 (Rs.180).*]

Now it is time for you to make your choice. It is important that you do not discuss your choice with anyone else here.

I would now like to invite you one at a time to see [*researcher assistant's name*] and make your decision with them in private. [*Direct each farmer one a time to a research assistant in the next area.*] After you have told him/her your decision, please return to your seat. We will play the game with each of you at the end of the workshop and calculate how much you have earned.

Script to be read out by the script-reader to each individual farmer and research assistant plays the game with the farmer

We will now play the game [*Ashira observes and records the outcome.*]

So, you have earned Rs.... I will write that amount on this piece of paper. [*Write their earnings on the form.*]

Thank you.

6.4 The Risk-and-Sharing Game Group Training Script

Now we are ready to play the third and final game. You are going to play this game in pairs. Each of you has been paired with someone else who is sitting here. You will never know who you are paired with. Only the computer *[point to Ashira's computer]* knows who is paired with whom.

Each of you is going to play a game of which-hand-is-it-in as in the last game. However, this time you will be playing one or other of these games *[reveal RSG Poster 1]*.

If you were play this which-hand-is-it-in game *[circle your finger around option S on the poster]* and you picked the hand with the blue counter in it *[circle your finger around the blue segment of option S on the poster]* you would get Rs760.

If you were play this which-hand-is-it-in game *[circle your finger around option S on the poster]* and you picked the hand with the yellow counter in it *[circle your finger around the blue segment of option S on the poster]* you would get Rs360.

If you were play this which-hand-is-it-in game *[circle your finger around option H on the poster]* and you picked the hand with the blue counter in it *[circle your finger around the blue segment of option S on the poster]* you would get Rs1520.

If you were play this which-hand-is-it-in game *[circle your finger around option H on the poster]* and you picked the hand with the yellow counter in it *[circle your finger around the blue segment of option S on the poster]* you would get Rs80.

[Now go to the section of this script that relates to the treatment being applied in current workshop.]

6.4.1 Treatment: Assigned

However, this game is different to the last which-hand-is-it-in game in two important ways.

First, you don't get to choose which which-hand-is-it-in game you play. If, when you arrived, you picked an ID badge with a number between 1 and 8 on it, you are going to play this game *[circle option S with your finger]*. And if, when you arrived, you picked an ID badge with a number between 9 and 16 on it, you are going to play this game *[circle option H with your finger]*.

And second, in this game, if you want to, you can share the money you get with the person you have been paired with. Let me explain this second difference in a bit more detail by going through some examples.

[Example 1]

Suppose your badge ID number is between 1 and 8. So, you are going to play this which-hand-is-it-in game *[circle option S with your finger]*. And suppose that when you play this game you find the blue counter and, so, get Rs760 *[circle your finger around the blue segment of option S]*. And suppose that the person you are paired with has a badge ID number between 9 and 16, so plays this game *[circle option H with your finger]*, and finds the yellow counter, so gets Rs80 *[circle your finger around the yellow segment of option H]*.

Then, the pair of you are in this situation *[reveal RSG Poster 2, but with the right-hand side covered up (with a piece of paper or some such)]*. So, you have Rs760 *[circle the blue segment of the option S at the bottom of the poster with your finger]* and the person you are playing with has Rs80 *[circle the yellow segment of the option H at the top of the poster with your finger]*.

In this situation, you have the most money. So, it is up to you to decide whether you want to leave things as they are *[circle both options in one]* or share *[reveal the right-hand side of the poster]*. If you decide to share, Ashira takes the money that you both got from your which-hand-is-it-in games *[circle both options on left-hand side of the poster in one]* and divides it equally between the two of you *[point to one of the "piles" of Rs420 and then the other]*. So, in this case, you would each get Rs420.

[Example 2]

Here is another example *[return to RSG Poster 1]*

Suppose your badge ID number is between 1 and 8. So, you are going to play this which-hand-is-it-in game *[circle option S with your finger]*. And suppose that when you play this game you find the yellow counter and, so, get Rs360 *[circle your finger around the yellow segment of option S]*. And suppose that the person you are paired with also has a badge ID number between 1 and 8, so also plays this game *[circle option S with your finger]*, but finds the blue counter, so gets Rs760 *[circle your finger around the blue segment of option S]*.

Then, the pair of you are in this situation *[reveal RSG Poster 3, but with the right-hand side covered up (with a piece of paper or some such)]*. So, you have Rs360 *[circle the yellow segment of the option S at the bottom of the poster with your finger]* and the person you are playing with has Rs760 *[circle the blue segment of the option S at the top of the poster with your finger]*.

In this situation, the person you are playing with has the most money. So, it is up to him to decide whether he wants to leave things as they are *[circle both options in one]* or share *[reveal the right-hand side of the poster]*. If he decides to share, Ashira takes the money that you both got from your which-hand-is-it-in games *[circle both options on left-hand side of the poster in one]* and divides it equally between the two of you *[point*

to one of the "piles" of Rs560 and then the other]. So, in this case, you would each get Rs560.

So, as you can see, if it is you who gets the most money from your which-hand-is-it-in game, you are the one who decides whether to share or leave things as they are. And, if it is the person you are playing with who gets the most money from his which-hand-is-it-in game, then, he is the one who decides whether to share or leave things as they are. Of course, it could be that you both get the same amount from your which-hand-is-it-in games. In this case, no-one has a decision to make.

Now, there is one more twist to the game. Each of you is going to make your decisions about whether to share or not **before** you play your which-hand-is-it-in game. That may sound a bit strange, but I assure you it is possible. Basically, each of you is going to meet with one of our assistants to tell them **what you would do if** the which-hand-is-it-in games that you and the person you are pair with turned out one way, then another, and then another. Once all of your decisions are made they will be put in the computer. Then, you will each meet with Ashira to play your which-hand-is-it-in game. She will enter the outcome of your game, then, the computer will decide which of the decision you and the person you are playing with is relevant and work out how much money each of you is to take home.

Does anyone have any questions? *[Answer questions, aiming to keep to script as much as possible. Do not say anything that could be viewed as prescribing a particular decision.]*

OK. We are ready for you to make your decisions. Each of you will be called by one of us to meet in private to make your decisions. Your decisions will be kept private. Also, remember that you will never know who you are paired with.

6.4.2 Treatment: Chosen

However, this game is different to the last which-hand-is-it-in game in two important ways.

First, you have to choose one of these two which-hand-is-it-in games *[point to each option in turn]*.

And second, in this game, if you want to, you can share the money you get with the person you have been paired with. Let me explain this second difference in a bit more detail by going through some examples.

[Example 1]

Suppose you choose to play this which-hand-is-it-in game *[circle option S with your finger]*. And suppose that when you play this game you find the blue counter and, so, get Rs760 *[circle your finger around the blue segment of option S]*. And suppose that the person you are paired with chooses to play this game *[circle option H with your finger]*, and finds the yellow counter, so gets Rs80 *[circle your finger around the yellow segment of option H]*.

Then, the pair of you are in this situation *[reveal RSG Poster 2, but with the right-hand side covered up (with a piece of paper or some such)]*. So, you have Rs760 *[circle the blue segment of the option S at the bottom of the poster with your finger]* and the person you are playing with has Rs80 *[circle the yellow segment of the option H at the top of the poster with your finger]*.

In this situation, you have the most money. So, it is up to you to decide whether you want to leave things as they are *[circle both options in one]* or share *[reveal the right-hand side of the poster]*. If you decide to share, Ashira takes the money that you both got from your which-hand-is-it-in games *[circle both options on left-hand side of the*

poster in one] and divides it equally between the two of you *[point to one of the "piles" of Rs420 and then the other]*. So, in this case, you would each get Rs420.

[Example 2]

Here is another example *[return to RSG Poster 1]*

Suppose you choose to play this which-hand-is-it-in game *[circle option S with your finger]*. And suppose that when you play this game you find the yellow counter and, so, get Rs360 *[circle your finger around the yellow segment of option S]*. And suppose that the person you are paired with also chooses to play this game *[circle option S with your finger]*, but finds the blue counter, so gets Rs760 *[circle your finger around the blue segment of option S]*.

Then, the pair of you are in this situation *[reveal RSG Poster 3, but with the right-hand side covered up (with a piece of paper or some such)]*. So, you have Rs360 *[circle the yellow segment of the option S at the bottom of the poster with your finger]* and the person you are playing with has Rs760 *[circle the blue segment of the option S at the top of the poster with your finger]*.

In this situation, the person you are playing with has the most money. So, it is up to him to decide whether he wants to leave things as they are *[circle both options in one]* or share *[reveal the right-hand side of the poster]*. If he decides to share, Ashira takes the money that you both got from your which-hand-is-it-in games *[circle both options on left-hand side of the poster in one]* and divides it equally between the two of you *[point to one of the "piles" of Rs560 and then the other]*. So, in this case, you would each get Rs560.

So, as you can see, if it is you who gets the most money from your which-hand-is-it-in game, you are the one who decides whether to share or leave things as they are. And, if

it is the person you are playing with who gets the most money from his which-hand-is-it-in game, then, he is the one who decides whether to share or leave things as they are. Of course, it could be that you both get the same amount from your which-hand-is-it-in games. In this case, no-one has a decision to make.

Now, there is one more twist to the game. Each of you is going to make your decisions about whether to share or not **before** you play your which-hand-is-it-in game. That may sound a bit strange, but I assure you it is possible. Basically, each of you is going to meet with one of our assistants to tell them **what you would do if** the which-hand-is-it-in games that you and the person you are pair with turned out one way, then another, and then another. Once all of your decisions are made they will be put in the computer. Then, you will each meet with Ashira to play your which-hand-is-it-in game. She will enter the outcome of your game, then, the computer will decide which of the decision you and the person you are playing with is relevant and work out how much money each of you is to take home.

Does anyone have any questions? *[Answer questions, aiming to keep to script as much as possible. Do not say anything that could be viewed as prescribing a particular decision.]*

OK. We are ready for you to make your decisions. Each of you will be called by one of us to meet in private to make your decisions. Your decisions will be kept private. Also, remember that you will never know who you are paired with.

6.4.3 Treatment: PosCorr

However, this game is different to the last which-hand-is-it-in game in two important ways.

First, **one** of each pair of participants gets to choose which of these two which-hand-is-it-in games *[point to each option in turn]* **both** members of the pair are going to play. If, when you arrived, you picked an ID badge with a number between 1 and 8 on it, you get to choose which game **both** you and the person you are playing with are going to play. If, when you arrived, you picked an ID badge with a number between 9 and 16 on it, you don't get to choose. You have to play the which-hand-is-it in game that the person you are playing with chose for both of you.

And second, in this game, if you want to, you can share the money you get with the person you have been paired with. Let me explain this second difference in a bit more detail by going through some examples.

[Example 1]

Suppose the person you are playing with decides that you are both going to play this which-hand-is-it-in game *[circle option H with your finger]*. And suppose that when **you** play this game you find the blue counter and, so, get Rs1520 *[circle your finger around the blue segment of option H]*. And suppose that when the person you are paired with plays this game *[circle option H with your finger]*, he finds the yellow counter, so gets Rs80 *[circle your finger around the yellow segment of option H]*.

Then, the pair of you are in this situation *[reveal RSG Poster 4, but with the right-hand side covered up (with a piece of paper or some such)]*. So, you have Rs1520 *[circle the blue segment of the option H at the bottom of the poster with your finger]* and the person you are playing with has Rs80 *[circle the yellow segment of the option H at the top of the poster with your finger]*.

In this situation, you have the most money. So, it is up to you to decide whether you want to leave things as they are *[circle both options in one]* or share *[reveal the right-hand side of the poster]*. If you decide to share, Ashira takes the money that you both got from your which-hand-is-it-in games *[circle both options on left-hand side of the poster in one]* and divides it equally between the two of you *[point to one of the "piles" of Rs800 and then the other]*. So, in this case, you would each get Rs800.

[Example 2]

Here is another example *[return to RSG Poster 1]*

Suppose you are the one who gets to choose the which-hand-is-it-in game and you decide that you are both going to play this which-hand-is-it-in game *[circle option S with your finger]*. And suppose that when **you** play this game you find the yellow counter and, so, get Rs360 *[circle your finger around the yellow segment of option S]*. And suppose that when the person you are paired with plays this game *[circle option S with your finger]*, he finds the blue counter, so gets Rs760 *[circle your finger around the blue segment of option S]*.

Then, the pair of you are in this situation *[reveal RSG Poster 3, but with the right-hand side covered up (with a piece of paper or some such)]*. So, you have Rs360 *[circle the yellow segment of the option S at the bottom of the poster with your finger]* and the

person you are playing with has Rs760 *[circle the blue segment of the option S at the top of the poster with your finger]*.

In this situation, the person you are playing with has the most money. So, it is up to him to decide whether he wants to leave things as they are *[circle both options in one]* or share *[reveal the right-hand side of the poster]*. If he decides to share, Ashira takes the money that you both got from your which-hand-is-it-in games *[circle both options on left-hand side of the poster in one]* and divides it equally between the two of you *[point to one of the "piles" of Rs560 and then the other]*. So, in this case, you would each get Rs560.

So, as you can see, if it is you who gets the most money from your which-hand-is-it-in game, you are the one who decides whether to share or leave things as they are. And, if it is the person you are playing with who gets the most money from his which-hand-is-it-in game, then, he is the one who decides whether to share or leave things as they are. Of course, it could be that you both get the same amount from your which-hand-is-it-in games. In this case, no-one has a decision to make.

Now, there is one more twist to the game. Each of you is going to make your decisions about whether to share or not **before** you play your which-hand-is-it-in game. That may sound a bit strange, but I assure you it is possible. Basically, each of you is going to meet with one of our assistants to tell them **what you would do if** the which-hand-is-it-in games that you and the person you are pair with turned out one way, then another, and then another. Once all of your decisions are made they will be put in the computer. Then, you will each meet with Ashira to play your which-hand-is-it-in game. She will enter the outcome of your game, then, the computer will decide which of the decision you and the person you are playing with is relevant and work out how much money each of you is to take home.

Does anyone have any questions? *[Answer questions, aiming to keep to script as much as possible. Do not say anything that could be viewed as prescribing a particular decision.]*

OK. We are ready for you to make your decisions. Each of you will be called by one of us to meet in private to make your decisions. Your decisions will be kept private. Also, remember that you will never know who you are paired with.

6.4.4 Treatment: NegCorr

However, this game is different to the last which-hand-is-it-in game in two important ways.

First, **one** of each pair of participants gets first pick of these two which-hand-is-it-in games *[point to each option in turn]* and the other members of the pair has to play the other game. If, when you arrived, you picked an ID badge with a number between 1 and 8 on it, you get first pick of the games. If, when you arrived, you picked an ID badge with a number between 9 and 16 on it, you don't get to choose. You have to play the which-hand-is-it-in game that the person you are playing with **did not** pick.

And second, in this game, if you want to, you can share the money you get with the person you have been paired with. Let me explain this second difference in a bit more detail by going through some examples.

[Example 1]

Suppose the person you are playing with picks this which-hand-is-it-in game *[circle option H with your finger]*, which means that you have to play this this game *[circle option S with your finger]*. And suppose that when **you** play this *[circle option S with your finger]* game you find the blue counter and, so, get Rs760 *[circle your finger around the blue segment of option S]*. And suppose that when the person you are paired with plays this game *[circle option H with your finger]*, he finds the yellow counter, so gets Rs80 *[circle your finger around the yellow segment of option H]*.

Then, the pair of you are in this situation *[reveal RSG Poster 2, but with the right-hand side covered up (with a piece of paper or some such)]*. So, you have Rs760 *[circle the blue segment of the option S at the bottom of the poster with your finger]* and the person

you are playing with has Rs80 *[circle the yellow segment of the option H at the top of the poster with your finger]*.

In this situation, you have the most money. So, it is up to you to decide whether you want to leave things as they are *[circle both options in one]* or share *[reveal the right-hand side of the poster]*. If you decide to share, Ashira takes the money that you both got from your which-hand-is-it-in games *[circle both options on left-hand side of the poster in one]* and divides it equally between the two of you *[point to one of the "piles" of Rs420 and then the other]*. So, in this case, you would each get Rs420.

[Example 2]

Here is another example *[return to RSG Poster 1]*

Suppose you get to pick the which-hand-is-it-in game you want to play and you pick this one *[circle option H with your finger]*, which means that the person you are playing with has to play this game *[circle option S with your finger]*. And suppose that when **you** play this game you find the yellow counter and, so, get Rs80 *[circle your finger around the yellow segment of option H]*. And suppose that when the person you are paired with plays this game *[circle option S with your finger]*, he finds the yellow counter, so gets Rs360 *[circle your finger around the blue segment of option S]*.

Then, the pair of you are in this situation *[reveal RSG Poster 5, but with the right-hand side covered up (with a piece of paper or some such)]*. So, you have Rs80 *[circle the yellow segment of the option H at the bottom of the poster with your finger]* and the person you are playing with has Rs360 *[circle the yellow segment of the option S at the top of the poster with your finger]*.

In this situation, the person you are playing with has the most money. So, it is up to him to decide whether he wants to leave things as they are *[circle both options in one]* or

share *[reveal the right-hand side of the poster]*. If he decides to share, Ashira takes the money that you both got from your which-hand-is-it-in games *[circle both options on left-hand side of the poster in one]* and divides it equally between the two of you *[point to one of the "piles" of Rs220 and then the other]*. So, in this case, you would each get Rs220.

[Note that the paragraph about both getting the same is missing. It never happens in this treatment.]

Now, there is one more twist to the game. Each of you is going to make your decisions about whether to share or not **before** you play your which-hand-is-it-in game. That may sound a bit strange, but I assure you it is possible. Basically, each of you is going to meet with one of our assistants to tell them **what you would do if** the which-hand-is-it-in games that you and the person you are pair with turned out one way, then another, and then another. Once all of your decisions are made they will be put in the computer. Then, you will each meet with Ashira to play your which-hand-is-it-in game. She will enter the outcome of your game, then, the computer will decide which of the decision you and the person you are playing with is relevant and work out how much money each of you is to take home.

Does anyone have any questions? *[Answer questions, aiming to keep to script as much as possible. Do not say anything that could be viewed as prescribing a particular decision.]*

OK. We are ready for you to make your decisions. Each of you will be called by one of us to meet in private to make your decisions. Your decisions will be kept private. Also, remember that you will never know who you are paired with.

6.5 RSG Decision Card Scenarios

6.5.1 Assigned Treatment – Badge Number 1 to 8

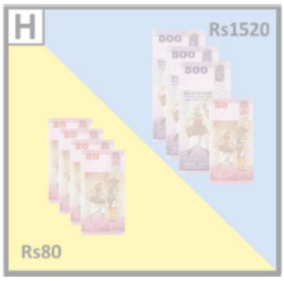
[Check that the correct village ID number, Workshop (morning or afternoon) and Participant badge number have been entered on the# Risk Sharing Game Decision Form.]
[Check that you are using the right set of decision cards given the participant's badge number.]
[Sit according to "Recommended seating plan and card positioning diagram"]
[Have the book of decision cards for participants 1 to 8 open at Card 1]

Because you picked a badge *[point to their conference badge]* with a number between 1 and 8 on it, you are going to play this *[circle option S on Card 1]* which-hand-is-it-in game.
So, if you find the blue counter you will get Rs760 *[point to blue section of option S]* and if you find the yellow count you will get Rs360 *[point to yellow section of option S]*.
The person you are playing the game with could also be playing this *[circle option S on Card 1]* which-hand-is-it-in game or he could be playing this one *[circle option H on Card 1]*.
Now we are going to consider the three possible scenarios which would lead to you having more money than the person you are playing with. In each case, you have to decide whether you are going to leave things as they are or share the winnings equally.

Later on, you are going to go and play this *[circle option S on Card 1]* which-hand-is-it-in game and the person you are playing with will play their game. Then, we will know which of your decisions to use to determine your winnings. This means that any one of the decisions you are about to make could be the one that counts. So, please think hard about the decisions.
[Turn to Card 2]

Card 1





In this scenario, you find the blue counter in your game *[circle the blue segment of the option S nearest to the participant with your finger]*. So, you have Rs. 760.
The person you are playing with is playing the same *[circle the option S further away from the participant with your finger]* which-hand-is-it-in game.
And, in this scenario, he finds the yellow counter in his game. So, he has Rs.360. *[circle the yellow segment of the option S furthest away from the participant with your finger]*.
So, you have Rs. 760 *[point to the amount in option S nearest the participant]* and he has Rs. 360 *[point to the amount in option S furthest from the participant]*.
In this scenario, would you
- leave things as they are *[circle the two option boxes on the left of the page as the participant looks at it with you finger]*
- or share, so you would get Rs.560 and he would get Rs.560 *[circle the two grey boxes on the right of the page as the participant looks at it with you finger]*?

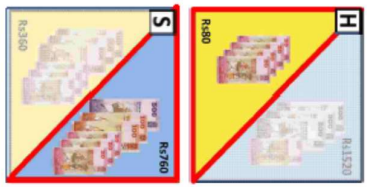
[Record their answer by ticking either "Leave" or "Share" on their Risk Sharing Game Decision Form in the row for "Card 2"]

[Turn to Card 3]

In this scenario, you find the yellow counter in your game *[circle the yellow segment of the option S nearest to the participant with your finger]*. So, you have Rs. 360.
The person you are playing with is playing this *[circle the option H (further away from the participant) with your finger]* which-hand-is-it-in game.
And, in this scenario, he finds the yellow counter in his game. So, he has Rs.80 *[circle the yellow segment of the option H with your finger]*.
So, you have Rs. 360 *[point to the amount in option S nearest the participant]* and he has Rs. 80 *[point to the amount in option H]*.
In this scenario, would you

- leave things as they are *[circle the two option boxes on the left of the page as the participant looks at it with you finger]*
- or share, so you would get Rs.220 and he would get Rs.220 *[circle the two grey boxes on the right of the page as the participant looks at it with you finger]*?

[Record their answer by ticking either "Leave" or "Share" on their Risk Sharing Game Decision Form in the row for "Card 4"]





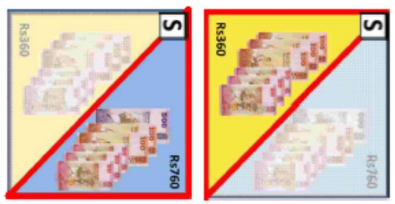
Card3

In this scenario, you find the blue counter in your game *[circle the blue segment of the option S nearest to the participant with your finger]*. So, you have Rs. 760.
The person you are playing with is playing this *[circle the option H (further away from the participant) with your finger]* which-hand-is-it-in game.
And, in this scenario, he finds the yellow counter in his game. So, he has Rs.80 *[circle the yellow segment of the option H with your finger]*.
So, you have Rs. 760 *[point to the amount in option S nearest the participant] and he has Rs. 80 [point to the amount in option H]*.
In this scenario, would you

- leave things as they are *[circle the two option boxes on the left of the page as the participant looks at it with you finger]*
- or share, so you would get Rs.420 and he would get Rs.420 *[circle the two grey boxes on the right of the page as the participant looks at it with you finger]*?

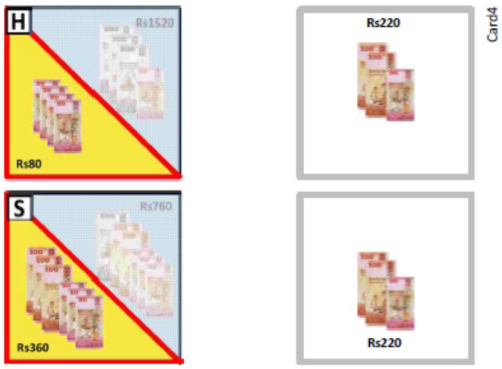
[Record their answer by ticking either "Leave" or "Share" on their Risk Sharing Game Decision Form in the row for "Card 3"]

[Turn to Card 4]





Card2



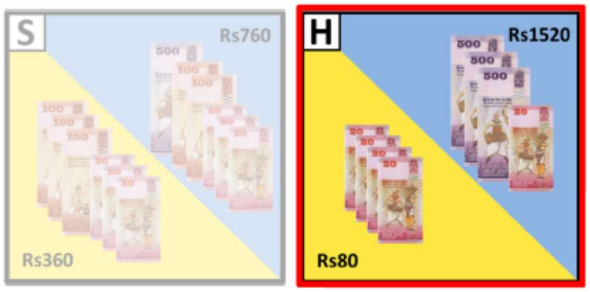
6.5.2 Assigned Treatment – Badge Number 9 to 16

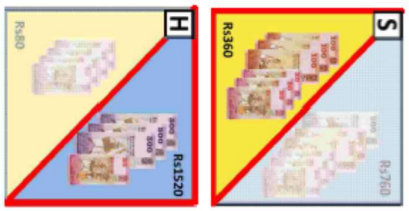
[Check that the correct village ID number, Workshop (morning or afternoon) and Participant badge number have been entered on their Risk Sharing Game Decision Form.]
[Check that you are using the right set of decision cards given the participant's badge number.]
[Sit according to "Recommended seating plan and card positioning diagram"]
[Have the book of decision cards for participants 9 to 16 open at Card 1]

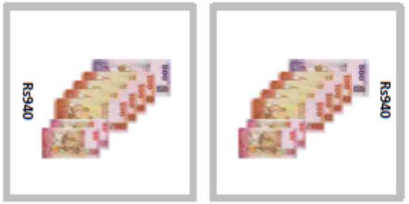
Because you picked a badge *[point to their conference badge]* with a number between 9 and 16 on it, you are going to play this *[circle option H on Card 1]* which-hand-is-it-in game. So, if you find the blue counter you will get Rs.1520 *[point to blue section of option H]* and if you find the yellow count you will get Rs80 *[point to yellow section of option H]*. The person you are playing the game with could also be playing this *[circle option H on Card 1]* which-hand-is-it-in game or he could be playing this one *[circle option S on Card 1]*.

Now we are going to consider the three possible scenarios which would lead to you having more money than the person you are playing with. In each case, you have to decide whether you are going to leave things as they are or share the winnings equally.
Later on, you are going to go and play this *[circle option H on Card 1]* which-hand-is-it-in game and the person you are playing with will play their game. Then, we will know which of your decisions to use to determine your winnings. This means that any one of the decisions you are about to make could be the one that counts. So, please think hard about the decisions.
[Turn to Card 2]

Card 1







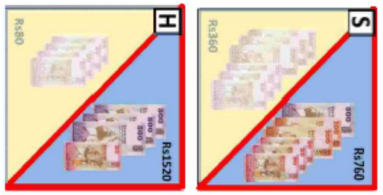
Card3

In this scenario, you find the blue counter in your game *[circle the blue segment of the option H nearest to the participant with your finger]*. So, you have Rs. 1520.
The person you are playing with is playing this *[circle the option S further away from the participant with your finger]* which-hand-is-it-in game.
And, in this scenario, he finds the yellow counter in his game. So, he has Rs.360. *[circle the yellow segment of the option S furthest away from the participant with your finger]*
So, you have Rs. 1520 *[point to the amount in option H nearest the participant]* and he has Rs. 360 *[point to the amount in option S furthest from the participant]*.
In this scenario, would you

- leave things as they are *[circle the two option boxes on the left of the page as the participant looks at it with you finger]*
- or share so you would get Rs.940 and he would get Rs.940 *[circle the two grey boxes on the right of the page as the participant looks at it with you finger]*?

[Record their answer by ticking either "Leave" or "Share" on their Risk Sharing Game Decision Form in the row for "Card 3"]

[Turn to Card 4]





Card2

In this scenario, you find the blue counter in your game *[circle the blue segment of the option H nearest to the participant with your finger]*. So, you have Rs. 1520.
The person you are playing with is playing this *[circle the option S further away from the participant with your finger]* which-hand-is-it-in game.
And, in this scenario, he finds the blue counter in his game. So, he has Rs.760. *[circle the blue segment of the option S furthest away from the participant with your finger]*
So, you have Rs. 1520 *[point to the amount in option H nearest the participant]* and he has Rs. 760 *[point to the amount in option S furthest from the participant]*.
In this scenario, would you

- leave things as they are *[circle the two option boxes on the left of the page as the participant looks at it with you finger]*
- or share so you would get Rs.1140 and he would get Rs.1140 *[circle the two grey boxes on the right of the page as the participant looks at it with you finger]*?

[Record their answer by ticking either "Leave" or "Share" on their Risk Sharing Game Decision Form in the row for "Card 2"]

[Turn to Card 3]

In this scenario, you find the blue counter in your game *[circle the blue segment of the option H nearest to the participant with your finger]*. So, you have Rs. 1520.
The person you are playing with is playing this *[circle the option H [further away from the participant] with your finger]* which-hand-is-it-in game.
And, in this scenario, he finds the yellow counter in his game. So, he has Rs.80. *[circle the yellow segment of the option H with your finger]*
So, you have Rs. 1520 *[point to the amount in option S nearest the participant]* and he has Rs. 80 *[point to the amount in option H]*.
In this scenario, would you

- leave things as they are *[circle the two option boxes on the left of the page as the participant looks at it with you finger]*
- or share so you would get Rs.800 and he would get Rs.800 *[circle the two grey boxes on the right of the page as the participant looks at it with you finger]*?

[Record their answer by ticking either "Leave" or "Share" on their Risk Sharing Game Decision Form in the row for "Card 4"]

6.5.3 Chosen Treatment

Treatment: Chosen

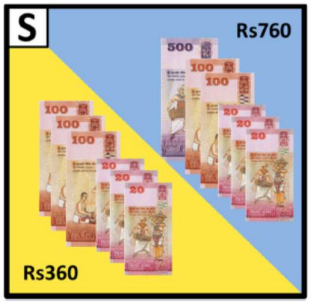
Introductory decision card

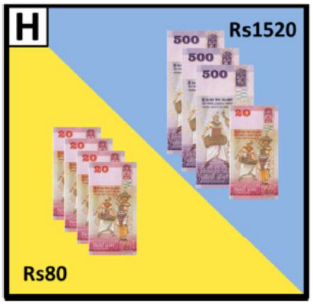
[Check that the correct village ID number, Workshop (morning or afternoon) and Participant badge number have been entered on their Risk Sharing Game Decision Form .]
[Sit according to "Recommended seating plan and card positioning diagram".]
[Have the introductory book of decision cards for the Chosen treatment open]

First, you have to decide which which-hand-is-it-in game you wish to play.
If you chose to play this *[circle option S on Card 1]* which-hand-is-it-in game and you find the blue counter you will get Rs760.
If you chose to play this *[circle option S on Card 1]* which-hand-is-it-in game and you find the yellow counter you will get Rs360.
If you chose to play this *[circle option H on Card 1]* which-hand-is-it-in game and you find the blue counter you will get Rs1520.
If you chose to play this *[circle option H on Card 1]* which-hand-is-it-in game and you find the yellow counter you will get Rs80.

Which would you like to play?

[Record the game they choose ticking either "S" or "H" on their Risk Sharing Game Decision Form in the row for "Game chosen".]
[Then, take either the "Chose S" or the "Chose H" (the one that matches the participant's game choice) book and open to Card 1]

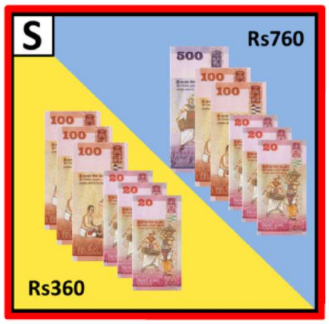




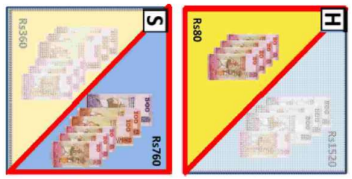
Treatment: Chosen
Chose **S**

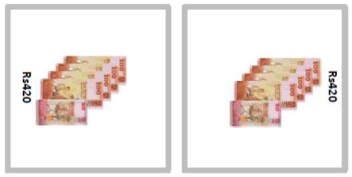
You have chosen to play this *[circle option S on Card 1]* which-hand-is-it-in game.
So, if you find the blue counter you will get Rs760 *[point to blue section of option S]* and if you find the yellow count you will get Rs360 *[point to yellow section of option S]*.
The person you are playing the game with might also choose to play this *[circle option S on Card 1]* which-hand-is-it-in game or he might choose to playing this one *[circle option H on Card 1]*.
Now we are going to consider the three possible scenarios which would lead to you having more money than the person you are playing with. In each case, you have to decide whether you are going to leave things as they are or share the winnings equally.
Later on, you are going to go and play this *[circle option S on Card 1]* which-hand-is-it-in game and the person you are playing with will play their game. Then, we will know which of your decisions to use to determine your winnings. This means that any one of the decisions you are about to make could be the one that counts. So, please think hard about the decisions.
[Turn to Card 2]

Card 1









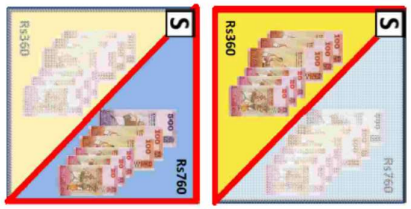
Card3

In this scenario, you find the blue counter in your game *[circle the blue segment of the option S nearest to the participant with your finger]*. So, you have Rs. 760.
The person you are playing with chose to play this *[circle the option H (further away from the participant) with your finger]* which-hand-is-it-in game.
And, in this scenario, he finds the yellow counter in his game. So, he has Rs.80 *[circle the yellow segment of the option H with your finger]*
So, you have Rs. 760 *[point to the amount in option S nearest the participant]* and he has Rs. 80 *[point to the amount in option H]*.
In this scenario, would you

- leave things as they are *[circle the two option boxes on the left of the page as the participant looks at it with you finger]*
- or share so you would get Rs.420 and he would get Rs.420 *[circle the two grey boxes on the right of the page as the participant looks at it with you finger]*?

[Record their answer by ticking either "Leave" or "Share" on their Risk Sharing Game Decision Form in the row for "Card 3"]

[Turn to Card 4]





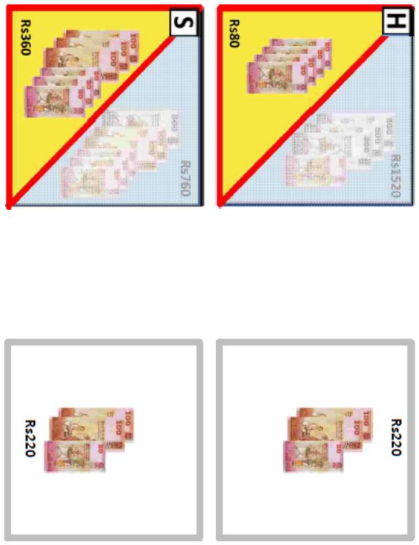
Card2

SIn this scenario, you find the blue counter in your game *[circle the blue segment of the option S nearest to the participant with your finger]*. So, you have Rs. 760.
The person you are playing with chose to play the same *[circle the option S further away from the participant with your finger]* which-hand-is-it-in game.
And, in this scenario, he finds the yellow counter in his game. So, he has Rs.360. *[circle the yellow segment of the option S furthest away from the participant with your finger]*
So, you have Rs. 760 *[point to the amount in option S nearest the participant]* and he has Rs. 360 *[point to the amount in option S furthest from the participant]*.
In this scenario, would you

- leave things as they are *[circle the two option boxes on the left of the page as the participant looks at it with you finger]*
- or share so you would get Rs.560 and he would get Rs.560 *[circle the two grey boxes on the right of the page as the participant looks at it with you finger]*?

[Record their answer by ticking either "Leave" or "Share" on their Risk Sharing Game Decision Form in the row for "Card 2"]

[Turn to Card 3]



Card4

In this scenario, you find the yellow counter in your game *[circle the yellow segment of the option S nearest to the participant with your finger].* So, you have Rs. 360.
The person you are playing with chose to play this *[circle the option H (further away from the participant) with your finger]* which-hand-is-it-in game.
And, in this scenario, he finds the yellow counter in his game. So, he has Rs.80 *[circle the yellow segment of the option H with your finger]*
So, you have Rs. 360 *[point to the amount in option S nearest the participant]* and he has Rs. 80 *[point to the amount in option H].*
In this scenario, would you

- leave things as they are *[circle the two option boxes on the left of the page as the participant looks at it with you finger]*
- or share so you would get Rs.220 and he would get Rs.220 *[circle the two grey boxes on the right of the page as the participant looks at it with you finger]*?

[Record their answer by ticking either "Leave" or "Share" on their Risk Sharing Game Decision Form in the row for "Card 4"]

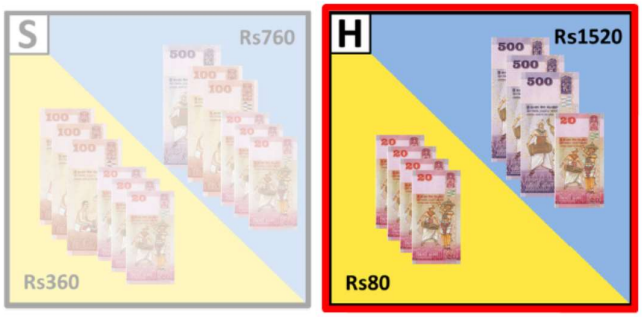
Treatment: Chosen
Chose **H**

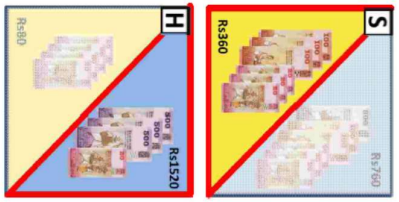
You have chosen to play this *[circle option H on Card 1]* which-hand-is-it-in game.
So, if you find the blue counter you will get Rs1520 *[point to blue section of option H]* and if you find the yellow count you will get Rs80 *[point to yellow section of option H]*.
The person you are playing the game with might also choose to play this *[circle option H on Card 1]* which-hand-is-it-in game or he might choose to playing this one *[circle option S on Card 1]*.

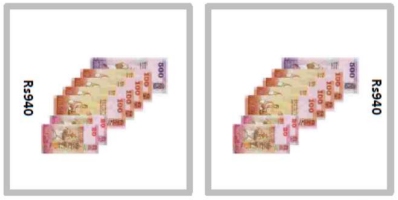
Now we are going to consider the three possible scenarios which would lead to you having more money than the person you are playing with. In each case, you have to decide whether you are going to leave things as they are or share the winnings equally.
Later on, you are going to go and play this *[circle option H on Card 1]* which-hand-is-it-in game and the person you are playing with will play their game. Then, we will know which of your decisions to use to determine your winnings. This means that any one of the decisions you are about to make could be the one that counts. So, please think hard about the decisions.

[Turn to Card 2]

Card 1







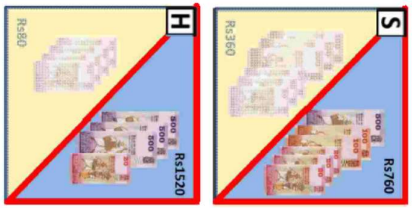
Card3

In this scenario, you find the blue counter in your game *[circle the blue segment of the option H nearest to the participant with your finger]*. So, you have Rs. 1520.
The person you are playing with chose to play this *[circle the option S (further away from the participant) with your finger]* which-hand-is-it-in game.
And, in this scenario, he finds the yellow counter in his game. So, he has Rs.360. *[circle the yellow segment of the option S furthest away from the participant with your finger]*
So, you have Rs. 1520 *[point to the amount in option H nearest the participant]* and he has Rs. 360 *[point to the amount in option S furthest from the participant]*.
In this scenario, would you

- leave things as they are *[circle the two option boxes on the left of the page as the participant looks at it with you finger]*
- or share so you would get Rs.940 and he would get Rs.940 *[circle the two grey boxes on the right of the page as the participant looks at it with you finger]?*

[Record their answer by ticking either "Leave" or "Share" on their Risk Sharing Game Decision Form in the row for "Card 3"]

[Turn to Card 4]





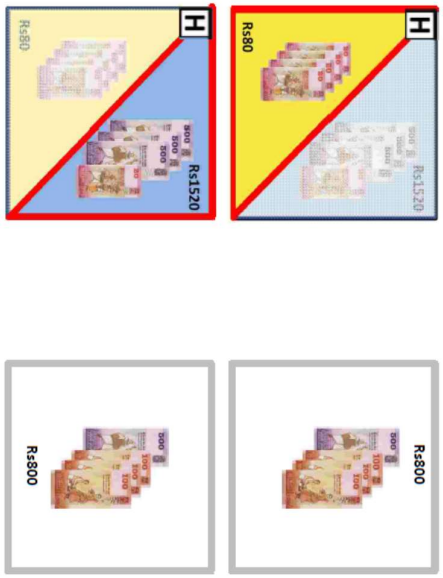
Card2

In this scenario, you find the blue counter in your game *[circle the blue segment of the option H nearest to the participant with your finger]*. So, you have Rs. 1520.
The person you are playing with chose to play this *[circle the option S further away from the participant with your finger]* which-hand-is-it-in game.
And, in this scenario, he finds the blue counter in his game. So, he has Rs.760. *[circle the blue segment of the option S furthest away from the participant with your finger]*
So, you have Rs. 1520 *[point to the amount in option H nearest the participant]* and he has Rs. 760 *[point to the amount in option S furthest from the participant]*.
In this scenario, would you

- leave things as they are *[circle the two option boxes on the left of the page as the participant looks at it with you finger]*
- or share so you would get Rs.1140 and he would get Rs.1140 *[circle the two grey boxes on the right of the page as the participant looks at it with you finger]?*

[Record their answer by ticking either "Leave" or "Share" on their Risk Sharing Game Decision Form in the row for "Card 2"]

[Turn to Card 3]



Card4

In this scenario, you find the blue counter in your game *[circle the blue segment of the option H nearest to the participant with your finger].* So, you have Rs. 1520.
The person you are playing with chose to play this *[circle the option H (further away from the participant) with your finger]* which-hand-is-it-in game.
And, in this scenario, he finds the yellow counter in his game. So, he has Rs.80 *[circle the yellow segment of the option H with your finger]*
So, you have Rs. 1520 *[point to the amount in option S nearest the participant]* and he has Rs. 80 *[point to the amount in option H].*
In this scenario, would you

- leave things as they are *[circle the two option boxes on the left of the page as the participant looks at it with you finger]*
- or share so you would get Rs.800 and he would get Rs.800 *[circle the two grey boxes on the right of the page as the participant looks at it with you finger]?*

[Record their answer by ticking either "Leave" or "Share" on their Risk Sharing Game Decision Form in the row for "Card 4"]

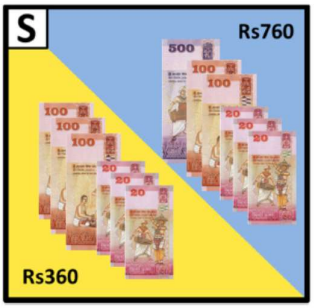
6.5.4 NegCorr Treatment – Badge Number 1 to 8

Treatment: NegCorr

Badge numbers 1 to 8 => Chooser

Introductory decision card

[Check that the correct village ID number, Workshop (morning or afternoon) and Participant badge number have been entered on their Risk Sharing Game Decision Form .]
[Sit according to "Recommended seating plan and card positioning diagram"]
[Have the introductory book of decision cards for Choosers in the NegCorr treatment open]
Because you picked a badge with a number between 1 and 8 you get to pick the which-hand-is-it-in game that you wish to play.
If you chose to play this *[circle option S on Card 1]* which-hand-is-it-in game and you find the blue counter you will get Rs760.
If you chose to play this *[circle option S on Card 1]* which-hand-is-it-in game and you find the yellow counter you will get Rs360.
If you chose to play this *[circle option H on Card 1]* which-hand-is-it-in game and you find the blue counter you will get Rs1520.
If you chose to play this *[circle option H on Card 1]* which-hand-is-it-in game and you find the yellow counter you will get Rs80.
Which would you like to play?
[Record the the game they choose ticking either "S" or "H" on their Risk Sharing Game Decision Form in the row for "Game chosen"]
[Then, take either the "Chose S" or the "Chose H" (the one that matches the participant's game choice) book and open to Card 1]





Treatment: NegCorr

Badge numbers 1 to 8 => Chooser

Chose **S**

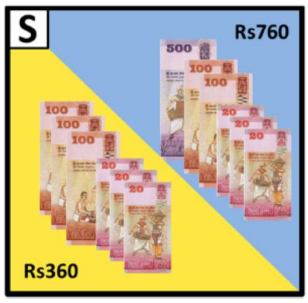
You have chosen to play this *[circle option S on Card 1]* which-hand-is-it-in game.

So, if you find the blue counter you will get Rs760 *[point to blue section of option S]* and if you find the yellow count you will get Rs360 *[point to yellow section of option S]*. Now we are going to consider the two possible scenarios which would lead to you having more money than the person you are playing with. In each case, you have to decide whether you are going to leave things as they are or share the winnings equally.

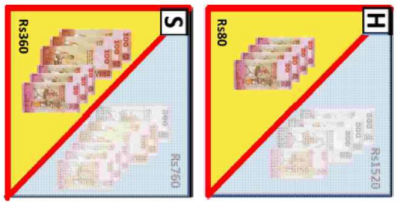
Later on, you are going to go and play this *[circle option S on Card 1]* which-hand-is-it-in game and the person you are playing with will play this *[circle option H on Card 1]* game. Then, we will know which of your decisions to use to determine your winnings. One of the decisions you are about to make could be the one that counts. So, please think hard about the decisions.

[Turn to Card 2]

Card 1







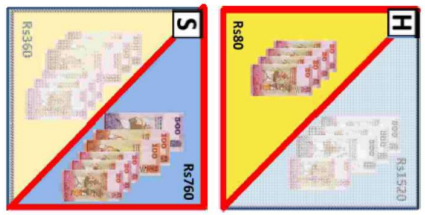


Card3

In this scenario, you find the yellow counter in your game *[circle the yellow segment of the option S nearest to the participant with your finger].* So, you have Rs. 360.
The person you are playing with plays this *[circle the option H further away from the participant with your finger]* which-hand-is-it-in game.
And, in this scenario, he finds the yellow counter in his game. So, he has Rs.80 *[circle the yellow segment of the option H furthest away from the participant with your finger]*
So, you have Rs. 360 *[point to the amount in option S nearest the participant]* and he has Rs. 80 *[point to the amount in option H furthest from the participant].*
In this scenario, would you

- leave things as they are *[circle the two option boxes on the left of the page as the participant looks at it with you finger]*
- or share so you would get Rs.220 and he would get Rs.220 *[circle the two grey boxes on the right of the page as the participant looks at it with you finger]?*

[Record their answer by ticking either "Leave" or "Share" on their Risk Sharing Game Decision Form in the row for "Card 3"]





Card2

In this scenario, you find the blue counter in your game *[circle the blue segment of the option S nearest to the participant with your finger].* So, you have Rs. 760.
The person you are playing with plays this *[circle the option H further away from the participant with your finger]* which-hand-is-it-in game.
And, in this scenario, he finds the yellow counter in his game. So, he has Rs.80 *[circle the yellow segment of the option H furthest away from the participant with your finger]*
So, you have Rs. 760 *[point to the amount in option S nearest the participant]* and he has Rs. 80 *[point to the amount in option H furthest from the participant].*
In this scenario, would you

- leave things as they are *[circle the two option boxes on the left of the page as the participant looks at it with you finger]*
- or share so you would get Rs.420 and he would get Rs.420 *[circle the two grey boxes on the right of the page as the participant looks at it with you finger]?*

[Record their answer by ticking either "Leave" or "Share" on their Risk Sharing Game Decision Form in the row for "Card 2"]

[Turn to Card 3]

Treatment: NegCorr

Badge numbers 1 to 8 => Chooser

Chose **H**

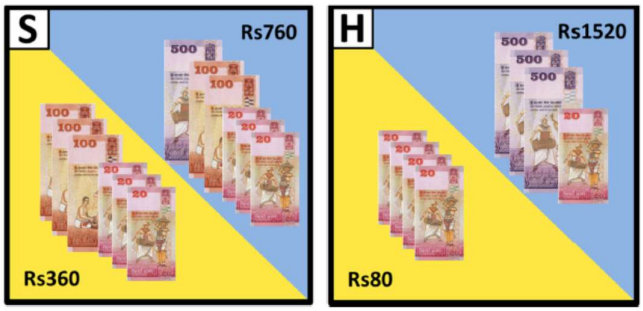
You have chosen to play this *[circle option H on Card 1]* which-hand-is-it-in game.
So, if you find the blue counter you will get Rs1520 *[point to blue section of option H]* and if you find the yellow count you will get Rs80 *[point to yellow section of option H]*.

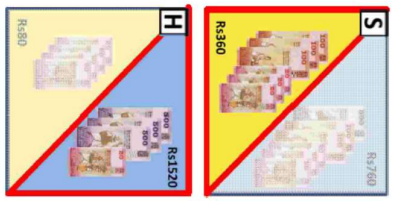
Now we are going to consider the two possible scenarios which would lead to you having more money than the person you are playing with. In each case, you have to decide whether you are going to leave things as they are or share the winnings equally.

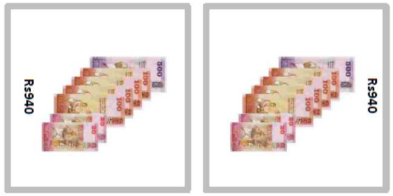
Later on, you are going to go and play this *[circle option H on Card 1]* which-hand-is-it-in game and the person you are playing with will play this *[circle option S on Card 1]* game. Then, we will know which of your decisions to use to determine your winnings. One of the decisions you are about to make could be the one that counts. So, please think hard about the decisions.

[Turn to Card 2]

Card 1





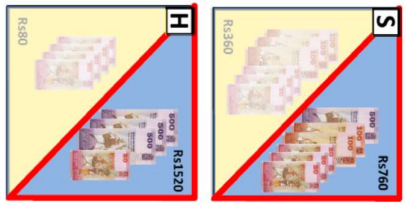


Card3

In this scenario, you find the blue counter in your game *[circle the blue segment of the option H nearest to the participant with your finger]*. So, you have Rs. 1520.
The person you are playing with plays this *[circle the option S further away from the participant with your finger]* which-hand-is-it-in game.
And, in this scenario, he finds the yellow counter in his game. So, he has Rs.360 *[circle the yellow segment of the option S with your finger]*
So, you have Rs. 1520 *[point to the amount in option H nearest the participant]* and he has Rs. 360 *[point to the amount in option S]*.
In this scenario, would you

- leave things as they are [circle the two option boxes on the left of the page as the participant looks at it with you finger]
- or share so you would get Rs.940 and he would get Rs.940 *[circle the two grey boxes on the right of the page as the participant looks at it with you finger]*?

[Record their answer by ticking either "Leave" or "Share" on their Risk Sharing Game Decision Form in the row for "Card 3"]





Card 2

In this scenario, you find the blue counter in your game *[circle the blue segment of the option H nearest to the participant with your finger]*. So, you have Rs. 1520.
The person you are playing with plays this *[circle the option S further away from the participant with your finger]* which-hand-is-it-in game.
And, in this scenario, he finds the blue counter in his game. So, he has Rs.760 *[circle the blue segment of the option S with your finger]*
So, you have Rs. 1520 *[point to the amount in option H nearest the participant]* and he has Rs. 760 *[point to the amount in option S]*.
In this scenario, would you

- leave things as they are [circle the two option boxes on the left of the page as the participant looks at it with you finger]
- or share so you would get Rs.1140 and he would get Rs.1140 *[circle the two grey boxes on the right of the page as the participant looks at it with you finger]*?

[Record their answer by ticking either "Leave" or "Share" on their Risk Sharing Game Decision Form in the row for "Card 2"]

[Turn to Card 3]

6.5.5 NegCorr Treatment – Badge Number 9 to 16

Treatment: NegCorr

Badge number between 9 and 16

Forced

[Check that the correct village ID number, Workshop (morning or afternoon) and Participant badge number have been entered on their Risk Sharing Game Decision Form .]
[Sit according to "Recommended seating plan and card positioning diagram"]
[Have the book of decision cards for Forced in the NegCorr treatment open at Card 1]

Because you picked a badge with a number between 9 and 16, the person you are playing the game with had first choice of which which-hand-is-it-in game and you get to play the game he does not choose.

If he chose to play this *[circle option H on Card 1]* which-hand-is-it-in game, you would play this one *[circle option S on Card 1]* and if you find the blue counter you will get Rs760.

If he chose to play this *[circle option H on Card 1]* which-hand-is-it-in game, you would play this one *[circle option S on Card 1]* and if you find the yellow counter you will get Rs360.

If he chose to play this *[circle option S on Card 1]* which-hand-is-it-in game, you would play this one *[circle option H on Card 1]* and if you find the blue counter you will get Rs1520.

If he chose to play this *[circle option S on Card 1]* which-hand-is-it-in game, you would play this one *[circle option H on Card 1]* and if you find the yellow counter you will get Rs80.

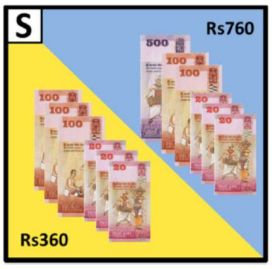
Now we are going to consider the four possible scenarios which would lead to you having more money than the person you are playing with. In each case, you have to decide whether you are going to leave things as they are or share the winnings equally.

Later on, you are going to go and play your which-hand-is-it-in game and the person you are playing with will play their game. Then, we will know which of your decisions to use to determine your winnings. One of the decisions you are about to make could be the one that counts. So, please think hard about the decisions.

In this scenario, the person you are playing with chooses this game *[circle option S with your finger]*. So, you play this game *[circle option H with your finger]*.

[Turn to Card 2]

Card 1





Now, suppose you find the blue counter in your game *[circle the blue segment of the option H nearest to the participant with your finger]*. So, you have Rs. 1520.
And the person you are playing with finds the blue counter in his game. So, he has Rs.760 *[circle the blue segment of the option S furthest away from the participant with your finger]*
So, you have Rs. 1520 *[point to the amount in option H nearest the participant]* and he has Rs. 760 *[point to the amount in option S furthest away from the participant]*.
In this scenario, would you

- leave things as they are *[circle the two option boxes on the left of the page as the participant looks at it with you finger]*
- or share so you would get Rs.1140 and he would get Rs.1140 [circle the two grey boxes on the right of the page as the participant looks at it with you finger]?

[Record their answer by ticking either "Leave" or "share" on their Risk Sharing Game Decision Form in the row for "Card 2"]

[Turn to Card 3]

Card2

In this scenario, the person you are playing with chooses this game *[circle option S with your finger]*. So, you play this game *[circle option H with your finger]*.

[Turn to Card 4]

Card 3

Now, suppose you find the blue counter in your game *[circle the blue segment of the option H nearest to the participant with your finger]*. So, you have Rs. 1520. And the person you are playing with finds the yellow counter in his game. So, he has Rs.360 *[circle the yellow segment of the option S furthest away from the participant with your finger]*
So, you have Rs. 1520 *[point to the amount in option H nearest the participant]* and he has Rs. 360 *[point to the amount in option S furthest away from the participant]*.
In this scenario, would you

- leave things as they are *[circle the two option boxes on the left of the page as the participant looks at it with you finger]*
- or share so you would get Rs.940 and he would get Rs.940 *[circle the two grey boxes on the right of the page as the participant looks at it with you finger]*?

[Record their answer by ticking either "Leave" or "Share" on their Risk Sharing Game Decision Form in the row for "Card 4"]

[Turn to Card 5]

Card4

In this scenario, the person you are playing with chooses this game *[circle option H with your finger]*. So, you play this game *[circle option S with your finger]*.

[
Turn to Card 6]

Card 5

Card 7

In this scenario, the person you are playing with chooses this game *[circle option H with your finger]*. So, you play this game *[circle option S with your finger]*.

[Turn to Card 8]

Card6

Now, suppose you find the blue counter in your game *[circle the blue segment of the option S nearest to the participant with your finger]*. So, you have Rs. 760. And the person you are playing with finds the yellow counter in his game. So, he has Rs.80 *[circle the yellow segment of the option H furthest away from the participant with your finger]*

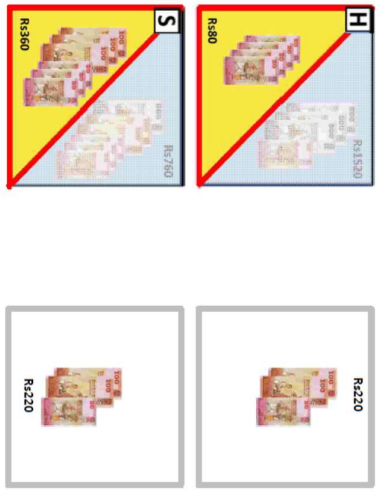
So, you have Rs. 760 *[point to the amount in option S nearest the participant]* and he has Rs. 80 *[point to the amount in option H furthest away from the participant]*.

In this scenario, would you

- leave things as they are *[circle the two option boxes on the left of the page as the participant looks at it with you finger]*
- or share so you would get Rs.420 and he would get Rs.420 [circle the two grey boxes on the right of the page as the participant looks at it with you finger]?

[Record their answer by ticking either "Leave" or "Share" on their Risk Sharing Game Decision Form in the row for "Card 6"]

[Turn to Card 7]



Card8

Now, suppose you find the yellow counter in your game *[circle the yellow segment of the option S nearest to the participant with your finger]*. So, you have Rs. 360.
And the person you are playing with finds the yellow counter in his game. So, he has Rs.80 *[circle the yellow segment of the option H furthest away from the participant with your finger]*
So, you have Rs. 360 *[point to the amount in option S nearest the participant]* and he has Rs. 80 *[point to the amount in option H furthest away from the participant]*.
In this scenario, would you

- leave things as they are *[circle the two option boxes on the left of the page as the participant looks at it with you finger]*
- or share so you would get Rs.220 and he would get Rs.220 *[circle the two grey boxes on the right of the page as the participant looks at it with you finger]*?

[Record their answer by ticking either "Leave" or "Share" on their Risk Sharing Game Decision Form in the row for "Card 8"]

6.5.6 PosCorr Treatment – Badge Number 1 to 8

Treatment: PosCorr

Badge numbers 1 to 8 => Chooser

Introductory decision card

[Check that the correct village ID number, Workshop (morning or afternoon) and Participant badge number have been entered on their Risk Sharing Game Decision Form .]
[Sit according to "Recommended seating plan and card positioning diagram"]
[Have the introductory book of decision cards for Choosers in the PosCorr treatment open]

Because you picked a badge with a number between 1 and 8, the first thing you have to do is decide which which-hand-is-it-in game you wish both you and the person you are playing with to play.

If you chose to play this *[circle option S on Card 1]* which-hand-is-it-in game and you find the blue counter you will get Rs760.

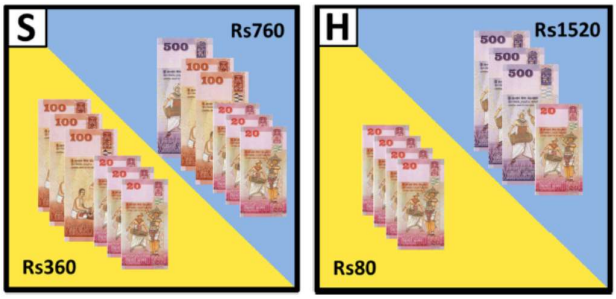
If you chose to play this *[circle option S on Card 1]* which-hand-is-it-in game and you find the yellow counter you will get Rs360.

If you chose to play this *[circle option H on Card 1]* which-hand-is-it-in game and you find the blue counter you will get Rs1520.

If you chose to play this *[circle option H on Card 1]* which-hand-is-it-in game and you find the yellow counter you will get Rs80.

Which would you like to play?

[Record the the game they choose ticking either "S" or "H" on their Risk Sharing Game Decision Form in the row for "Game chosen"]
[Then, take either the "Chose S" or the "Chose H" (the one that matches the participant's game choice) book and open to Card 1]



Treatment: PosCorr

Badge numbers 1 to 8 => Chooser

Chose **S**

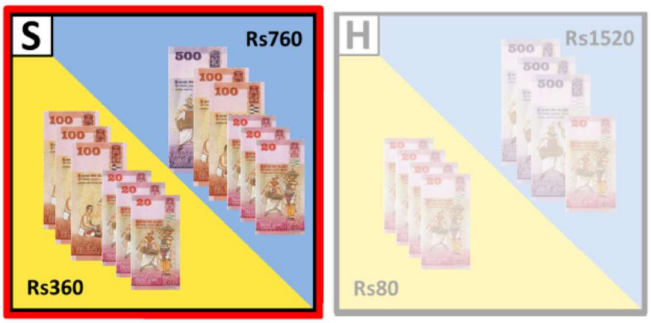
You have chosen to play this *[circle option S on Card 1]* which-hand-is-it-in game.

So, if you find the blue counter you will get Rs760 *[point to blue section of option S]* and if you find the yellow count you will get Rs360 *[point to yellow section of option S]*. Now we are going to consider the one possible scenario which would lead to you having more money than the person you are playing with. You have to decide whether you are going to leave things as they are or share the winnings equally.

Later on, you are going to go and play this *[circle option S on Card 1]* which-hand-is-it-in game and the person you are playing with will play their game. Then, we will know which of your decisions to use to determine your winnings. The decision you are about to make could be the one that counts. So, please think hard about the decision.

[Turn to Card 2]

Card 1



In this scenario, you find the blue counter in your game *[circle the blue segment of the option S nearest to the participant with your finger]*. So, you have Rs. 760.
The person you are playing with plays the same *[circle the option S further away from the participant with your finger]* which-hand-is-it-in game.
And, in this scenario, he finds the yellow counter in his game. So, he has Rs.360 *[circle the yellow segment of the option S furthest away from the participant with your finger]*
So, you have Rs. 760 *[point to the amount in option S nearest the participant]* and he has Rs. 360 *[point to the amount in option S furthest from the participant]*.
In this scenario, would you

- leave things as they are *[circle the two option boxes on the left of the page as the participant looks at it with you finger]*
- or share so you would get Rs.560 and he would get Rs.560 *[circle the two grey boxes on the right of the page as the participant looks at it with you finger]*?

[Record their answer by ticking either "Leave" or "Share" on their Risk Sharing Game Decision Form in the row for "Card 2"]

Card2

Treatment: PosCorr

Badge numbers 1 to 8 => Chooser

Chose **H**

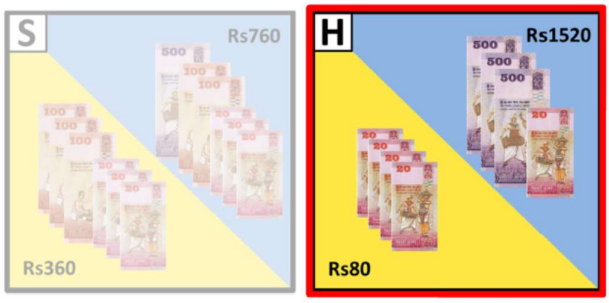
You have chosen to play this *[circle option H on Card 1]* which-hand-is-it-in game.
So, if you find the blue counter you will get Rs1520 *[point to blue section of option H] and if you find the yellow count you will get Rs80 [point to yellow section of option H]*.

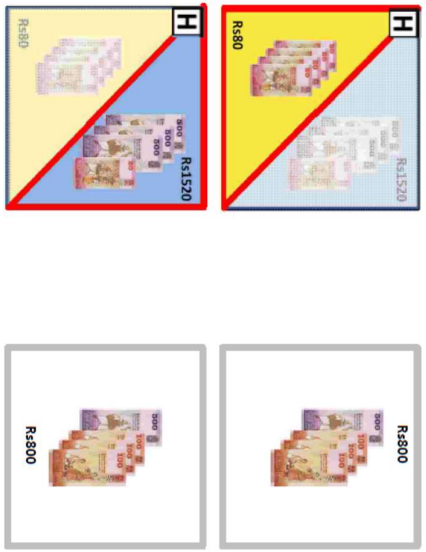
Now we are going to consider the one possible scenario which would lead to you having more money than the person you are playing with. You have to decide whether you are going to leave things as they are or share the winnings equally.

Later on, you are going to go and play this *[circle option H on Card 1]* which-hand-is-it-in game and the person you are playing with will play their game. Then, we will know which of your decisions to use to determine your winnings. The decision you are about to make could be the one that counts. So, please think hard about the decision.

[Turn to Card 2]

Card 1





Card2

In this scenario, you find the blue counter in your game *[circle the blue segment of the option H nearest to the participant with your finger]*. So, you have Rs. 1520.
The person you are playing with is plays the same *[circle the option H (further away from the participant) with your finger]* which-hand-is-it-in game.
And, in this scenario, he finds the yellow counter in his game. So, he has Rs.80 *[circle the yellow segment of the option H with your finger]*
So, you have Rs. 1520 *[point to the amount in option S nearest the participant]* and he has Rs. 80 *[point to the amount in option H]*.
In this scenario, would you

- leave things as they are *[circle the two option boxes on the left of the page as the participant looks at it with you finger]*
- or share so you would get Rs.800 and he would get Rs.800 *[circle the two grey boxes on the right of the page as the participant looks at it with you finger]*?

[Record their answer by ticking either "Leave" or "Share" on their Risk Sharing Game Decision Form in the row for "Card 2"]

6.5.7 PosCorr Treatment – Badge Number 9 to 16

Treatment: PosCorr

Badge numbers 9 to 16 => Forced

[Check that the correct village ID number, Workshop (morning or afternoon) and Participant badge number have been entered on their Risk Sharing Game Decision Form.]
[Sit according to "Recommended seating plan and card positioning diagram"]
[Have the book of decision cards for Forced in the PosCorr treatment open at Card 1]

Because you picked a badge with a number between 9 and 16, the person you are playing the game with will decide which which-hand-is-it-in game you are to play.

If he chose to play this *[circle option S on Card 1]* which-hand-is-it-in game and you find the blue counter you will get Rs760.

If he chose to play this *[circle option S on Card 1]* which-hand-is-it-in game and you find the yellow counter you will get Rs360.

If he chose to play this *[circle option H on Card 1]* which-hand-is-it-in game and you find the blue counter you will get Rs1520.

If he chose to play this *[circle option H on Card 1]* which-hand-is-it-in game and you find the yellow counter you will get Rs80.

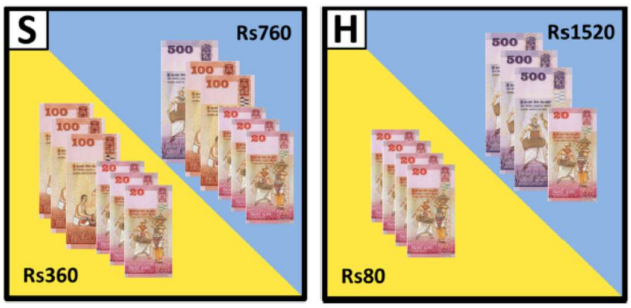
Now we are going to consider the two possible scenarios which would lead to you having more money than the person you are playing with. In each case, you have to decide whether you are going to leave things as they are or share the winnings equally.

Later on, you are going to go and play your which-hand-is-it-in game and the person you are playing with will play their game. Then, we will know which of your decisions to use to determine your winnings from this game. One of the decisions you are about to make could be the one that counts. So, please think hard about the decisions.

In this scenario, the person you are playing with decides that you will both play this game *[circle option H with your finger.]*

[Turn to Card 2]

Card 1



Card 3

In this scenario, the person you are playing with decides that you will both play this game *[circle option S with your finger.]*

[Turn to Card 4]

Card2

Now, suppose you find the blue counter in your game *[circle the blue segment of the option H nearest to the participant with your finger]*. So, you have Rs. 1520. And the person you are playing with finds the yellow counter in his game. So, he has Rs.80 *[circle the yellow segment of the option H furthest away from the participant with your finger]*

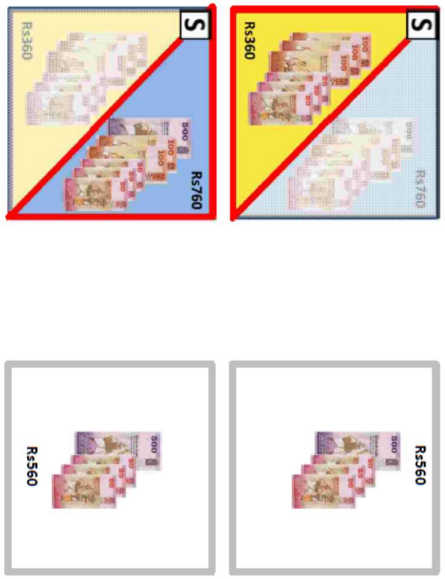
So, you have Rs. 1520 *[point to the amount in option H nearest the participant]* and he has Rs. 80 *[point to the amount in option H furthest away from the participant]*.

In this scenario, would you

- leave things as they are *[circle the two option boxes on the left of the page as the participant looks at it with you finger]*
- or share so you would get Rs.800 and he would get Rs.800 *[circle the two grey boxes on the right of the page as the participant looks at it with you finger]*?

[Record their answer by ticking either "Leave" or "Share" on their Risk Sharing Game Decision Form in the row for "Card 2"]

[Turn to Card 3]



Card4

Now, suppose you find the blue counter in your game *[circle the blue segment of the option S nearest to the participant with your finger]*. So, you have Rs. 760.
And the person you are playing with finds the yellow counter in his game. So, he has Rs.360 *[circle the yellow segment of the option S furthest away from the participant with your finger]*
So, you have Rs. 760 *[point to the amount in option S nearest the participant]* and he has Rs. 360 *[point to the amount in option S furthest away from the participant]*.
In this scenario, would you

- leave things as they are *[circle the two option boxes on the left of the page as the participant looks at it with you finger]*
- or share so you would get Rs.560 and he would get Rs.560 *[circle the two grey boxes on the right of the page as the participant looks at it with you finger]*?

[Record their answer by ticking either "Leave" or "Share" on their Risk Sharing Game Decision Form in the row for "Card 4"]

6.6 Household Survey[1]

Collective responses to environmental risk

Introduction

Thank-you for agreeing to take part in this survey. Remember the survey is designed to be confidential; the information you provide will not be shared with anyone other than the researchers involved in the project. During all analyses this information will be processed anonymously; i.e. your name of personal contact details will not be visible. By completing the survey you affirm you are at least 18 years old and that you give consent for the lead researcher and their team to use your answers in their research. If you have any questions about this research, please feel free to ask at any point. We greatly appreciate your time and willingness to be part of our research project.

Name of interviewer_____ **Date**_____ **Time**_____

Identification details

Community No. _____

Household No._____ 1xx for morning session , 2xx for afternoon session

How sampled (circle) 1=original list 2=first replacement 3=second replacement

Name of interviewee _____ **Household ID**_____(complete after filling in roster)

Physical address _____

Mobile Numbers _____/_____

1

[1]This is the original household survey which was piloted and subsequently used in the field. Not all questions were posed owing to time constraints during each one-day workshop.

Code for Section A

2. Relationship to Household Head

1=Head
2=Spouse
3=Own child
4=Parent
5=Grandparent
6=Grandchild
7=Sibling
8=Member of extended family (uncle/aunt nephew/niece/inlaw)
9=Servant
10=Tenant/lodger
11=Other unrelated person

5. Ethnicity

1=Sinhala
2=Sri Lankan Tamil
3=Indian Tamil
4=Sri Lankan Moors
5=Malay
6=Burgher
7=Other
8=Not applicable

6. Religion

1=Buddhist
2=Hindu
3=Muslim
4=Christian
5=Other

7. Marital Status

1=Never married
2=Married and live together
3=Married and live separately
4=Widow/widower
5=Separated
6=Legally divorced

8. Highest educational attainment

0=Pre-school
1=Grade 1
2=Grade 2
3=Grade 3
4=Grade 4
5=Grade 5
6=Grade 6
7=Grade 7
8=Grade 8
9=Grade 9
10=Grade10
11=Grade 11
12=Grade 12
13=Grade 13
14=Diploma
15=BSc/BA and above
16=Vocational
17=Other
18=Not applicable

9. Main activity

1=Farmer or farm worker
2=Domestic worker (inc. housewife)
3=Manual worker (builder/carpenter/craftworker/potter/ blacksmith/plumber/metalworker/welding)
4=Sewing/dressmaking/knitting
5=Foodseller (e.g. pre-school /school packed lunches)
6=Grocery store
7=Driver/mechanic
8=Repair work (welding or plumbing)
9=Factory worker
10=Government service (teacher/health worker)
11=Disabled/unable to work
12=Unemployed
13=Other

10. Why?

1=Looking after elderly family members
2= Help with family business
3=Claim inheritance
4=Good farming conditions
5=Employment opportunity
6=Better quality of life
7=Civil disturbance in prior residence
8=Relocated due to government's environment conservation strategy
9=Relocated due to another government scheme
10=Received land allocation applied for
11=Received land as compensation
12=Other (specify):_____

14. Medical condition

1=Farming-related injury/fracture/wound/burn/snakebite
2=Heart/blood pressure/stroke
3=Stomach pain/nausea/diarrhoea/gastritis
4=Asthma/flu/cough/cold
5=Catarrh
6=General pain in eyes/limbs/teeth
7=Sore throat/tonsils/ears
8=Childbirth/pregnancy
9=Mental illness/memory loss/sleeplessness/restless
10=Neurological/dizziness/epilepsy/paralysis
11=Passing blood/blood flow
12=Haemorrhoids
13=Headaches
14=Disabled
15=Arthritis
16=Diabetes
17=Cancer
18=Other

SECTION A: INDIVIDUAL AND HOUSEHOLD CHARACTERISTICS

ID	1. Full names (including Wasagama and all family members including children and elderly members)	2.Relationship to Household Head	3. Date of birth (year)	4. Gender		5. Ethnicity	6. Religion	7. Marital status	8. Highest educational attainment	9. Main activity
1	Respondent:			*M*	*F*					
2				*M*	*F*					
3				*M*	*F*					
4				*M*	*F*					
5				*M*	*F*					
6				*M*	*F*					
7				*M*	*F*					
8				*M*	*F*					
9				*M*	*F*					

ID	10. Residence in this village			11. Expenditure on children's education (Rs. per month)			12. How many times does this family member require medical attention per month? (Tick.)				13. Has this family member sought medical attention in the last 4 weeks?		14. What were the symptoms of this family member's medical condition? (place comma between numbers)	15. Total cost of consultation, treatment in last 4 weeks? (Rs.)
	a. Since when? (Year)	b. If moved, where from?	c. If moved, why?	a. Fees	b. Transport	c. Boarding	1	2	3	3+				
1											*Yes*	*No*		
2											*Yes*	*No*		
3											*Yes*	*No*		
4											*Yes*	*No*		
5											*Yes*	*No*		
6											*Yes*	*No*		
7											*Yes*	*No*		
8														
9														

SECTION B: TENURE AND PROPERTY RIGHTS

1. Description (residence, farm plot)	2. Is this land....? (Tick.)			3. Did other family members farm/live on this land before you?		4. Distance from residence (km)	5. Mode of transport used to travel from residence to farm plot (see codes)	6. Time taken to travel from residence to farm plot (mins)	7. Acres	8. How acquired	9. When acquired (Year)	10. Holds (Tick.):				11. If yes, when were deeds/COE granted? (Year)	
	Owned	Rented	Share-cropped									Deeds		COE		Deeds	COE
Residence				*Y*	*N*							*Y*	*N*	*Y*	*N*		
Farm Plot 1.				*Y*	*N*							*Y*	*N*	*Y*	*N*		
Farm Plot 2.				*Y*	*N*							*Y*	*N*	*Y*	*N*		
Farm Plot 3.				*Y*	*N*							*Y*	*N*	*Y*	*N*		
Farm Plot 4.				*Y*	*N*							*Y*	*N*	*Y*	*N*		
Farm Plot 5.				*Y*	*N*							*Y*	*N*	*Y*	*N*		

	12. If sharecropped, how many acres?	13. Did other family members sharecrop this land before you?		14. When was sharecropping contract agreed? (Year)	15. Distance from wildlife sanctuary (km)	16. Distance from natural water source (km)	17. Did you have a choice in location of land?		18. If chosen, main reason for location		
									#1	#2	#3
Residence		*Y*	*N*				*Y*	*N*			
Farm Plot 1.		*Y*	*N*				*Y*	*N*			
Farm Plot 2.		*Y*	*N*				*Y*	*N*			
Farm Plot 3.		*Y*	*N*				*Y*	*N*			
Farm Plot 4.		*Y*	*N*				*Y*	*N*			
Farm Plot 5.		*Y*	*N*				*Y*	*N*			

5. Mode of transport used to travel to farm plot

1=On foot
2=Bicycle
3=Motorcycle
4=Three-wheeler
5=Bus
6=Van
7=Lorry
8=Car

8. How was land acquired?

1=Purchased by respondent
2=Inherited
3=Received as a gift
4= Received as compensation
5=Resettled in this location by government
6=Rented
7=Encroachment
8=Other

18. If chosen, what was the main reason for location?

1=Away from wildlife risk
2=Proximity to water source
3=Favourable soil conditions
4=Elevation
5=Affordable purchase
6=Easily accessible
7=Direct sunlight

SECTION C1: FREQUENCY AND ESTIMATED COST OF DAMAGE

1. When a disaster occurs, who do you go to for help? (Choose from compensation codes (1-8) below. If more than one source, list in order of importance)
   __/__/__/__/__/__/__/__/

2. When was the last time you experienced house damage, crop damage or personal injury to you/or your family members due to…?			3. List from most to least damage done (1-7)	4. Estimated house damage	5. Estimated crop damage		6. Estimated cost of personal injury to you and/or your family?		7.Comp-ensated/ assisted for house damage?	8.If yes, by whom?	9.If yes, how much?	10.Comp ensated/ assisted for crop damage?	11.If yes, by whom?	12. If yes, how much?	13.Comp-ensated/ assisted for personal injury?(medical costs)	14. If yes, by whom?	15. If yes, how much ?	16. Labour days lost?
	Y/N	*When? Mth/Yr*		Cost (Rs.)	Acres	Cost (Rs.)	Who	Cost (Rs.)	*Y/N*	(List)	(Rs.)	*Y/N*	(List)	(Rs.)	*Y/N*	(List)	(Rs.)	
1.Elephant	*Y/N*								*Y/N*			*Y/N*			*Y/N*			
2.Monkey	*Y/N*								*Y/N*			*Y/N*			*Y/N*			
3.Peacock	*Y/N*								*Y/N*			*Y/N*			*Y/N*			
4.Flood	*Y/N*								*Y/N*			*Y/N*			*Y/N*			
5.Drought	*Y/N*								*Y/N*			*Y/N*			*Y/N*			
6.Land slip	*Y/N*								*Y/N*			*Y/N*			*Y/N*			
7.Civil dist-urbance	*Y/N*								*Y/N*			*Y/N*			*Y/N*			
8.Other	*Y/N*								*Y/N*			*Y/N*			*Y/N*			

Codes for: 8, 11, 14. If compensated or assisted, by whom?

1=Department for Wildlife Resources and Conservation
2=Other government department
3=Local non-government organisation
4=International non-government organisation
5=Farmers' Organisation
6=Community
7=Family members
8=Friends

Translation for 2. Due to:

1= 2=
3= 4=
5= 6=
7= 8=

6. List who suffered personal injury

1=Head
2=Spouse
3=Own child
4=Parent
5-Grandparent
6=Grandchild
7=Sibling
8=Uncle/aunt/nephew/niece/in-law
9=Servant
10=Tenant/lodger
11=Other unrelated person

SECTION C2: FREQUENCY AND ESTIMATED COST OF DAMAGE

In the last (...) months /years	17. Frequency of house damage caused by HEC	18. Frequency of crop damage caused by HEC	19. Frequency of personal injuries to you and/or your family caused by HEC	20. List who suffered personal injury	21.Time taken after incident to receive compensation for *house damage* (months)	22. By whom? (List in order of importance)	23. How much? (Rs.)	24. Time taken after incident to receive compensation for *crop damage* (months)	25.By whom? (List in order of importance)	26. How much? (Rs.)	27. Time taken after incident to receive compensation for *personal injury* to you and/or your family (months)	28. By whom? (List in order of importance)	29. How much? (Rs.)
Jan													
Oct-Dec													
Jul-Sep													
Apr-Jun													
Jan-Mar													
2012													
2011													

Codes for: 22, 25, 28. If compensated or assisted, by whom?

1=Department for Wildlife Resources and Conservation
2=Other government department
3=Local non-government organisation
4=International non-government organisation
5=Farmers' Organisation
6=Community
7=Family members
8=Friends

Codes for: 20. List who suffered personal injury

1=Head
2=Spouse
3=Own child
4=Parent
5-Grandparent
6=Grandchild
7=Sibling
8=Uncle/aunt/nephew/niece/in-law
9=Servant
10=Tenant/lodger
11=Other unrelated person

SECTION D1: PREVENTION

Watch-hut Location	1. No. of watch huts at this location	2. How many watch-hut(s) are located *at* or *above* ground level (e.g. in a tree)?		3. *Main* material used to build watch-hut(s)	4. Cost of construction (Rs.)	5. List who keeps watch in the watch-huts at any one time (comma after each)	6. Total days per month spent in watch-hut by all members (Sep-Mar)		7. Total days per month spent in watch-hut by all members (Apr-Aug)		8. Neighbouring Plots (belonging to other people)		9. Do you watch other farmers' plots? (circle)	10. Do other farmers watch your plot? (circle)	11. Nature of agreement: Formal (community); Informal (private); Casual arrangement? (circle)
		No. *At*	No. *Above*				Days	Hrs per day	Days	Hrs per day	No. of plots	No. using huts			
Residence													*Y / N*	*Y / N*	For Inf Cas
Farm plot: 1													*Y / N*	*Y / N*	For Inf Cas
2													*Y / N*	*Y / N*	For Inf Cas
3													*Y / N*	*Y / N*	For Inf Cas
4													*Y / N*	*Y / N*	For Inf Cas
5													*Y / N*	*Y / N*	For Inf Cas

3. *Main* material used to build watch-hut

1=Bricks
2=Kabook
3=Cadjan/straw
4=Bamboo
5=Mud
6=Metal sheets
7=Tiles
8=Pressed soil blocks
9=Cement blocks
10=stone
11=Other_____

5. List who keeps watch in the watch-huts at each location at any one time

1=Head
2=Spouse
3=Own child
4=Parents
5=Grandparent
6=Grandchild
7=Sibling
8=Uncle/aunt/nephew/niece/in-law
9=Servant
10=Tenant/lodger
11=Unrelated person

SECTION D2: PREVENTION

Prevention measures	12. Number of times this measure was used on your farm during the following periods							13. Number of times this measure was used on neighbouring farms during the following periods							14. How was the item obtained?	15. Cost (Rs.) if purchased	16. Is it Essential or Not?	17. Circle effectiveness from most to most to least
	Jan	Oct-Dec	Jul-Sep	Apr-Jun	Jan-Mar	'12	'11	Jan	Oct-Dec	Jul-Sep	Apr-Jun	Jan-Mar	'12	'11				
Surveying own farm from watch-hut																	E/N	1 2 3 4
Building a wooden fence around farm																	E/N	1 2 3 4
Installing an electric fence around farm																	E/N	1 2 3 4
Creating traps around farm																	E/N	1 2 3 4
Digging a trench around farm																	E/N	1 2 3 4
Cultivating undesirable plants/crops																	E/N	1 2 3 4
Lighting firecrackers or thunderflashes																	E/N	1 2 3 4
Firing mock gun shots																	E/N	1 2 3 4
Lighting fires at night																	E/N	1 2 3 4
Flashing large torches																	E/N	1 2 3 4
Using horns																	E/N	1 2 3 4
Other (specify)																	E/N	1 2 3 4

14. How prevention measure was obtained
1=Department for Wildlife Resources and Conservation
2=Other government department
3=Local non-government organisation
4=International non-government organisation
5=Farmers' Organisation
6=Community
7=Family members
8=Friends
9=other_____

16. Effectiveness
1. Highly effective
2. Effective
3. Not very effective
4. Ineffective

SECTION E: CONTINGENT VALUATION

Imagine that an NGO came to your village offering the resources to build an electric fence(s) to protect yours and fellow villagers' homes and crops from elephant-related damage. The NGO would provide financial resources, construction materials and technical know-how in order for you and your fellow villagers to build the electric fence(s) yourselves. In addition, you and your fellow villagers would have to manage the maintenance of the electric fence as a community.

1. How much time (in hours) would you be prepared to spend constructing the electric fence? 0 2 4 6 8 10 12 14 16 18 20 >20

2. How much time (in hours) would you be prepared to spend maintaining the electric fence per week after the fence was constructed?

0 1 2 3 4 5 6 7 8 9 10 >10

3. Who do you think is responsible for managing the HEC? Rank in order of importance: Government_____; NGOs____; Community____; Individual_____

4. List the societies that you belong to	5. Run by: Government, NGO, Community, Individual	6. Frequency of attending meetings
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		

Code 4. 1. Agricultural 3. Religious 5. Education 7. Sports 9. Mothers
2. Social 4. Cooperative and thrift 6. Funeral 8. Savings 10. Other

7. Who have you gone to for help in last year?	8. Tick if Yes	9. How many times?	10. For what purpose?	11. How much?
1. Immediate family				
2. Relatives				
3. Friends				
4. Community				
5. NGO				
6. Government				
7. Private money lenders				

Purpose code: 1. Agriculture; 2. Consumption; 3. Housing/housing repair; 4. Education; 5. Medical costs

SECTION F: INCOME FROM AGRICULTURAL ACTIVITIES

All questions relate to farming costs and quantities from Yala and Maha seasons 2013/14 (Yala – April 2013 to August 2013; Maha – September 2013 to March 2014)

1.Season	2.Crop code	3.Acres planted	5.Did you take out a loan to cultivate this crop?				6.Family and hired labour			7.Fertilizer use			8.Manure	9.Insecticides/ pesticides		
			Y	N	Amount (Rs.)	From whom?	No. family labour days	No. hired labour days	Daily rate (Rs.)	Unit	No.	Cost (Rs.)	Kilos	Unit	No.	Cost (Rs.)
1.*Maha*			*Y*	*N*												
2.*Maha*			*Y*	*N*												
3.*Maha*			*Y*	*N*												
4.*Maha*			*Y*	*N*												
5.*Maha*			*Y*	*N*												
6.*Maha*			*Y*	*N*												
1.*Yala*			*Y*	*N*												
2.*Yala*			*Y*	*N*												
3.*Yala*			*Y*	*N*												
4.*Yala*			*Y*	*N*												
5.*Yala*			*Y*	*N*												
6.*Yala*			*Y*	*N*												

6. Labour days: number of workers * number of days = labour days

Unit: 1=kilograms 2= 40kg bag 3=bushel

	10.Irrigation (Tick if rain-fed or motorised)			11.Total output in quantity terms Estimated/Actual (circle)		12.Sales			13.Place(s) of sale			14.Amount retained and stored	
Season	Rain-fed	Motorised	Cost (Rs. if applicable)	Unit	No.	Unit	No.	Value (Rs.)	#1	#2	#3	Unit	No.
1.*Maha*					E/A								
2.*Maha*					E/A								
3.*Maha*					E/A								
4.*Maha*					E/A								
5.*Maha*					E/A								
6.*Maha*					E/A								
1.*Yala*					E/A								
2.*Yala*					E/A								
3.*Yala*					E/A								
4.*Yala*					E/A								
5.*Yala*					E/A								
6.*Yala*					E/A								

2.Crop code (write out in Sinhala to match codes on page 14)

5.From whom?
1=Friend
2=Relative
3=Microfinance organization
4=Private moneylender/trader
5=Bank

13.Place(s) of sale
1=Local markets
2=Neighbours
3=Lorries
4=Moneylenders/traders
5=Government economic centres

SECTION G: INCOME FROM NON-AGRICULTURAL ACTIVITIES

1.Economic activity	2. Location of employment	3. Number of days worked (for pay, cash or in-kind)		4. Amount earned if paid in cash (Rs.)		5. Amount earned if paid in-kind				6. Number of days worked (if labour sharing)		7. What were the two main uses of income generated from these activities?	
		Jan	Jul-Dec	Jan	Jul-Dec	Jan		Jul-Dec		Jan	Jul-Dec	#1	#2
						Form	Unit	Form	Unit				
1.													
2.													
3.													
4.													
5.													

1. Economic activity

1=Manual worker (builder/carpenter/craftworker/ potter/blacksmith/plumber/metalworker/welding)
2=Sewing/knitting/dressmaking
3=Foodseller (e.g. pre-school and school lunches)
4=Grocery store
5=Driver/mechanic
6=Repair work (not welding or plumbing)
7=Factory worker
8=Government service (teacher/health worker) 9=other_____

2. Location of employment

1=This village
2=Neighbouring village
3=Village nearby
4=Town nearby
5=City further away

5. Amount earned if paid in-kind: Form

1=Seeds/fertilizer/inputs
2=Maize
3=Other food
4=Ploughing
5=Clothing
6=Soap
7=Milk
8=Livestock

Units: 1=Kilogrammes
2=40kg bag
3=Bushel

7. Two main uses of income generated

1=Food
2=General, non-food purchases for household
3=School fees/books/uniforms
4=Reinvestment into business
5=Asset purchases (e.g livestock, machinery)
6=Service purchases (e.g. labour)
7=Savings
8=Non-educational expenditure for children
9=Health-related expenses
10=Loan repayment
11=Other

Community No. _____ Household No._____ Name of interviewee_____

SECTION H: REMITTANCES

Type of receipt	1. Remittances received by whom in the household?	2. Who provided the remittances?	3.Amount received in the past 6 months				4. If cash, what was income *mainly* used for?
			a. Cash (Rs.)	In-kind			
				b. Amount	c. Unit	d. Form	
1.Gift/assistance/aid							
2.Inheritance							
3.Pension							
4.Remittance: a. cash							
b. in kind							

1.Who received?

1=Head
2=Spouse
3=Own child
4=Parent
5=Grandparent
6=Grandchild
7=Sibling
8=Uncle/aunt/nephew/niece/inlaw
9=Servant
10=Tenant/lodger
11=Unrelated person

3b. Amount received in the past 6 months

Units: 1=Kilogrammes
2=40kg bag
3=Bushel

1=Seeds/fertilizer/inputs
2=Maize
3=Other food
4=Ploughing
5=Clothing
6=Soap
7=Milk
8=Livestock

2. Who provided?

1=Government department
2=Local non-government organisation
3=International non-government organisation
4= Farmers' organisation
5= Other community-based organisation
6=Family members
7=Friends

4. If cash, what was income *mainly* used for?

1=Food
2=General, non-food purchases for household
3=School fees/books/uniforms
4=Reinvestment into business
5=Asset purchases (e.g livestock, machinery)
6=Service purchases (e.g. labour)
7=Savings
8=Non-educational expenditure for children
9=Health-related expenses
10=Loan repayment
11=Other

SECTION I: INVENTORY OF DURABLE GOODS (Tick appropriate boxes.)

	Y	N	1. How many?	2. Total Value (Rs.) (how much to replace)	Purchased with savings	Purchased with loan	Purchased with seettu	Aid/donation	Inherited	In-kind payment	Gift
Agricultural equipment			a	B	c	d	e	f	g	h	i
1. Ox-plough	Y	N									
2. Sprayer	Y	N									
3. Wheelbarrow	Y	N									
4. Hoe/axe/spade/machete/ slasher	Y	N									
5. Tractor	Y	N									
6. Tractor plough/harrow/ cultivator/trailer	Y	N									
7. Thresher/"tsunami"/"boothaya"	Y	N									
8. Crop sheller	Y	N									
9. Irrigation pump/pipes	Y	N									
10. Saw/trowel	Y	N									
11. Water motor	Y	N									
12. Grinding mill	Y	N									
13. Other	Y	N									
Vehicles											
14. Bicycles	Y	N									
15. Three-wheeler	Y	N									
16. Motorcycle	Y	N									
17. Van	Y	N									
18. Bus	Y	N									
19. Lorry	Y	N									
20. Car	Y	N									
Household items											
21. Bedframes	Y	N									
22. Mattresses	Y	N									
23. Tables	Y	N									
24. Chairs	Y	N									
25. Stereo	Y	N									
26. Television	Y	N									
27. VCD/DVD player	Y	N									
28. Gas/paraffin stove	Y	N									
29. Sewing machine	Y	N									
30. Refrigerator	Y	N									
31. Gas/electric cooker	Y	N									
32. Battery/generator	Y	N									
33. Electric stand fan	Y	N									
34. Ceiling fan	Y	N									
35. Telephone (landline)	Y	N									
36. Mobile telephone	Y	N									
37. Personal computer	Y	N									
38. Sofa	Y	N									
39. Glass cabinet/ cupboard	Y	N									
40. Lamp/lantern/ torch	Y	N									

	Y	N	3. How many?	4. Total Value (Rs.)	Purchased	Inherited	Gift	Aid/donation	Collateral/ loan repayment	In-kind payment	Using loan	Seettu
Non-durable items			a	B								
41. Goats	Y	N										
42. Cows	Y	N										
43. Chickens	Y	N										
44. Buffalo (mi-harak)	Y	N										
45. Pigs	Y	N										
46. Other (specify)												
47. Other (specify)												

Inventory of crops stored (crop code)	a. Where stored	Amount stored		d. Value of amount stored (Rs.)	e. Where from?	f. Are you storing for future sale?		If yes, how much do you intend to sell?	
		b. Unit	c. No.					g. Unit	h. No.
48.						Yes	No		
49.						Yes	No		
50.						Yes	No		
51.						Yes	No		
52.						Yes	No		
53.						Yes	No		
54.						Yes	No		
55.						Yes	No		
56.						Yes	No		

48-56. Crop code

1=Maize	7=Millets	13=Beelunu	19=Battu	25=Moringa
2=Groundnuts	8=Chilli	14=Okra	20=Coconut	26=Yams
3=Cowpea	9=Pepper	15=Pineapple	21=Sugarcane	27=Papaya
4=Mung beans	10=Tomato	16=Bananas	22=Bitter gourd	
5=Sesame	11=Pumpkin	17=Watermelon	23=Snake gourd	
6=Paddy	12=Red onion	18=Aubergines	24=Ridge gourd	

a. Where stored

1=In own house
2=In another house
3=Communal storage
4=In shop
5=Other (specify)

b,g. Unit

1=Kilogrammes
2=40kg bag
3=Bushel

e. Where from?

1=Own produce
2=Purchased
3=Gift
4=Aid/donation
5=Collateral/loan repayment
6=In-kind payment

SECTION J: INFORMATION REGARDING HOUSEHOLD CONSTRUCTION

1. How would you describe your main residence? (Circle the most appropriate response.)

Single-storey house *Multi-storey house* *House with annex* *Other_____*

2. How many rooms are there in your dwelling? (Please state.) _____

3. What were the main materials used to build your walls? (Circle the most appropriate response.)

Cement bricks *Mud bricks* *Mud huts* *Coconut palms* *Metal sheets*

Stone *Bamboo* *"Buta"* *Kabook* *Other_____*

4. With what material has your floor been finished? (Circle the most appropriate response.)

Cement *Concrete* *Terazzo tiles* *Mud/manure* *Sand* *Other_____*

5. What was the main material used to construct your roof? (Circle the most appropriate response.)

Tiles *Sinhala tiles* *Asbestos* *Concrete slab* *Metal sheets*

Coconut palms *Cadjan* *Stone* *Straw* *Other_____*

6. Are your windows fitted with: A. Glass B. Iron grates C. Both D. Neither? (Circle the most appropriate response.)

7. What is your main source of water? (Circle the most appropriate response.)

Agricultural well *Tube well* *Well on property* *Tap water on property* *River*

Tanks/reservoir *Streams* *Ponds* *Rainwater* *Other_____*

8. How far, in kilometres, do you travel to access water? (Please state.) _____

9. What kind of toilet do you have? (Circle the most appropriate response.)

Flush toilet *Pour flush (squatting)* *Covered pit latrine* *None* *Other_____*

10. How do you dispose of your garbage? (Circle the most appropriate response.)

Collected by municipal council *Buried on premises* *Burned* *Dumped within premises*

Processed for fertilizer *Dumped on neighbouring plot* *Left on the street* *Other_____*

11. What is your main source of lighting? (Circle the most appropriate response.)

Kerosene *Electricity* *Generator/battery* *Solar power*
Torch *Candle* *Gas lamp* *Fire* *Other_____*

12. What is your main source of cooking fuel? (Circle the most appropriate response.)

Firewood *Gas* *Charcoal* *Kerosene*
Electricity *Saw dust* *Paddy husk* *Other_____*

13. If you use firewood as your main source of cooking fuel, from where do you obtain it?

Own land *Forest* *Purchased* *Other land*

15

Community No. _____ Household No._____ Name of interviewee_____

SECTION K: CREDIT & SAVINGS

1. Do you have any outstanding loans now? *Yes, No,* if yes complete table below?
2. If NO, have you had loans in the past? *Yes, No.*
3. If Yes, why do you not have a loan now (circle)? *Not needed; could not get; would struggle to repay; have struggled to repay in past; other_____*
4. If No, why have you never had a loan (circle)? *Not needed; could not get; would struggle to repay; other_____*

ID	5. From whom?	6. Amount borrowed (Rs.)	7. Loan purpose	8. Interest rate %
1				
2				
3				
4				
5				
6				
7				

9. Do you lend money to others? *Yes No*

	10. To whom (borrower)?	11. Amount lent (Rs.)	12. Interest rate %
Loan 1			
Loan 2			
Loan 3			

11. How much cash does your household hold now? Rs.? Rs. 0-5,000; 5,001 – 10,000; 10,001-20,000; 20,001-25,000; more than 25,000

12. Does any family member hold a savings account? *Yes No* If yes, complete table below:

13.Type-code for 13, 17, 21 1. Bank 2.Community savings group 3. Other	14. Savings Balance (Rs.)	15. Purpose	16. Monthly Amount Saved (Rs.)	17. Type (code)	18. Savings Balance (Rs.)	19. Purpose	20. Monthly Amount Saved (Rs.)	21. Type (code)	22. Savings Balance (Rs.)	23. Purpose	24. Monthly Amount Saved (Rs.)

Codes for 5,10. From whom?

1=Friend
2=Relative
3=Microfinance organisation
4=Private moneylender/trader
5=Bank
6=Trader
7=Business associate
8=Neighbour

7.Purpose of loan/savings

1=Buy farm/other implements
2=Buy seasonal inputs
3=Buy livestock
4= Buy food/goods for family
5= Start an off-farm business
6= Pay for ploughing
7= Pay for hired labour
8= Pay for travel expenses
9= Pay for building materials
10= Pay for health expenses
11= Pay for educational expenses
12= Pay for New Year expenses

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