Decision Making Under Scarcity: An Inquiry into The Effects of Cognitive Load

Suvarna Pande

Thesis submitted for the degree of Doctor of Philosophy

School of International Development, University of East Anglia

May, 2023

Student registration number: 100253025/1

This copy of the thesis has been supplied on condition that anyone who consults it is understood to recognise that its copyright rests with the author and that use of any information derived there from must be in accordance with current UK Copyright Law. In addition, any quotation or extract must include full attribution.

Abstract

Scarcity, or the feeling of having less than you need, alters the decision-making process. This poverty-triggered mechanism makes economic decisions more difficult by curtailing cognitive control. This involuntary load redirects the deliberative part of the cognitive system towards making rational choices for scarcity alleviation. At the same time, other preferences get overwhelmingly guided by the affective system. Such recalibration results in the rational-bias split or tunnelling in preferences. Pressed for resources, people become judicious about relevant commitments as other beneficial but irrelevant choices suffer. This sensitivity to 'what matters' changes preferences. My work investigates this dichotomy of preferences.

I look at financial scarcity and intimate partner violence as sources of cognitive load and examine split and changes in probability weighting function and risk preferences through the attentional mechanism. I undertook two lab-in-field experiments in Uganda and the Dominican Republic to investigate this framework. To understand the within-subject differences, each participant takes two decisions- one relevant to resolve the scarcity at hand and the other that is not. I use the common consequence ladders to track probability weighting, Eckel Grossman and Holt-Laury price lists for risk preferences.

I confirm the pervasive characteristics of scarcity. Finances are a constant worry for those facing shortages. The level of scarcity affects cognitive load: inhibitory control and attention are taxed by expected scarcity. Working memory scores are affected by unexpected scarcity and the interaction of expected and shock. Additionally, previous experience of economic abuse, higher inhibitory control, and attention risk seeking. Finally, the scarcity-irrelevant probability weighting function is more likely to be non-linear than that for the scarcity-relevant attribute. I show that split or tunnelling depends on the strength of the top-down force of scarcity, the bottom-up force from the choice and their congruence. I find a by-scarcity-relevance split in probability weighting and risk preferences.

Access Condition and Agreement

Each deposit in UEA Digital Repository is protected by copyright and other intellectual property rights, and duplication or sale of all or part of any of the Data Collections is not permitted, except that material may be duplicated by you for your research use or for educational purposes in electronic or print form. You must obtain permission from the copyright holder, usually the author, for any other use. Exceptions only apply where a deposit may be explicitly provided under a stated licence, such as a Creative Commons licence or Open Government licence.

Electronic or print copies may not be offered, whether for sale or otherwise to anyone, unless explicitly stated under a Creative Commons or Open Government license. Unauthorised reproduction, editing or reformatting for resale purposes is explicitly prohibited (except where approved by the copyright holder themselves) and UEA reserves the right to take immediate ‘take down’ action on behalf of the copyright and/or rights holder if this Access condition of the UEA Digital Repository is breached. Any material in this database has been supplied on the understanding that it is copyright material and that no quotation from the material may be published without proper acknowledgement.

Acknowledgements

This thesis would not have been possible without the immense help and support from my supervisors, Professor Arjan Verschoor, Paul Clist and Maria Isabel Santana. I will remain forever in gratitude for their guidance and encouragement. The journey was long and winding, with many upsets along the way. Even though, at times, all seemed disappointing, they never gave up on me. Looking back, they transformed me into a wiser academic and kinder, better person for life.

One needs a caravan village to wade through the enchanted forest to get to the promised doctorate land. And as is the case with all fairy tales, there are demons to be tamed along the way with the help of fellow dreamers that join the journey. Sometimes, as the main protagonist is close to giving up, inspirational, wise characters appear to correct her course. I liken my journey to this adventure and would be remiss not to acknowledge the critical people encountered throughout this quest.

My story began in JNU, India. I was fortunate enough to be mentored by professors who introduced me to behavioural development economics. I will remain forever indebted to them for recommending the book *Scarcity* to me, which sparked a spirit of inquiry that assumed a life of its own and transformed into this research topic. Supervisors from my Masters and MPhil. motivated and offered the most exciting projects to work on. They continually encouraged me to explore newer research interests, even on topics beyond their expertise.

My arrival here in the UK began the arduous journey of the PhD. The first year was probably one of the most challenging periods of my life. Settling here, understanding the academic culture and dealing with debilitating anxiety levels took a toll in more ways than one. This was the first five-headed demon on this journey. I was fortunate to find comrades at this stage. Rajanya di, Agathe, Lucas, Tauseef and Gaurav people became family. I continue to remain in awe and be inspired by them every day. With their unwavering support in agony and pragmatic advice, they became my support system, a source of smiles and serotonin. PhD suddenly started feeling a lot less emotionally daunting as I looked forward to our afternoon Monopoly deal sessions filled with laughter and inadvertent therapy. They accepted me for all my weirdness and anxieties, and I drew strength from their love.

The demons gained strength during the two covid years when the world reached a standstill. Sitting in the UK alone, as my fieldwork was stopped, things going downhill back home in Delhi was a challenge I was unprepared for. Zam, Joshua and the many research assistants in Uganda and the Dominican Republic were pillars of academic strength in this period. This work data collection could not be possible without their help, input and commitment.

As if the struggles of complete isolation were not enough, Covid took some dearest people away from me, especially my Bade Babba, Raboo Mama and Vibha Bua. Along with my grandparents, today they would be very proud of this third-generation doctorate coming into the family. This thesis is the product of my extended family's love, encouragement and resilience - Badi Bua, Abha Bua, Asha Bua, Mausi, Mama and all my cousins, nieces and nephews. Irrespective of anything and everything, they believed in me. Every day I feel incredibly lucky to have been born into a family that goes above and beyond for each other and embodies selfless love in the truest form.

There were many dark, hopeless phases where I was close to giving up, and I have been fortunate enough to be protected by a group of fierce confidants who have stood through thick and thin. Snigdha, my go-to for the last 18 years. She has seen it all, and I couldn't have asked for a better compatriot. I feel blessed to have Priyal with her craziness, Aasthu with her constant cheerleading, Hirak and Els with their unwavering warmth, Varun, Dimps, Kakks, Tittu, Thais, Paul, Malo and all the many, many friends with their love and support in my life. I remain indebted.

Finally, I extend all my heart and life to people central to everything I do, my anchor, my family. My parents and Nanu, all of this is for you. Ma, Babba, I am proud to be your daughter every day. This thesis, this life is all yours. I could not be luckier. Your thought is behind everything I do, every decision I make. I owe it all to you. You are perfect parents, fighting against the world to give me all the happiness and comfort. I could not and would not do it without you. I can conquer the world and take up any challenge with your support and encouragement. Babba, your inspirational speeches are my lifeline when I feel lost. Ma, your relentless strength, patience and absolute selflessness can calm any storm and bring down any Goliath. I hope, work and aim to make you proud and happy all my life. My sister, Nanu, is all heart and my rock. Her love, her laughter is a blessing. She held my hand when I was struggling the most. I forgot who I was. Her encouragement pulled me back to keep marching ahead. I love you all so much. Your hugs and love are lifelines for the soul in their unique way, my personal slice of heaven.

My Caravan-village became merrier, the journey lovelier, and the happy ending became sweeter when I met my partner. Ravi, thank you for all your love, endless cheers, laughter, non-judgemental acceptance, support, and for always putting things in perspective. Your patience with my emotions, tears, endless cribbing, anxieties and thought overdrives should qualify you for an award. You are my miracle, my sunshine, making everything easier, everything better. I cannot wait to see what the future holds for us. I'm just grateful I get to share it with you.

I could not have realised my strength and value without this merry band and moved past the horribleness. There were times when I was stuck in a rut, cut off from everyone, and they would pull me up, help me stand back up and take on the world again.

You're all my sky full of stars,
Rescuing me in your ways,
I couldn't have done it without you all.
Thank you.

Table of Contents

List of Tables

List of Figures

1 Introduction

Every expenditure, each penny, matters more when we are short on finances. While we focus on rationalising single spending individually, everything else that is not of immediate concern and does not address the current difficult situation, like preventative medical care, and gainful investments, are neglected. If things were simpler, maybe it won't matter as much, but life is complex, with many things that must be managed parallelly. This thesis looks at the effect on and the dynamics of decision-making when the shortfall of resources or scarcity overpowers the mind and takes precedence over all other concerns.

Economics as a discipline is the study of scarcity. The idea of constraints and its response to prices is one of the introductory lessons. While some forms of physical scarcity may be universal, irrespective of economic and social status, the acute feeling of monetary scarcity or poverty is not. The constant awareness of being short on finances leads to a cycle of dissatisfaction, unpleasantness, and struggle.

The lives and economic decision-making of the poor have received much attention over the last few decades. The subject has been the fundamental focus of development economics. Extensive studies and cross-national household surveys (Banerjee and Duflo, 2007; Bank, 2000) report some common themes from low levels of investment specialisation and risk appetite, high instances of petty entrepreneurs, low expenditures on food, poor quality of primary schooling and meagre wealth accumulation levels. These, in turn, have intergenerational effects through parenting investment and maternal depression (Baranov et al., 2020). A recurring theme within the literature is the relationship between path dependence, risk-aversion, and long-term poverty (Jumare et al., 2018; Yesuf and Bluffstone, 2009). The spillovers accentuate the persistence and complicate policy interventions further. A direct implication is the formation of self-reinforcing mechanisms called poverty traps. This peculiar feature, where poverty begets poverty, is operational at both macro and micro levels. By now, there exists overwhelming support for different aspects of this hypothesis on poverty traps (Azariadis and Stachurski, 2005; Balboni et al., 2020; Barrett et al., 2016; Bowles et al., 2006; Carter and Barrett, 2006; Ghatak, 2015). However, a critical review of country-level S-shaped savings functions, non-linear food consumption and occupational poverty traps underscore behavioural insights' theoretical and evidentiary importance (Kraay and McKenzie, 2014).

Most of the literature on poverty and poverty traps focuses on systemic, information-institutional failures, environmental pressures, or a combination of the three to explain outcomes. A rapidly emerging debate between policymakers brings forth a fourth perspective (Kremer et al., 2019). Within

this framework, the shortfall of resources or poverty changes cognitive systems that ultimately affect decisions (Schilbach et al., 2016). A key aspect under this ambit is the consequences of the psychological and cognitive state brought about by poverty. The "behavioural constellation of deprivation" (Anand and Lea, 2011) examines the effects on affective states that lower productivity, cognitive biases, and actions. This perspective falls under the vicious cycle of inequalities along with embedded early life circumstances to intergenerational feedback of increasing constraints resulting from the multi-domain present-biased and low self-control.

From this perspective, seemingly self-sabotaging activities like low pickup rates of preventative health, medications, risk-aversion and high-interest borrowing behaviours of the poor are natural fallouts of the easily activated, challenging to suppress, interfering monetary thoughts that shape valuations and associations. A mind functioning in poverty would focus so ardently on meeting immediate needs that other equally important but not immediate things would bear the brunt.

Evidence suggests two mechanisms through which the self-reinforcing mechanism works. The first compares allocations between temptation and non-temptation goods and finds the higher levels of present bias among the poor behind the unwillingness to undertake small high-return investments. The second focuses on the high mental effort in their daily lives as a potent force in forming a trap. Understanding this capture of attention is crucial as it may change the thinking process, what remains on top of the mind, what is noticed, and how decisions are made (Duflo, 2006).

Around World War II, psychologists conducted the first known experiment on scarcity (Keys et al., 1950). The experiment on hunger and starvation documented two trajectories of changes once scarcity was triggered – physical and mental changes. While physical changes were an obvious outcome, the more interesting arena of changes happened within their psyche. Subjects were found to be almost fixated on the scarce good – food. Participants' attention was wholly consumed and absorbed by it. Repeated experiments by triggering different forms of scarcity found a similar effect of constraints. The thought capture resulted in heightened focus and attention. One such example is how socially lonely people were more efficient in recognising emotions in pictures presented to them.

Moreover, once their loneliness was primed, they were better at recalling details that involved social content (Mullainathan and Shafir, 2013a). Therefore, the mind tends to focus on what it wants to have but does not. Consequently, such a mind so preoccupied with that need ignores everything else.

Scarcity, or the feeling of having less than you need, alters the decision-making process (Mullainathan and Shafir, 2013a, 2013b). First, the concern imposes a burden on the limited cognitive capacity – the cognitive load. Then, pressed for resources, people tend to become judicious about relevant

commitments as other beneficial but irrelevant choices suffer, a metaphorical focus tunnelling effect. This sensitivity to *what matter*s changes preferences (Figure 1). My work investigates this process and the resulting dichotomy of preferences with the primary research question –

How does the scarcity-triggered cognitive load change risk preferences?

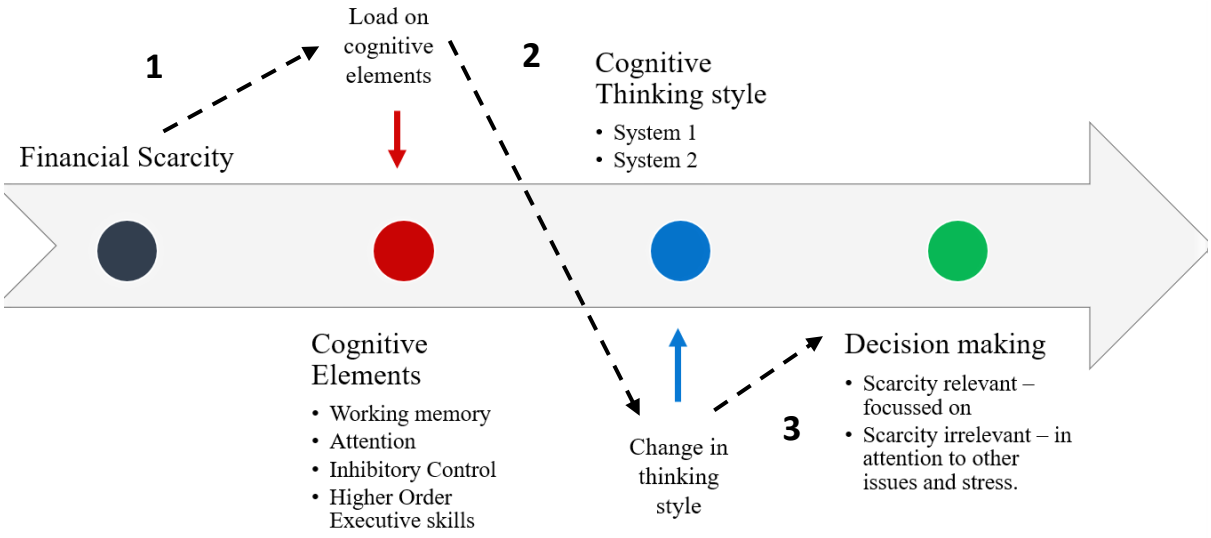


Figure 1 The Scarcity Mechanism

Risk preferences are at the core of economic decision-making. It affects the decision-maker's life and has a role in intergenerational perpetuation or elevation from poverty. These conditions often correlate with higher stress levels within the family, intimate partner violence, crime and overall tricky circumstances. With this thesis, I look at financial scarcity, its hypothesised effect on cognitive load and risk preferences. The first two papers look at the static effects of scarcity while the third paper takes it further and looks at one of the correlates of poverty. More specifically, it focuses on a section of the population that faces Intimate partner violence and economic abuse from their partners. It looks at the resulting cognitive load and the impact on risk parameters.

I undertake two lab-in-field experiments in Uganda and the Dominican Republic to investigate various aspects of this framework. Each chapter focuses on different aspects of scarcity, cognitive load, and tunnelling for risk preferences in isolation and interaction with familial variables. I first look at the most consequential of all– financial scarcity and the resulting changes in probability weighting function and risk preferences through the cognitive attentional mechanism. Then, I investigate the same process in a more real-world setting of mothers facing Intimate Partner Violence.

From the conceptual framework that links poverty, its cognitive effect, the mechanics of the attentional processes at play and the eventual impact on preferences for probability weighting and

risk preferences, I derive three sub-research questions that are also the themes for my three empirical papers –

1. ***How does scarcity-led cognitive load alter probability weighting?***
2. ***How does scarcity-led cognitive load alter risk preferences?***
3. ***Does Intimate Partner Violence (IPV) on the mother affect her risk preferences?***

I hypothesise that the participants facing the most significant potent weight of financial scarcity would be most cognitively loaded from it. Therefore, they are most likely to rationalise choices that resolve their scarcity and least prone to show biases. Simultaneously, the same individuals would be the most biased for everything else. In terms of probabilities, their perceptions would be closest to the actual values of probabilities for scarcity-relevant needs while also being the most biased in probability weighting for scarcity-irrelevant attributes. Additionally, for the group, I see subjects most risk-averse for tunnelled-in choices for gains while parallelly being most risk-seeking for scarcity irrelevant choices. The trends in differences between scarcity-relevant and irrelevant choices for gains and losses are similar, with the individuals being more tolerant of losses when facing most pressure of scarcity. Thus, preferences are split based on relevance to the scarcity at hand.

This is a significant departure from the probability weighting and risk preference theory. Most literature looks at preferences as a monolith. With my work, I contribute to a growing body of evidence that shows that may not be the case. What sets my work apart is the proof of differences at the within-subject level. I show there is something beyond the external factors moderating, guiding and changing preferences – the cognitive attentional mechanism.

Continuing from similar works that looked at links between various aspects of the theoretical mechanism - scarcity and cognitive load in India and the USA (Mani et al., 2013) and its effect on lower exchange asymmetries in Zambia (Fehr et al., 2020) and tunnelling effects in Brazil (Lichand and Mani, 2020), I use the natural harvest cycle of the Bwikhonge region of Uganda to design for expected cyclical shortfalls. The distinct harvest and lean seasons provide a source of external variation in financial scarcity.

For each season, I prime half the participant pool with hypothetical worries that do not directly allude to financial positions but would get at scarcity's unprompted, easily triggered characteristics (Spears, 2011). Next, all the participants – primed and control complete the two-question cognitive load test. The tool is a literacy level-adjusted Stroop and the Digit Span test. Together, they measure the impact on working memory, inhibitory control and attention from the previous scarcity treatment. Following this, I introduce the decision-making activities with everything the same but their relevance attribute. Each participant makes the same decision for the same payoffs twice - once when it is relevant to the

scarcity at hand and once when it is not. Therefore, I have a 2*2*2 between-within-subject design for gains and losses where I capture the effects of expected scarcities, financial shock, its effect on cognitive load on a between-subject level and its tunnelling impact on probability weighing, risk-aversion at a within-subject level.

For the probability weighting function, I administer the five-choice common consequence ladders for gains and losses for each attribute. Common Consequence ladders have been tested in the region (Verschoor and D'Exelle, 2020). They are an easy way to approximate the theoretical inverse-S-shaped probability weighting curve in populations where literacy may be a constraint. The method works on the principle of violation of the Allais paradox. When probability mass is moved between them, the participants must choose one out of the Risky and Safe lotteries for the five rungs. A "rational" person who chooses Risky or Safe in the first should continue until the fifth. A switch to safe or risky from the previous rung is indicative of the presence of probability weighting. Since I aim to go beyond probability weighting and look at the difference scarcity relevance cause, all participants in each season– Lean (346) and Plenty (330) do the 5-rung decision-making task twice for each attribute, giving me ten decision points at a within-subject level.

Next, I introduce the decision attribute indexed risk preference task for all the participants. I use the Eckel- Grossman 6 choice lotteries for gains and losses (Dave et al., 2010; Eckel and Grossman, 2008, 2002). Each subject chooses one of the six for either gains or losses, depending on the random group allotment. They repeat the same activity twice, scarcity-relevant and irrelevant, thus allowing me to measure the extent of the within-subject role of scarcity-guided bottom-up attentional capture or tunnelling.

Finally, I look at one of the sources of intergenerational transfer of poverty and one of its most common correlates – Intimate Partner Violence. With over 40 per cent of women reporting instances of some form of violence in the Dominican Republic, it remains an urgent public health issue. In addition to the stresses of poverty, it is one of the most long-term sources of mental trauma for women. While poverty alone is dire enough, choices in poverty are not isolated. Sometimes, the responsibilities coexist, are inescapable and may compound the effect of financial scarcity (Bassuk et al., 2006; Bedi and Goddard, 2007). Intimate Partner Violence becomes another source of cognitive load for the mother.

I conducted my experiments with the dyads of mothers and young children to examine the toll that cognitive load takes on the mother who faces domestic violence in her daily life and its effect on her mothering style and risk preferences. In developing countries, where social protection is not as strong and gender norms are rigid (like the Dominican Republic), one of the most common reasons given by

women to stay in the relationship even as they face violence is to provide guardianship for their child. In such a scenario, the mother usually copes with the abuse to focus and shield the child. As a result, I expect her other preferences (risk preferences for my thesis) to change as she is tunnelling on the child.

Theoretically, a mother under cognitive load, acting as an emotional anchor and a safety buffer, tunnelling in on her child's needs, will have different risk preferences. I explore this pathway in an experimental setting by first priming the mother with scenes of partner violence, then administering the standard NIH cognitive toolbox (Weintraub et al., 2013) to look at the effect on her inhibitory control, attention and working memory. After a series of games with the child, she does the Holt and Laury Price list task for risk preferences (Andersen et al., 2008). In addition to the experimental priming for violence, I also look at the heterogenous effect of trigger effects of previous experiences of abuse and violence on risk preferences.

Behavioural economics allows the identification of two aspects of individual choices – decision quality and risk preferences. While recent theories (Adamkovič & Martončik, 2017) propose theoretical models that integrate poverty – cognitive load- executive functions- thinking styles and decision-making, it misses the element of tunnelling and the selective reorientation of cognitive systems. Therefore, I seek to address some critical gaps in my work. First, I add to the limited available evidence for "decision neglect" or "tunnelling". Second, I document the effects of the primary trigger for the tunnel-split - cognitive load and decision attribute. Thus, answering a vital question of the underlying mechanism. Thirdly, I extend the incomplete understanding of risk preferences under cognitive load and thinking styles. Finally, after these conceptual clarities, I question how much of this holds up in the real world, especially for women where Intimate Partner Violence is an everyday reality.

I find conclusive evidence of scarcity as a force between periods. Participants primed in the lean season in Uganda report statistically significant higher levels of monetary concerns even when there is no direct mention of finances. Additionally, I find a marked effect on inhibitory control, attention and working memory for different levels of financial scarcities. Individuals in the lean season and primed with shock scarcity performed significantly worse in the tests than the other corresponding groups, thus providing direct evidence of the effect of scarcity on cognitive load.

Furthermore, I show that the hypothesised bifurcation in preferences or tunnelling would depend on two things – the force of scarcity and the nature of choice itself. I show that once the Top-down cognitive force from scarcity and the attentional capture mechanism of scarcity relevance is strong enough, probability weighting and risk preferences as we know them begin to split. I also find statistical evidence of cognitive load moderating the mechanism for probability weighting and not risk

preferences, which can be explained by the fact that making probabilistic decisions themselves require cognitive effort. This differentiation between the level of cognitive effort due to the nature of choice, its relevance to scarcity and the overall force of scarcity determines how an individual weighs probabilities, their risk-seeking behaviour, and the level of bifurcation[1].

Moving beyond financial scarcity, I show that previous experiences of trauma, violence and economic abuse affect women's risk preferences and cognitive load. I find inhibitory control and attention play a role in increasing the risk parameter. How a mother copes with violence is a matter of ongoing inquiry from my work. Nevertheless, these findings support the hypothesis that violence affects risk preferences.

This thesis combines three standalone papers examining one of the research questions. First, I begin by looking at scarcity's effect on probability weighting. The paper begins with the literature overview and the emerging gaps leading to the first research question. Then, I frame the conceptual framework using insights from the scarcity and cognitive attentional theory to look into what it implies for the probability weighting function. Finally, I discuss the experimental design and results in detail to assess if the framework holds. I move to the second chapter on risk preferences with the same template. After discussing the literature on risk preferences and a brief overview of the common elements leading to the research question, I refine the conceptual framework further for cases where choices may not grab the decision-makers attention. I follow it up with the methods section and detail the reasons for choosing the field-friendly Eckel Grossman method for risk preferences. Finally, I discuss the results and examine the level of the split in preferences due to scarcity relevance. In my third chapter, I move beyond looking at financial scarcity and analyse another coexisting source of cognitive load – Intimate Partner Violence. I begin the chapter by sketching the theoretical framework after giving an overview of the literature. I discuss, in detail, the complete experimental design and the elements which would be the paper's focus. Finally, I present the results and heterogenous analysis from my experimental data. Lastly, I end with a short conclusion summarising my results and how they fit into the originally proposed conceptual framework.

[1] None of the data collection activities could be possible without the logistical and field support from the Field Lab in Uganda, Instituto Tecnologico de Santo Domingo (INTEC) and its Centre for Gender Studies and the Economics Department. Their helpful insights on what would work in the field helped at all stages of the thesis. Financial support for the two experiments came from the Field Lab seed fund for experiments and the University of East Anglia Quality Related Global Challenges Research Fund (UEA GCRF) grant. The Pre-analysis plans for the work in Uganda are registered and published in the American Economic Association RCT registry. Finally, inputs from conferences and seminars at the European Science Association (ESA) 2022 (Bologna), Foundations of Utility and Risk (FUR, 2022, Ghent, Belgium), International Conference of the French Association of Experimental Economics (ASFEE, 2022, Lyon) and the CeDeX-CBESS- CREED (University of Nottingham, University of East Anglia and University of Amsterdam, 2021) were instrumental in shaping up the conceptual framework and discussing the results. All the experiments were received ethical approval from the Ethical Board of the School of International Development, University of East Anglia.

2 Scarcity, Cognitive Load, and the Probability Weighting Function

Money seems to matter more when we are short on it. Expenses are rationalised way more when short on cash. The focus on meeting an urgent, inescapable expenditure is so high that other commitments get forgotten. An individual struggling to meet daily life expenditures may engage in self-sabotaging behaviours like low pickup of preventative healthcare and high-interest borrowing. Looked over the long-term, these decisions may form a self-sustaining cycle. Individuals managing their current needs would neglect other beneficial needs not because they do not know the importance of doing so, but because of the involuntary lack of cognitive space. Each round of juggling scarcity would push them further back of the starting line. Thereby increasing the gap between the haves and the have-nots with each scarcity cycle. These effects may lead to slower development gains with generation after generation falling behind. This perspective falls under the vicious cycle of inequalities, embedded in early life circumstances to intergenerational feedback of increasing constraints resulting from the multi-domain present-biased and low self-control. This paper looks at the mechanisms that guide the change in valuations when a decision-maker faces financial scarcity. The theory has neural support. It has been shown that poverty affects the parts of the brain involved in long-term planning, self-control and delaying gratification. As a result, the continuous struggle to meet immediate needs comes at the cost of public health.

Scarcity imposes two direct effects – cognitive load and tunnelling. This feeling of having less than one needs alters the decision-making process. This poverty-triggered mechanism makes economic decisions more difficult by curtailing cognitive control. The involuntary load redirects the slower, deliberative part of the cognitive system towards making the most rational choices for scarcity alleviation. At the same time, other preferences get overwhelmingly guided by the faster, affective system—such recalibration results in the rational-bias split or tunnelling in preferences. Pressed for resources, people tend to become judicious about relevant commitments as other beneficial but irrelevant choices suffer. This sensitivity to ‘what matters’ changes preferences.

In this paper, I focus on the effects of this scarcity mechanism on one of the two components of risk preferences – the probability weighting function for gains and losses. I undertook a two-phased lab-in-field experiment with 679 participants in Uganda, wherein I combined natural and artefactual sources of scarcity to examine the cognitive load level they enforce. Additionally, I test whether this scarcity leads to a split or tunnelling effect on the probability weighting function based on what

resolves the scarcity at hand. If it does, I look at the extent to which the relevance to the current scarcity matters.

My findings can be summarised in four points. First, thoughts about financial scarcity arise unprompted and are persistent. Second, the level of cognitive load increases as the force of scarcity increases. Here, I also find heterogeneous effects on cognitive load by the nature of scarcity. While expected cyclical scarcity imposes a more significant load on inhibitory control and attention, shock scarcity affects working memory.

Additionally, there is a disproportionate tax on working memory for decision-makers facing both expected and unexpected scarcity. This is particularly interesting. When an individual has lived through shortfalls and is expecting a shortfall, memories and experiences of those past cycles may have a role in multiplying the effect on working memory. Third, I show that scarcity relevance and tunnelling begin to exert themselves only after the level of scarcity reaches a critical point and that the effect is moderated by inhibitory control and attention. Finally, I find the probability weighting function is likely to be more rational, and probabilities are weighted closer to their actual values when the choice is more relevant to the scarcity at hand.

The rest of the paper is organised in the following sections. I begin with a brief overview of where the literature stands on scarcity, cognitive load, probability weighting, risk preferences and where they meet. I follow it by sketching a conceptual model that links the scarcity, attentional mechanism, and the level of decision-attribute-dependent split in preferences. Next, I discuss the experimental design to operationalise the theoretical framework. Following the methods section, I present the findings from my experiment for each element and analyse the extent of rationality in the probability weighting function.

2.1 Literature Review

The literature on poverty and poverty traps in both developed and the developing world broadly focuses on systemic factors, individual human capital shortfalls, environmental pressures, or a combination of the three to explain outcomes. Anti-poverty policies in the UK and the USA, especially from the 1970s onwards, blamed the poor's 'immoral' values or failure to understand the importance of education and preventative health benefits. These narratives failed to consider the possibility of poverty intrinsically changing the decision-making process in a way that is beyond the control of the individual. This lays the responsibility of decisions on the individual already struggling to make ends meet.

Living in circumstances when basic needs are stifled creates a mindset wherein considerations are narrowed as the decision-maker is continuously preoccupied with maximising the use of limited resources. It has a bearing on preferences as choices are guided by what resolves the most pressing need at that point. For example, parents in India may know the benefit of secondary education for their children. However, around the time when school fees need to be paid, if they are struggling to meet other household essential needs, they may not be able to meet those expenditures. In the long run, this may contribute to the intergenerational perpetuation of poverty. Analysing school dropouts without considering the behavioural state in which the decision was taken would be an incomplete understanding of the issue.

Similarly, merely looking at low willingness to pay for preventative health like deworming medication and insecticide bed nets (Cohen and Dupas, 2010; Miguel and Kremer, 2004) without including the effect of selective cognitive engagement on relevant information misses the complete picture (Zwane, 2012). Therefore, the thought mindset could supersede all other long-term welfare concerns, even when there is enough awareness but not commensurate uptake, multiplying the poverty trap mechanisms.

Looking at behaviours from this perspective is not about rejecting or critiquing other explanations in the literature. I seek to offer additional insights into how poverty's self-reinforcement cycle works through mechanisms beyond the decision-maker's control. It can be likened to filling a leaking bucket with water.

Understanding outcomes in poverty where daily trade-offs take up the bulk of mind space may lead to a better appreciation of the context of decision-making, thereby stripping off the misjudgement of policy failures that most welfare development evaluations come with. The behavioural lens could explain many of the far-reaching implications of neglect of essential things when trying to manage daily life in the most efficient way possible in an environment of limited means.

The psychology of poverty presents a new perspective to analyse these broad spectra of behaviours (Haushofer and Fehr, 2014; Schilbach et al., 2016). Within these behavioural analyses, Scarcity theory provides a unified, parsimonious explanation of economic decisions using insights from cognitive psychology. In its original formulation, Mullainathan and Shafir (2013) define scarcity as the feeling of "having less resources than you need." While monetary scarcity or poverty is not the only type of scarcity an individual may face, it is the most consequential. Insufficient resources incommensurate with demands, tight budgets, and income uncertainty whilst managing expenditures may add to the vicious cycle effects of poverty.

This thought mindset from financial scarcity works atop everything else and is not limited to those chronically poor. The intermediary mechanism is not only limited to those living below the international poverty standard of $2.15 per day[2]. By this, I mean that non-poor in low-income settings across nations may face these contexts of limited means. Additionally, qualitative surveys conclude sizeable fluidity between poor and non-poor across countries (Bank, 2014). Therefore, a considerable number of "non-poor" are expected to face cognitive triggers borne out of scarcity.

Day-to-day decisions weigh down the mental capacity (Banerjee and Mullainathan, 2008). Faced with such scarcities, the daily juggling of choices has two natural characteristics – a tax on total mental resources (bandwidth tax) and tunnelling (Mullainathan and Shafir, 2013a). The strain and limited resources load cognitively, resulting in bandwidth tax (Schilbach et al., 2016; Shafir, 2017; Shah et al., 2012). Such impaired cognitive abilities have real-world consequences which escaped scholarly attention until recently. Measurements of the cognitive capabilities of the same Indian sugarcane farmers before and after harvest show significant differences (Mani et al., 2013) on standardised cognitive tests. By controlling for all other variables, the authors could filter out the effect of distress caused by cyclical variation in finances. The results also extend to otherwise "non-poor" American subjects in a New Jersey mall. Using identical methods, analogous differences were found between participants primed to think about financial expenditures at a New Jersey mall. These ever-present concerns leave lower available bandwidth for the decision-makers after loading the cognitive resources. The scenario becomes increasingly consequential as the scarcity-led stress, limited attention, and the negative affective state may lead to short-sighted, risk-averse behaviour that may form a vicious feedback loop (Haushofer and Fehr, 2014).

A direct consequence of this bandwidth tax is the second characteristic that looks at the involuntary realignment of focus or *tunnelling* (Mullainathan and Shafir, 2013a) on the scarce need. For example, when pressed for time, we automatically concentrate on the deadline for the immediate work to be handed in and are more responsive to food-related cues when hungry or dieting (Piech et al., 2010; Radel and Clément-Guillotin, 2012; Shapiro and Burchell, 2012). In financial terms, it may include immediate rent payments or other impending expenditures. As more cognitive resources tend to get engaged in meeting these needs, the cognitive costs of dealing with everything else get magnified. For

[2] World Bank has adjusted global poverty lines in 2022 to $2.15 per day (using 2017 prices). With this adjustment, 648 million people now live in abject poverty globally. This thesis is a first attempt at understanding the psychology of poverty and hence only uses the most conventional method. If multidimensional poverty measures are also included, we can expect the figures to be higher. Analysing effects beyond monetary poverty and the core mechanism is a further extension and can be a starting point for future work.

poverty, such a scarcity state implies efficiency and judiciousness for immediate concern at the expense of all else. As the focus shifts, the mindset rebalances the after-tax cognitive resources and moves perceptions of value closer to its economic value (Shah et al., 2015, 2012). By repeating the classic WTP (willingness to pay) experiments (Thaler, 1985), the authors find a higher propensity to engage in trade-off thinking as income falls.

The results hold up in their self-replication exercises (A. K. Shah et al., 2018). Using the same variations of the wheel of fortune, angry blueberries, and family feud as in their previous experiments, they find scarcity led to increased focus and overborrowing. In fact, eye-tracking measures from restaurant menus with randomly assigned rich and poor monetary and calorie budgets show significant differences in attention to price vs calorie menus (Tomm and Zhao, 2016). Their subsequent work supports their assertion of this separation between increased focus and neglect due to the nature of the scarce good, which laid out the possible mechanism. Eye-tracking of cognitive tests illustrates the resulting informational neglect of time-scarce participants (Tomm and Zhao, 2018). The work shows the simultaneous duality of scarcity-induced neglect of otherwise significant needs and effects on preferences due to the higher focussed cognitive realignment.

Understanding preferences in this context of altered cognitive mechanisms necessitates revaluating the decision-making problem itself. Erstwhile preference theories in economics predominantly assume a monolithic cognitive system of decision-making. The subjective values are considered to be outcomes of a unitary cognitive system perceiving probabilities, not accounting for mechanics and contextual features. Thus, the normative theories in microeconomics have presumed fixed preferences. This is quite different from psychology, where there is a broad consensus that human behaviour is a result of the interaction of two frames of thinking – the dual thinking modes (Cristofori et al., 2019; Evans, 2008; Miller and Buschman, 2015; Morvan and Jenkins, 2017; Thompson et al., 2009). However, economics has recently begun to recognise the fundamental role of attention allocation in choice theory (Bordalo et al., 2022; Gabaix, 2014; Maćkowiak et al., 2023).

In its most standard form, the dual-process theory in economics and psychology organises the total cognitive capabilities into two broad categories based on their process mechanisms - the Controlled-Automatic systems (Camerer et al., 2005). The controlled or System 2 (Kahneman and Frederick, 2002) processes are distinguished by serial, effortful deliberation, while automatic or System 1 processes are the default, effortless, parallel mode of operations that require no cognitive introspection. Camerer et al. (2005) conceptualise controlled processing as coming into play when a decision interrupts the default and overrides the automatic response.

The processes are distinguished by their mechanistic flows. The controlled System-2 functions in a top-down manner. Attention and cognitive resources are directed effortfully and consciously - a collection of basic functions termed as Executive functions (EF) (Diamond, 2013). The broad umbrella term comprises three essential core features: inhibitory control, working memory and cognitive flexibility. Different combinations of the three feed into higher orders of cognitive functioning like Reasoning, problem solving and planning. These three distinct core mental operations, subsumed by the term "cognitive control," are involved in goal-directed activity.

Any other external, salient stimulus can involuntarily distract the decision-maker in a bottom-up manner, and inhibitory control must ward off that interference to control and sustain attention on the goal. It allows guiding selective attention to the relevant stimuli at that point in the presence of other disturbances. Another aspect is the ability to not act on first instinct, delay gratifications and stay fixed on task despite distractions. This self-control and selectivity in where cognitive resources are used is critical in the decisions made at the end. Therefore, any goal completion requires self-control and resisting distractions while doing so.

To exert self-control to keep in line with goals, the decision-maker needs to be able to recall them. This ability to hold information and use it comes from the second core component of Executive Function: Working memory (WM). Definitionally, dependent on the level of permanence of storage, it involves both holding information for active use (Short term memory, STM) and the capability to recall, manipulate prior information and cues (Working memory). Inhibitory control and Working Memory, in most cases, function complementarily (Diamond, 2013). The two support each other and involve two-way active feedback. Momentary concentration on a goal requires the additional ability to sustain the current goal in active memory to decrease the probability of inhibitory control errors. Similarly, to effectively retrieve and combine the stored information, the decision maker needs the ability to inhibit distractions and focus on the problem at hand.

While retrieving and manipulating information may be key functions, sometimes the decision maker may need to update priors, and change perspectives when approaching a choice. Such higher-order functioning requires the third component, Cognitive flexibility (CF). It uses core functions of both WM and Inhibitory control to change decision paths midway or make a choice to switch between tasks. Eventually, Cognitive flexibility takes a call on whether the decision maker may need to change course to solve a problem, the best way to do so (problem-solving), reason it out and plan ahead. This part senses trends, picks up on patterns, engages in logical reasoning and feeds into fluid intelligence.

Exerting Executive function or System 2 is cognitively costly. It is much more challenging to re-evaluate first instincts, and resist defaults than give in to automatic responses. Processing and sustaining selective attention to stay on goal takes up cognitive space. This effort, or cognitive load, is a tax on total mental resources. It is a combination of divided attention, inhibitory control and working memory. It curtails the ability to simultaneously attend to more than one stimulus, spatial sector, or modality and overlaps with Executive function (EF).

The terms indicate the specialised features of the processes. System-1 is the mode of thought where thinking is fast and used for routine decisions, whereas System-2 is slow and rationalising. A broad consensus within the literature now agrees that System-1 uses fewer resources (Evans and Stanovich, 2013) and is prone to bias and error. In contrast, System-2's pondering is more likely to give way to balanced and accurate results. As System-2 monitoring is more effortful, it depends on cognitive ability and motivation. Stanovich (2011) traces any bias due to failure at two levels – System-1 generating "faulty" judgment and System-2's inability to detect or modify it.

That is, an aberration from "rationality" can result from either the System-1 intuition being too strong to be overridden or the depleted capacity of the decision-maker to be motivated enough to engage in deliberative processing. Motivation, attention, and cognitive control are components of the net cognitive effort that mediates preferences. Suppose the cognitive strength required for the system- 2 engagement is too costly or depleted at the final choice formation step. In that case, it is less likely that the deliberative would move decisions away from the "affective optimum" of System-1 (Loewenstein et al., 2015; Westbrook and Braver, 2015).

As the slow, effortful mental resources become involved in meeting the cognitive demands of immediate scarcity, capabilities left for other choices reduce. System 2 becomes engaged in dealing with tunnelled needs. Processing everything else becomes cognitively costly, and there is a reduced ability to engage in deliberative decision-making for unrelated needs (Pocheptsova et al., 2009).

Therefore, when scarcity distracts and unconsciously pulls away attention towards the unmet need, it reduces the propensity for higher-order thinking for all else. The cognitive focus dividend (Mullainathan and Shafir, 2013a) increases one kind of resource efficiency at the cost of other "biased" choices. These seemingly "worse" decisions end up causing the vicious scarcity poverty trap (Figure 2).

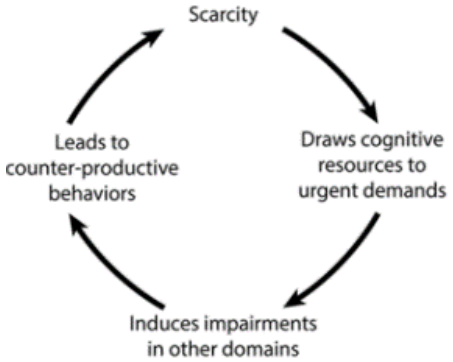


Figure 2 The theoretical scarcity trap
Source: (Zhao and Tomm, 2018)

Neural evidence supports this dual-system interaction theory between low-effort automatic System-1 and System-2 deliberations (Glimcher and Fehr, 2013; Nermend and Łatuszyńska, 2017; Rustichini, 1966, 2009a). The increased activity in the "rational" orbital and medial prefrontal cortex and "emotional" amygdala measured for risky choices under pressure along with fMRI images reinforces the theory (De Martino et al., 2006; Huijsmans et al., 2019). Extensive reviews (Braeutigam, 2005; Camerer et al., 2005; Glimcher and Rustichini, 2004; Gold and Shadlen, 2007; Kenning and Plassmann, 2005; Rustichini, 2009) connect the dual-process theory with cognitive-affective neural systems, domain-specific expertise, experimental methods and implications for choice construction. The prime contribution of neuroeconomics has been to provide better explanations for risky, intertemporal, and social preferences.

Of the three, risk being the starting point for studies of preferences has received the most focus from neuroeconomics and dual-process literature. While psychology establishes background traits that drive preferences, risk theory has only recently recommended establishing more direct links between risky choices and psychology (Mata et al., 2018). There is a push to include causal insights from psychology in analysis, especially when concluding real-world behavioural from behavioural measures.

The baseline, original risk preference theory, Expected Utility (EUT), begins with questioning the assumption that the decision-maker chooses the option that maximises expected value (EV). That is, a lottery (*prospect)* (x, p) with a value x , probability p, and value 0 otherwise gives the EV = $p.x$. A decision maker is said to be *risk neutral* if he/ she is indifferent between the prospect and the EV. They are *risk-seeking* if they prefer the risky lottery to a sure payment equivalent to the EV and *risk-averse* if they prefer the sure payment to the risky prospect of an equivalent expected value. Expected Value maximisation only allows for neutrality towards risk. Therefore, a decision maker would prefer a 50-50 chance of £100 over a sure payment of £49 within the framework. To refine this original formulation, Bernoulli (1738) proposed the Expected Utility Theory, where the decision maker

chooses the option with the greatest Expected Utility (EU) where EU $= p.u(x)$, $u(x)$ is the concave utility function over wealth x. In the same vein, Von Neumann and Morgenstern (1947) proposed the *substitution* (*independence)* and the *sure-thing* axioms to codify the Expected Utility Theory further. The two postulate the linear effects of probability on preferences. The *independence* axiom remains one of the central aspects of the Expected Utility Theory. If a person prefers the lottery L_1 over L_2, then, if there is a third common lottery L_3 added to both, the preference order should not change. That is, a preference relation ($\succcurlyeq$), for any $\alpha \in (0, 1)$ if $L_1 \succcurlyeq L_2$ iff $\alpha L_1 + (1-\alpha) L_3 \succcurlyeq \alpha L_2 + (1-\alpha) L_3$. The *sure- thing* principle on the other hand, formulates that the preference among options L_1, L_2 should not depend on common particular consequence.

However, abundant evidence soon emerged that people's risk-taking behaviour exhibits nonlinear dependence on probability instead of the initially hypothesised rational linear relationship. One of the most potent challenges came from the Allais paradox (Allais, 1953). His famous example presented the following decision problem – a choice between \$5 million with 98% probability versus \$1 million for sure. Most would choose the latter, implying $u(1) > 0.98\, u\,(5)$. Now, if the respective probabilities are scaled down by a factor of 100, from the perspective of EUT, the preference order should not change. If the same amounts are offered with probabilities of 0.98% and 1%, respectively, the ranking of preferring \$1 million over \$5 million would stay intact. However, this is not the case. If offered, most people would reverse their preference and choose 0.98% of \$5 million over 1% of \$1 million. Thus implying $0.01u(1) < 0.0098\, u(5)$, a violation of the substitution axiom of the Expected Utility Theory (*common ratio effect*). A similar decision problem depicting the violation of the sure thing principle was put forth by Kahneman and Tversky (1979) -

Choice A: (A1) 33% chance of \$2500, 66% of \$2400 and 1% of \$0
(A2) \$2400 for sure

Choice B: (B1) 33% chance of \$2500 and 67% of \$0
(B2) 34% chance of \$2400 and 66% of \$0

Choice B is a direct transformation of choice A as the 66% chance of \$2400 common consequence is removed from both. As before, most people choose A2 over A1 but would prefer B1 over B2 - a direct violation of the sure-thing principle. If they behaved according to Expected Utility Theory, they would choose B1 over B2 if and only if they chose A1 over A2. This reversal in ranking violation is the *common consequence effect.*

Common consequence and common ratio effect imply that people tend to become more sensitive to probabilities near endpoints (0 and 1) than they are in the middle of the scale. Numerous empirical replications with real, hypothesised lotteries across domains confirmed these violations (Fehr-Duda and Epper, 2012). Then, attempts were made to propose more behaviourally grounded models to explain risk preferences. Broadly, they fall under two categories – Rank dependent models (Barberis, 2013; Tversky and Kahneman, 1992; Wakker, 2010) and disappointment aversion (Gul, 1991). Of the two, rank-dependent models of Cumulative Prospect Theory (CPT) (Tversky and Kahneman, 1992) remain the most dominant.

Within the model, an individual maximises a strictly increasing function $v: X \to \mathbb{R}$, where X is a set of monetary outcomes, with the neutral reference outcome denoted as 0. Values are segregated and ranked into gains and losses, thus generating separate weighting functions for the two domains. Amounts greater or lesser than the neutral outcome are denoted as positive or negative numbers, respectively. Individuals do not weight the probability of an outcome by its equivalent numerical objective value p_i, but instead by a transformed decision weight π_i that is calculated using a probability weighting function $w(.)$. Cumulative Prospect Theory applies these weights to cumulative probabilities rather than isolated single events. That is, the outcome x_i is weighted by the cumulated probability of obtaining an x_j $(j \neq i)$ at least as good as x_i, if x_i is a gain and at least as bad as x_i, if it is a loss. Therefore, decision weight π_i is defined according to $\pi_i = w(p_1)$ if $i = 1$ and $\pi_i = w\left(\sum_{k=1}^{i} p_k\right) - w\left(\sum_{k=1}^{i-1} p_k\right)$ for $2 \leq i \leq n$.

Accordingly, the decision weight of the best outcome x_1 is equivalent to $w(p_1)$ while for the next best outcome, the decision weight generated is $w(p_1 + p_2) - w(p_1)$, where $w(p_1 + p_2)$ is the weight of x_2 or better. The probability weighting function translates probabilities $0 \leq p_i \leq 1$ into weights $w^+(p_i)$ or $w^-(p_i)$ dependent on the domain of outcomes with $w^+(0) = w^-(0) = 0$ and $w^+(1) = w^-(1) = 1$.

$$\pi_n^+ \equiv w^+(p_n) \qquad (1)$$

$$\pi_i^+ = w^+(p_i + \cdots + p_n) - w^+(p_{i+1} + \cdots + p_n)\,, 0 \leq i \leq n-1 \qquad (2)$$

$$\pi_{-m}^- \equiv w^-(p_{-m}) \qquad (3)$$

$$\pi_i^- = w^-(p_{-m} + \cdots + p_i) - w^-(p_{-m} + \cdots + p_{i-1})\,, 1 - m \leq i \leq 0 \qquad (4)$$

Overall, outcomes are evaluated according to value V, which is given by $V(x, p) = w(p) \cdot v(x)$ where w denotes the effect of probability and v denotes the impact of the value of the outcome. Given sign-

separability, the outcomes $(f^+ \ and \ f^-)$ when multiplied with decision weights $\pi_i()$ together gives the value function for gains and losses (Verschoor and D'Exelle, 2020).

$$V(f) = V(f^+) + V(f^-) = \sum_{i=0}^{n} \pi_i^+ \, v(x_i) + \sum_{i=-m}^{n} \pi_i^- \, v(x_i) \qquad (5)$$

The weighting function, in essence, captures the diminishing sensitivity to changes in probability. People are less sensitive to probability changes as they move from reference probabilities. Given that the probability scale has two natural reference points, impossibility (0) and certainty (1), this formulation explains the tendency to be overly sensitive to probability near endpoints, overweighting probabilities closer to 0 and underweighting closer to 1. Therefore, exhibiting concavity near 0 and convexity near 1, an inverse S curve (Figure 3) (Abdellaoui, 2000; Fehr-Duda and Epper, 2012; Kahneman and Tversky, 1979; Tversky and Kahneman, 1992; Wu and Gonzalez, 1998, 1996).

In terms of common consequence shifts, the change in preferences results from changes in perception of probabilities as the same weight is removed or added to the choice list. For a rational decision-maker, these identical shifts should not matter, and the weighting function should correspond to its actual value ($w(p) = p$). Therefore, the observed inverse S shape depicts changes in the perception of probabilities with common shifts. A real-world consequence of this tendency is the greater change in the value of a prospect as the probability of the gain falls from 0.95 to 0.90 than from 0.65 to 0.60. A fact that explains the popularity of both insurance and lotteries.

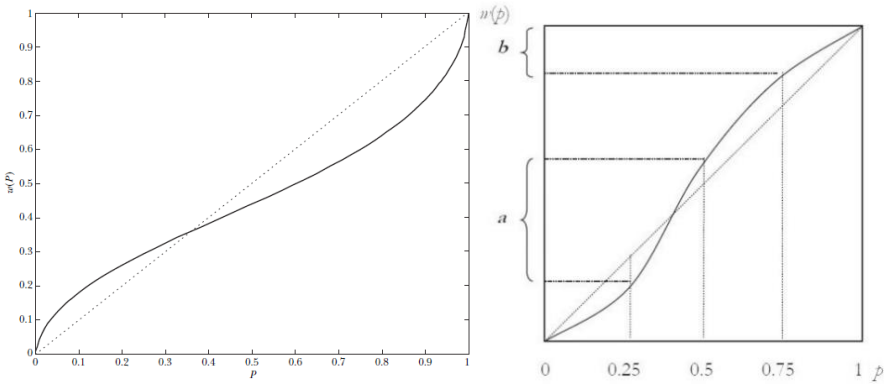


Figure 3 The typical weighting function
Source: (Tversky and Kahneman, 1992; Verschoor and D'Exelle, 2020)

From the Expected Utility Theory perspective, the transformation of probabilities for both gains and losses is thus a behavioural anomaly. Though comparisons between developed and developing worlds bring in an active debate between the inverse S and S shape of the probability weighting function (Harrison et al., 2010; Humphrey and Verschoor, 2004; Verschoor and D'Exelle, 2020). The common

thread remains that any factor that affects the decision-making process would change the probability weighting function.

The cumulative prospect theory has a series of pairs of choices. Of the two, one is relatively safe, and the other is riskier. Each pair is generated from the previous by shifting probability mass between respective outcomes (S_i, R_i) and (S_{i+1}, R_{i+1}) in both lotteries. The independence axiom of Expected Utility Theory states that between the pairwise choices over such choices i or $i + 1$, either the riskier lotteries should always be chosen, the safer lotteries is always chosen, or indifference is retained. However, observed behaviour diverges from the theoretical hypotheses. These identical probability or common consequence shifts between the two choice pairs lead to a violation of the Expected Utility Theory predictions. The reversal in preferences from S in i to R in $i + 1$ indicates the nonlinear curvature of the weighting function.

In their original work, Tversky and Kahneman (1992) proposed a single-parameter probability weighting function (pwf from hereon)-

$$w(p) = \frac{p^{\gamma}}{(p^{\gamma} + (1-p)^{\gamma})^{1/\gamma}}$$

The inverse- S results from overweighting and underweighting of low and high to moderate probabilities, respectively, for $\gamma < 1$. Soon after, other one-parameter and two-parameter functional forms followed. The most popular of them explained the probability weighting function through elevation and curvature (Gonzalez and Wu, 1999; Prelec, 1998; Stott, 2006). Presenting the curve in terms of curvature (discriminability, δ) and elevation (attractiveness, γ), they provide a psychological insight for the non-linearity.

$$w(p) = \frac{\delta p^{\gamma}}{\delta p^{\gamma} + (1-p)^{\gamma}}$$

High discriminability implies high sensitivity to changes in probability. Small changes in probability would result in a steeper weighting function—the steeper the probability weighting function, the finer differential of probability perception. Low discriminability means decision-makers evaluate the different probabilities moderately, leading to a flatter curve. The second parameter that explains the probability weighting function is prospect attractiveness. This relates to the extent of overweighting and underweighting relative to actual probability and determines the level of absolute weights (Gonzalez and Wu, 1999). The idea of attractiveness has also been linked to individual sensitivities to elation and disappointment (Brandstätter et al., 2002). For example, two people with w(0.4) = 0.6 and w(0.4) = 0.2 are different from each other. Then for the choice (0.4, £x), the utility U = w(p)v(x) is higher for the former. A gain prospect with p = 0.4 seems more attractive for person 1.

Within Prospect Theory, this simultaneous existence of likelihood insensitivity around mid-probability levels and curvature (discriminability) around endpoints (the inverse-S) has been traced to primarily two sources - cognitive abilities and emotions. Emotion as a source of the level of decision weighting inverse-S has been explored through various channels. Charupat et al. (2013) link gender differences in hypothetical choices to emotional balance and find a more significant movement towards Expected Utility. Additionally, they see the differential role of emotions between domains. Losses were processed more emotionally and less cognitively than gains, though significance remained an issue. The conformity with Expected Utility included both less insensitivity and pessimism for losses. Similar results were reflected in the level of optimism (the elevation parameter) and women's moods (Fehr-Duda et al., 2011). Similarly, Brandstätter et al. (2002) find correlations between the level of surprise and the degree of overweighting.

Of the two, the cognitive limits of the ability to discriminate between probabilities is usually the more accepted explanation (Kahneman, 2003a). The higher the cognitive ability, the more linear the function (Etchart-Vincent, 2009; Hey and Pace, 2014; Wakker, 2010). This intuition predates the theory itself. Even when the inverse-S curve was unknown, discriminability power was explained through increased cognitive abilities (Clark, 1918).

While theoretical discussions on the cognitive links were alluded to in the seminal papers (Gonzalez and Wu, 1999; Tversky and Kahneman, 1992), until recently, empirical links remained far and few. Choi (2022) replicated the measures from Kahneman and Tversky (1992) using the 2-parameter probability weighting function and found a strong negative relationship with cognitive abilities. Using a 300-subject sample with a wide range of cognitive abilities, correcting for choice errors and a within-subject time pressure treatment, they find conclusive support for an inverse relationship between cognitive abilities and the inverse-S probability weighting function. Undertaking the probability weighting function measurement for gains and losses, Etchart (2009) interprets the cumulative effect of unfamiliarity and differential mental effort between the two domains as the reason for lower discriminability for losses.

Cognitive processing effort has also been proxied through numerical abilities. Studies that used numeracy as a shorthand for cognitive abilities found similar results for the probability weighting function. Lower numeracy levels correlated with nonlinearity in probability weighting curves (Petrova et al., 2014; Riege and Teigen, 2013; Traczyk and Fulawka, 2016). Fitting the one parameter function of probability weighting function, Millroth and Juslin (2015) find less concavity of the utility function, a greater propensity to follow Expected value maximisation and linear- Expected Utility Theory consistent probability weighting function as numeracy levels rise.

However, the empirical evidence holds less conclusively in field settings. Grevenbrock et al. (2021) use big data on age-dependent survival beliefs and find a direct correlation with measures of cognitive abilities. Thus, supporting the cognitive interpretation. Similarly, looking at the country-wise probabilistic perceptions of IPCC climate change statements, Budescu et al. (2014) explain the inverse S findings through cognitive abilities. On the other side, with a representative sample of equity stockholdings from the USA, Dimmock et al. (2021) find a weak but significant positive relationship which they theorise as supporting evidence for the inverse S-shaped being a deliberate thought and not probability misperception.

This interplay between emotion- cognition- motivation can pull the function in different directions, so the insights from dual process theory become important. As Etchart-VIncent (2009) also discusses, emotions and motivations can exacerbate or control the cognitive limitations argument. Hogarth and Einhorn (1990) modelled the decision weighting of probabilities as outcomes of mental processes that included motivational and cognitive factors. Though, comparing the two sources, Einhorn and Hogarth (1985) and Zeckhauser and Viscusi (1990) suggest it is more likely to come from the cognitive side than the emotions. The study of numeracy and pwf by Traczyk and Fulakwa (2016) finds no role of emotions in moderating the shape of the probability weighting function. Splitting for sources for the inverse-S curve and deviations from rationality, Kunreuther et al. (2001) and Tenorio and Cason (2002) independently find greater support for cognitive reasons as compared to motivation.

Despite the differences, the underlying mechanics have some standard features. Images from functional magnetic resonance imaging (fMRI) find similar patterns in the reward encoding process of the brain as the Prospect theory probability weighting function. Statistical differences in striatal activity correlate with non-linearity in the weighting (Glimcher and Rustichini, 2004; Hsu et al., 2009). Finally, the probability weighting function mapped using certainty equivalents found increasing correspondence between the inverse-S transformation and prefrontal cingulate cortex (Paulus and Frank, 2006). These consistent neural evidences motivate the movement from the unitary system to include dual-system insights.

This neural appeal supports explaining the two-system executive mechanism, where specific parts are crucial in determining the thinking styles. Beginning with the risk as feelings hypothesis (Loewenstein et al., 2001), the initial focus on the increased S shape of probability weighting function for affect-rich cases (Rottenstreich and Hsee, 2001), the literature has begun to formalise prospect theory as a filter for attention allocation. Even though these cognitive processes were not part of the original theory, the fundamental parameters are systematically associated with selective attention (Johnson and Busemeyer, 2016; Pachur et al., 2018). The authors find an inverse relationship between the attention

index and the probability weighting function parameters of curvature and elevation. In fact, attention weight models applied to common consequence effects fit the common functional forms, allowing for the inclusion of thinking systems in the probability weighting function theory.

These contributions, when looked at from the System 1-System 2 lens, imply –

i. System 2, or Deliberative system, encodes probability without any bias, at w(p) = p, thus mimicking Expected Utility Theory predictions.
ii. System 1 or Affect- heavy responses are driven by less effort and prone to non-linearity.

While there is an active debate on the chronological and the form of interaction of the two systems (Diederich and Trueblood, 2018; Fudenberg and Levine, 2006; Grayot, 2020; Shiv and Fedorikhin, 1999), none of them undermines the fact that System-1 rapidly evaluates and ends up generating preferences before System-2 does (Dhar and Gorlin, 2013). In terms of risk preferences, under serial processing, System-1 assigns Prospect theory (PT) preferences, and then System 2 enters and evaluates choices with Expected Utility (EU) parameters (Evans, 2003; Kahneman and Egan, 2011; Stanovich and West, 2000). In contrast, the parallel analysis proposes that System-2 combines Expected Utility Theory and Prospect Theory with System-1, firmly directing the process through the complete process (Loewenstein et al., 2015; Loewenstein and O'Donoghue, 2004; Mukherjee, 2011, 2010). Between the two, what remains common is the propensity of System-2 heavy response to move probability weighting to its actual value, consistent with Expected Utility Theory predictions. Simultaneously, System -1 heavy response would further impair perception and lead to more significant aberrations due to common consequence shifts.

Each decision or gamble is a combination of Affective and deliberative systems. The relative influence of each would depend on the extent to which they occupy essential cognitive elements like working memory (Dhar and Gorlin, 2013). Any manipulation or external stimuli would change the process and the choices made. Scarcity-led-cognitive load is one such involuntary force that changes things bottom-up. This understanding of positive and negative affect dimensions and the dual-process theory make room for studying choices that engage both systems and can be decomposed into cognitive and economic dimensions (Schonberg et al., 2011).

Preferences are expected to differ based on which system is more engaged in processing it. Once scarcity enters, cognitive load is felt. This taxes the total fixed capabilities. As a result, it alters the balance of what is left. The relative weights of each system change. Therefore, the overall value of each choice $V(G) = V_A(G) \oplus V_D(G)$ transforms based on which system has a more significant role.

The standout feature of scarcity-enforced- cognitive load is the focus on what is scarcity relevant. This means the decision attribute is pivotal in determining where the focus dividend is felt. By "dividend", we suggest moving towards "economic rationality" and a greater deliberative System-2 heavy response. This automatically means that what is not scarcity-irrelevant gets tuned out purely due to this attribute (Figure 4). The red line indicates the movement away from unitary system analysis. The "irrelevant" decision is an outcome of System 1 and is expected to be more "biased". Therefore, combining the scarcity-cognitive load and prospect theory literature, we expect a bifurcation in the pwf. The degree of tunnelling (θ) is a function of the cognitive load and decision attribute (relevance) and has the following properties –

1. $\theta \in [0,1]$ depending on the degree of scarcity relevance - irrelevance and cognitive load.
2. $\theta = 1$ for a perfect rational-bias split, which may be possible under – scarcity-relevant decisions under a scarcity-led-cognitive load.
3. $\theta = 0$ for no split in decisions which may be possible either as a result of insufficient scarcity relevance or an absence of cognitive load.

Current academic literature has begun to look at the overall effects of scarcity while barely addressing the underlying mechanism or the resulting bifurcation. Financial scarcity can influence lifelong development outcomes and preferences through mental channels that remain relatively unexplored—these are over and above the documented social process, mental health, and heritable effects.

Increased exposure to poverty affects in-group-outgroup & intergroup relations, self-efficacy, genetic alterations to stress response, cooperation behaviours in dictator games, trust and stereotyping (Duffy et al., 2016; Krosch and Amodio, 2014; Schulz et al., 2014). Sustained financial concerns are associated with lower performances on higher cognitive tasks and those that measure inhibitory control and focused attention. The effects extend to behavioural patterns and choices made. Altered aspirations, low academic achievements, parenting styles, employment choices, risk decisions, technological adoptions, low pickup of medications & welfare, and self-control-compromised behaviours are all direct consequences (Anand and Lea, 2011; Chivers, 2017; Rojas, 2011; Sheehy-Skeffington and Haushofer, 2014; Spears, 2011; Vohs, 2013; Zwane, 2012).

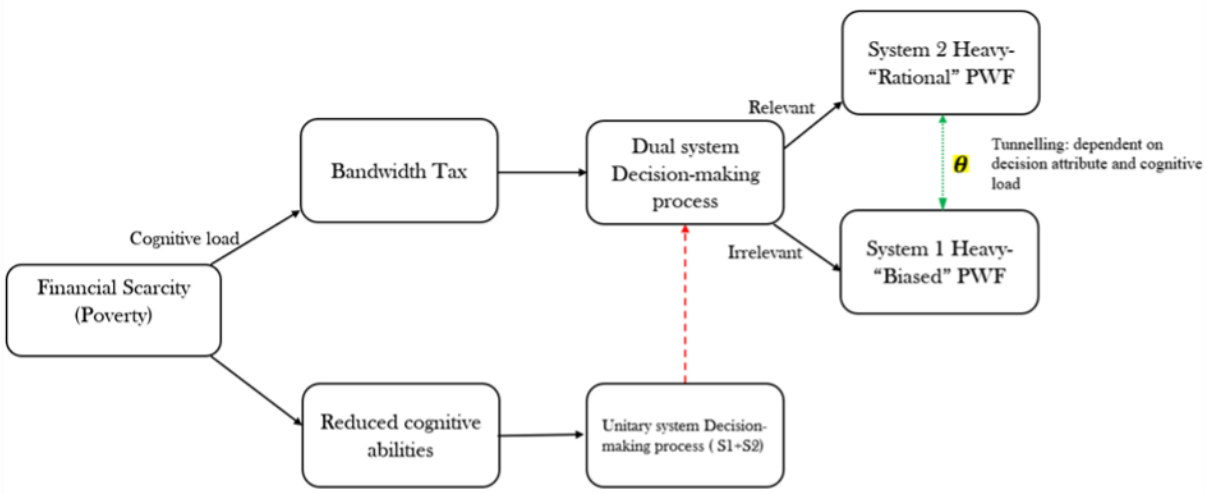


Figure 4 Moving from unitary to dual process theories of decision-making

Because of financial concerns, mental burdens adversely affect productivity and potentially form a cycle that reduces the capacity to earn (Figure 5, the feedback loop). Workers with greater cash in hand have shown fewer lapses of attention, thus bringing forth a previously overlooked psychological mechanism (Kaur et al., 2021). This aligns with other evidence that finds changes in decision-making and improved psychological test results as debts are reduced for people experiencing poverty (Ong et al., 2019). Some have gone beyond studying the effects of a simple lack of finances. Using mixed methods and linking internal and external influences, recent works highlight the multidimensionality by coining a new term, "triple scarcity effect", - to symbolise loan decisions, perceived consequences and decisions (Cook and Sadeghein, 2018).

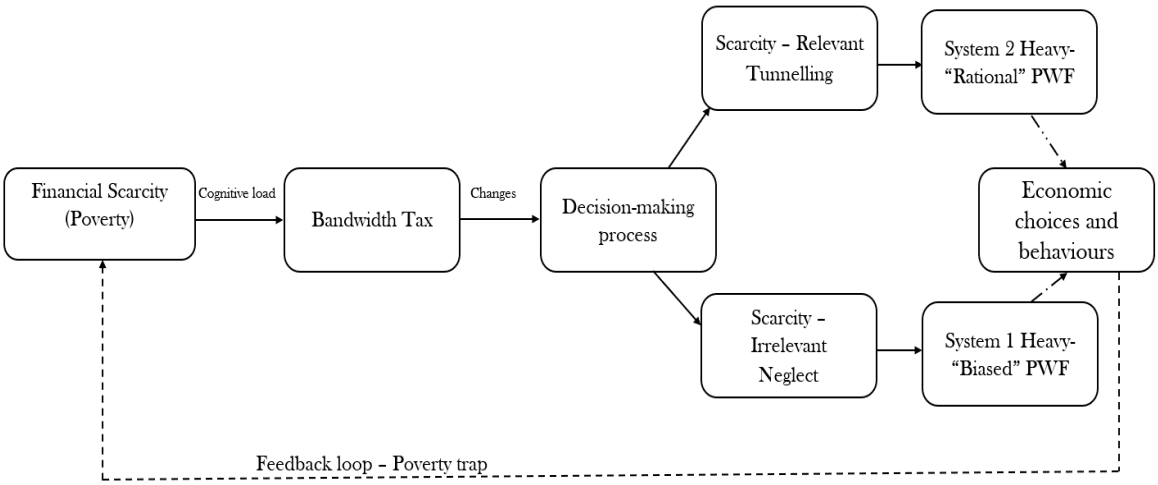


Figure 5 Scarcity's Feedback Loop

At first glance, several behaviours seem actively self–sabotaging, e.g., low pickup rates of preventative health, medications or high-interest borrowing, and race. Looking closer, they seem to be the natural fallout of the easily activated, omnipresent, challenging to suppress, interfering monetary thoughts

that shape valuations and associations (A. Shah et al., 2018). These poverty-triggered mechanisms make economic decisions more difficult by curtailing cognitive control and leading to more impulsive, mixed evidence of risk-averse decisions (de Bruijn and Antonides, 2021; Deck and Jahedi, 2015; Haushofer and Fehr, 2014; Mullainathan and Shafir, 2013a; Schilbach et al., 2016; Spears, 2011).

Scarcity mechanism and the change in thinking style layout a mediating role for the cognitive load. While recent theories (Adamkovič and Martončik, 2017) propose theoretical models that integrate poverty – cognitive load- executive functions- thinking styles and decision-making, they miss the element of tunnelling and the selective reorientation of cognitive systems discussed in erstwhile literature (Mullainathan and Shafir, 2013a; Spears, 2011). This itself may be one of the reasons behind the inconclusive evidence on risky preferences. The literature has begun to gain enough traction to generate broad academic interest, and linkages have begun to be explored. However, a study that looks at the complete mechanism for both gains and losses remains to be seen, particularly for field studies (de Bruijn and Antonides, 2021).

However, there is evidence to the contrary (Andersson et al., 2016; Gerhardt et al., 2016). Survey measures on before and after payday for monetary versus nonmonetary tasks (Carvalho et al., 2016) find mixed evidence in the United States. Intertemporal choices are more present-biased for financial rewards between the two periods, while no differences in risk-taking or cognitive functions were observed. Ongoing work seeks to reassess these aberrations (Mani et al., 2020) and finds behavioural effects around paydays. Besides confirming the financial scarcity hypothesis by analysing cognitive functions before and after paydays, they also explain the inconclusive findings from Carvalho et al. (2016). They reason the surprising results principally due to two design issues – (i) Insufficient uncertainty in payday randomisations. To be eligible, the participants were required to give a detailed history and upcoming dates of payments for the duration of the study. This suggests a substantial absence of financial uncertainties in their lives, thus the insufficient magnitude of scarcity as a trigger force. (ii) High frequency of payments in their study setting. The design randomised time from pay date to study cognitive effects, risk, and intertemporal choices. However, the American households in the original study received up to four payments in their 1-month study period, out of which one incident was chosen randomly for the experiment. There is then, a chance that the period randomly chosen for the “before” payday was in fact, very close to the expected, predictable payday. Therefore, there is a chance that their insignificant findings may be driven by the noise in treatment allocation design.

Therefore, I address some of the critical gaps in the subject with my work. First, I add to the limited available evidence for "decision neglect" or "tunnelling" for a critical aspect of risk preferences – the

probability weighting function. Second, I document the effects of the primary mechanism for the tunnel split - cognitive load and decision attribute. Thus, answering a vital question of the underlying mechanism. Finally, after these conceptual clarities, I question how much this theoretical explanation holds up in the real world. Emerging literature has begun to inspect parts of the framework. The telephonic version of the Stroop task on farmers in Brazil shows significant increases in cognitive load with scarcity levels and relevance (Lichand and Mani, 2020).

Similarly, feelings of poverty affect discounting rates in lab-in-field experiments in Uganda (Bartos et al., 2018). With these contributions in mind, I seek to provide a conceptual, empirical account that proposes a single phenomenon, financial scarcity, as the underlying cause for various economic decisions and behaviours. This is achieved by identifying two fundamental psychological mechanisms: tunnelling and cognitive load.

I add to the existing literature by moving the analysis of decision-making under poverty closer to reality and reassessing the process. The different strands result in the following overarching research question -

How does scarcity-led cognitive load alter probability weighting?

To answer the research question, in the next section, I detail a conceptual framework that links the scarcity theory with the risk and probability weighting theory working through the mechanics of cognitive load, attentional processes and the dual system framework of cognition. Next, I discuss the study design that seeks to answer the primary research question and the emerging hypotheses. Following this, I describe summary results and analysis to lead into the concluding discussion.

2.2 Conceptual Framework

In this section, I set up the conceptual framework using insights from the literature to answer the research question sketched in the previous section. The discussion begins (Figure 6) with a summary of the key takeaways from the scarcity theory, followed by an assessment of models on risk and dual thinking styles. After appraising the existing models, I differentiate the top-down – bottom-up mechanics of attention and the newly proposed theories that include this attentional capture. Finally, I bring insights from these theories to explain the workings of the scarcity theory in general and, more specifically, how the probability weighting function (pwf) is operationalised.

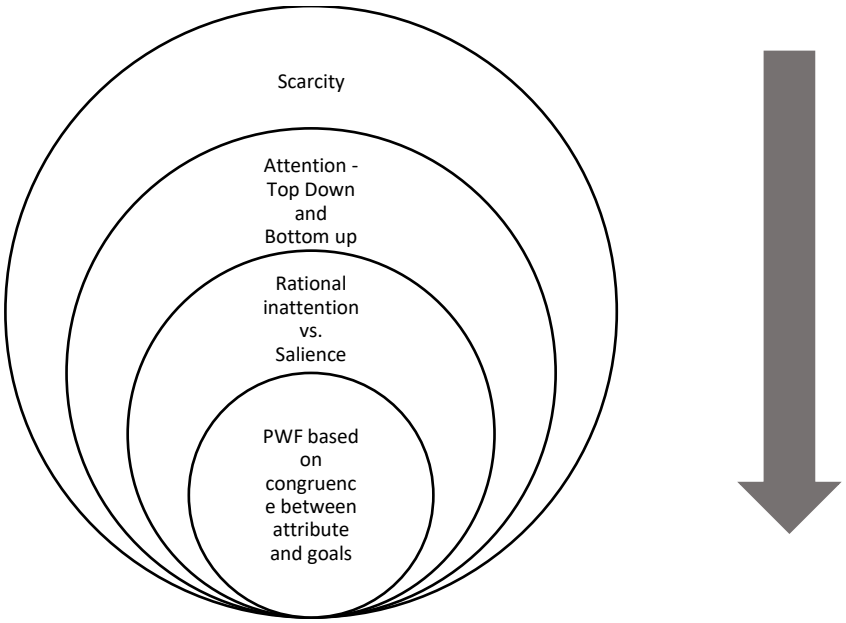


Figure 6 Sketching the Conceptual Framework

Two phenomena characterise decision-making under financial scarcity - *cognitive load* and *tunnelling* (Figure 7). Cognitive systems are redirected to meet urgent, unmet needs. Thus, scarcity-relevant choices get disproportionately more deliberative thought, making them System-2 heavy to be maximally "efficient". However, this *focus dividend* (Mullainathan and Shafir, 2013) comes at a cost. As mental resources are pulled involuntarily towards the relevant needs, capabilities left for other choices that may not be directly relevant to the scarcity at that stage reduce. Therefore, scarcity-led psychological *cognitive load* triggers a mechanism where resource efficiency is at the cost of other biased choices.

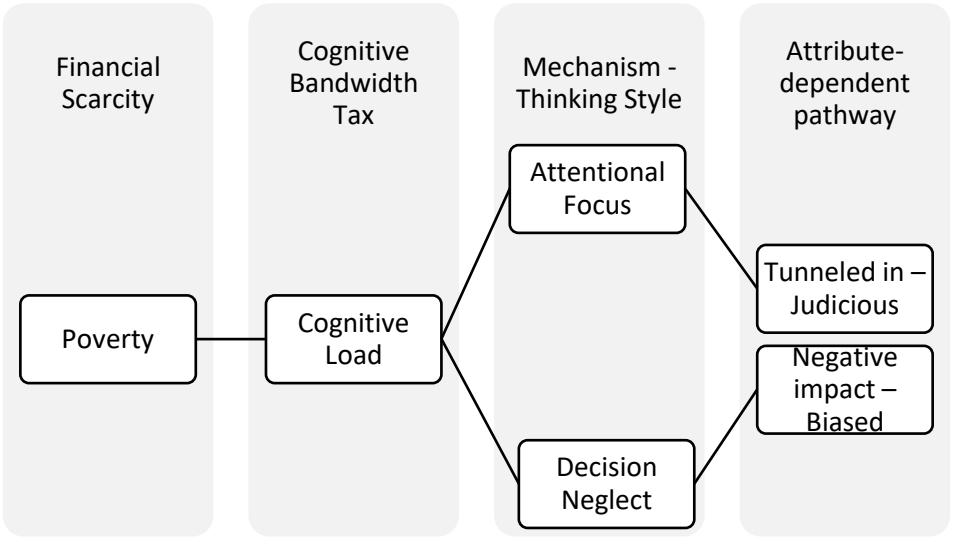


Figure 7 Simplified diagram of scarcity theory

The degree of relevance to scarcity determines the mix of cognitive processes that would be used. The decision attribute, thus, holds the key to explaining the second key effect of scarcity. In such a scenario, the choices that resolve the scarcity at hand take up the bulk of the after-tax cognitive space, getting a higher proportion of the deliberative, thoughtful system (System 2). Therefore, the decision maker (dm) becomes more judicious for choices with those scarcity-relevant attributes. At the same time, the irrelevant choices bear the brunt. They are likely to be outcomes of greater affective or System 1 functioning. This split in preferences as a function of their relevance to scarcity is *tunnelling.*

There has been an active debate in the psychology literature to better model risk preferences by shifting from erstwhile unitary thinking formulations of decision-making and including insights from the Dual Process Theories (DPT) and thinking styles. The models seek to provide a more behavioural theory of how cognitive systems combine in static and dynamic states to determine weights of affective and deliberative components on individual choices. Both states structure their formal models based on two fundamentally core components of decision-making – the affective, intuitive, automatic System-1 and the deliberative, analytical, slower System-2 (Stanovich and West, 2000). The former is theorised to require lower cognitive effort, while the latter engages more rule-based thinking. Within the framework, any stimulus that pushes up the affective response is expected to increase sensitivity to probability (Rottenstreich and Hsee, 2001). This is in line with the *risk as feelings* hypothesis which stipulates a change in the weighting function as emotional reactions get heightened (Loewenstein et al., 2001).

Broadly, without any external force, choices are understood to be a functional combination of the two thinking styles. In terms of the effect on the shape of the probability weighting function, it depends on the eventual weight (γ) on the affective system (Mukherjee, 2011). The inverse-S-shaped curve becomes increasingly curved towards endpoints as the decision-makers affective system's role increases. The overarching consideration is that due to its nature, the deliberative system perceives probabilities as the true mathematical value $w(p) = p$ and the affective system only responds to the degrees of hope, fear, or the emotion it invokes. In terms of utilities, it implies –

$$V(G) = \gamma V_A(G) + (1 - \gamma)V_D(G)$$

The parameter of interest, γ is defined as the level of involvement of System 1 and depends on thinking styles, the nature of outcomes and task construal. The author concedes that the list is not exhaustive but is just the core of the affective system at work. In conjunction with the experimental findings from an earlier (Mukherjee, 2010) paper, he shows links between affective thinking (System 1) and a greater propensity for overweighting smaller probabilities and the Allais paradox. He explains

the findings within the context of hope, feelings, and fear literature. Now, while this model discusses the static conditions of primarily affective functioning, it does not account for interactions and changes in the role of the deliberative system. Other models take it to more general implications.

Lowenstein et al. (2015) theorise that this relative influence between the two systems is mediated through willpower. They assume serial processing, where the deliberative system must exert an effort to control affective motivation (M (x, a)), where a is the intensity of affective motivations. This cognitive effort is the willpower function ($h(W, \sigma)$). The greater the cost of controlling affective reaction, the higher the function. They postulate two factors that may hamper the ability to do so – the willpower strength reserve (W) and the competing cognitive demands (σ). For a decision maker who has had to exert willpower to hold back continuously, the lower their reserve, the lower the W. As a result, they may find it harder to moderate the affective response. Therefore, the function h is decreasing in W. Similarly, when there are multiple demands on the limited cognitive capability (higher the σ), more deliberative effort may be required to focus. Thus, making the function increase in σ. In their formal model, the subject's behaviour is a function of this $h(W, \sigma)$ and its exact position between the deliberative-affective optimum will depend on how low the willpower cost is.

Diederich and Trueblood (2018) move to more dynamic modelling of risky decision-making using experimental data using measures of dwell time attention and the nature of dual system interaction. Their model statistically fits different functional forms of the probability weighting functions and supports system 1 being more prone to Prospect Theory while system 2 guides to more Expected utility *rational* predictions. In line with cognitive theory, the time taken to decide is important in guiding the system's role in their model. The drift between systems 1 and 2 is dependent on the dwell time. E.g., although framing effects are guided by System 1, their magnitude will be determined by how delayed the switch to System 2 is.

The cognitive theory on attentional weights through stimulus perception in a dynamic environment has also been the focal point of other process studies (Johnson and Busemeyer, 2016). In these advanced models, decision weights are conceptualised as outputs of the relative impact of choice attributes on the deliberation process. Therefore, the source of changes in the weights is a product of a shift in attention, which depends on the outcome's salience. The decision-making process uses the information picked up from the stimulus. Attention, at any time t, is guided towards features of the salient outcome. This sequential sampling over aspects of options is accumulated over time across different attributes until a sufficient preference is made for one option. The theory proposes independent evaluations in a Markov chain loop attention process dependent on dwell time on each

state. The attention process model weighting then reproduces a similar inverse-S probability weighting function as known in standard economic theory.

While these theoretical models give us a decision-making framework under Dual Process Theory, they preclude the fundamental discussion on cognitive redistribution. The question boils down to the extent of attentional capture of the choice attribute and the strength of scarcity being felt. Neurally, it implies the relative influence of controlled vs automatic processes directs the choices made. The orbital and prefrontal cortex (pFC), or the executive region, absorbs the load, affecting the strength of the controlled cognitive system (Camerer et al., 2005). Processing the loading factor draws the deliberative System 2 towards itself. As a result, the individual is expected to be guided by System 1 for choices irrelevant to the decision-makers goals.

Apart from neural location, the two processes can be distinguished by their integration with long-term versus short-term goals. Controlled processes are top-down processes initiated from the prefrontal cortex of the brain. This part guides the deliberate thought processes in forming goals, planning, carrying out a goal-directed plan, and performing effectively (Lezak 1983; Miller and Cohen 2001). The process draws inputs from all other sources, combines them to form goals and guides actions taking those long-term goals into account.

Now, while goals predetermine the distribution of attention- cognitive channel in a world with no distractions, decisions can sway by anything and everything that catches the attention of the decision-makers from the outside. Two theoretical channels and decision theories have been proposed for the two mechanisms of attentional allocation. The first is the top-down channel (TD), and the other is the bottom-up (BU) (Engelmann et al., 2021). As the name suggests, top-down is the endogenous mode of attentional control related to the decision-maker's goals and expectations. In contrast, the bottom-up mode is the attentional allocation that is beyond the direct control of the decision-maker. A mode that is directed by attributes of the choices that capture attention. This can be how the choice stands out, its prominence or any feature that draws the decision-maker towards itself.

The distinction between the two modes is critical in understanding where attention gets focused and what choices are made eventually. Engelmann et al. (2021) show a connection between top-down attention and goals. If the top-down mechanisms guide attention, then the role of executive cognitive processes takes primacy, and the decision maker can be modelled to be an optimising economic agent. This is reflected in the rational inattention models (Gabaix, 2014; Maćkowiak et al., 2023; Sims, 2010; Wiederholt, 2010) that assume an endogenous optimum allocation of attention to what is deemed

most useful. Given the processes involved, the top-down attentional differences between-subject reflect differences in cognitive abilities.

Attention can also be captured by exogenous sensory stimulation. The salience of attributes like choice environments, novelty, prominence, contrast, and surprise can draw attention by virtue of their characteristics (Bordalo et al., 2022, 2012a). Selective attention can therefore be focussed on most task-relevant stimuli. Here, contextual environments shape the categorization of choices (Ellis and Masatlioglu, 2022). Categorical thinking affects attentional allocation based on salience function. Salience models from Bordalo et al. (2012a) focus on choice attributes as drivers of attention where the most relevant information gets overweighted in the erstwhile cognitive processing balance. The models propose a competitive mechanism where the bottom-up force is so strong that initial top-down goals are neglected in light of the complete attention capture. The models have reanalysed established results from risk theory like Allais Paradox and the prospect theory pwf framework by proposing a ranked salience function that captures attention and preferences. This top–down–bottom–up interaction, where bottom–up determines perceptions, side-lines goals and supersedes top-down, operates at a within-subject level (Engelmann et al., 2021) and is shown to direct attention to attributes that capture attention and are ultimately chosen.

Broadly, two clear lines have been drawn between goal-directed and stimulus-driven (Corbetta and Shulman, 2002), dependent on how the brain processes the two attentional processes. Now, while it is known that both top–down and bottom-up play specialised roles in decision-making (Orquin and Lagerkvist, 2015; Orquin and Loose, 2013), there are only limited unified models that bring the two mechanisms together. Kluwe- Schiavon et al. (2017) and Engelmann et al. (2021) propose dynamic and empirical studies that look at their interplay. While Engelman et al. (2021) experimentally prove the separation between agent-specific (top–down) and Decision-specific variation (bottom-up) and their contributions to the choice variable. Kluwe- Schiavon et al. (2017) extend the partitioned Dual Process Theory model and hypothesise an interactive model where executive functioning (EF) plays an adaptive role. They conceptualise cognitive systems away from the straitjacketed System 1 – System 2 duality to a more continuum-like process. It balances the System-1 (automatic) and System-2 (controlled) state when faced with a bottom-up (BU) salience state. In this way, it acts as a mediator by providing the most efficient balance of attention between the two states.

Therefore, when salient choice triggers the bottom-up mode of attentional capture, the pro-active Executive Function coordinates for attributes that align with the top–down goals. For those relevant choices, goal-oriented behaviour is instigated. Thus, there is a net top–down functioning. The decisions receive a bulk of Controlled- System 2 processing. Parallelly, given that the total System-2

capability is fixed, other irrelevant attributes receive the bulk of System- 1 functioning. The split between the outcomes from the two mechanisms depends on how much Executive Function can sense goal relevance from bottom-up attention and how much it can pull towards System-2 processing after sensing congruence with top–down goals.

It is not a zero-sum game between the top–down and bottom-up mechanisms and the Automatic (System-1) – Controlled (System-2) duality. Decisions depend on the strength and congruence between goals and the salience of goal-relevant attributes. If the goal-relevant information is salient, then Executive Function assesses the congruence with the top-down mechanism and allocates the bulk of controlled System- 2 processing. If the two are perfectly congruent and robust, then choices perfectly coincide with the region (a) on the goal-oriented, System-2 rational behaviour line (Figure 8). It is possible that sometimes the two are not strong enough to pull towards a complete System-2 functioning, and then the level would fall in quadrant 1.

In contrast, for goal-irrelevant attributes, choices get predominantly guided by automatic System- 1. If all System-2 resources are completely occupied for resolving goal-relevant decisions (Region a), then there is a perfect split, and all irrelevant needs get System- 1 and fall into Region b (Figure 8). Correspondingly, if not an outcome of complete, but a majority of System- 1 functioning, they fall in quadrant 2.

With this framework, I seek to understand preferences under scarcity and the extent of realignment in System- 1 - System-2 cognitive system weights. First, starting from the restive Top-Down state, scarcity imposes an involuntary cognitive load (Figure 9(A)), and goals for resolving the scarcity at hand are set.

As discussed, cognitive load is absorbed by System-2, reducing the strength of the remaining total available Top-Down resources. Next, functioning with these taxed abilities, the decision-maker faces choices with different attributes – some relevant to the scarcity at hand and some irrelevant. The salient scarcity relevance attribute captures attention in a bottom-up manner (Figure 9(B)). The relevance stimulus imposes a counteracting bottom-up force on the conscious top-down process. Finally, on sensing the congruence between scarcity goals and what is salient (scarcity relevance), the Executive Function directs the bulk of System-2 functioning in a Top-Down manner. Simultaneously, all others are BU mechanism-heavy and are more likely to be System-1-heavy (Figure 9(C)). This concurrent perfect bifurcation, or *tunnelling,* would split choices into economically rational (System-2) and biased (System-1) preferences. As discussed in the literature review section, theoretically, this would imply $\theta = 1$. When facing choices in the real world, there is a possibility that the strength of

salient attributes or the pull of goal-relevant System-2 attention is not enough for a perfect decision tunnel to form (Quadrants 1 and 2, Figure 8). In such a scenario, the split or tunnelling would be between θ =[0, 1].

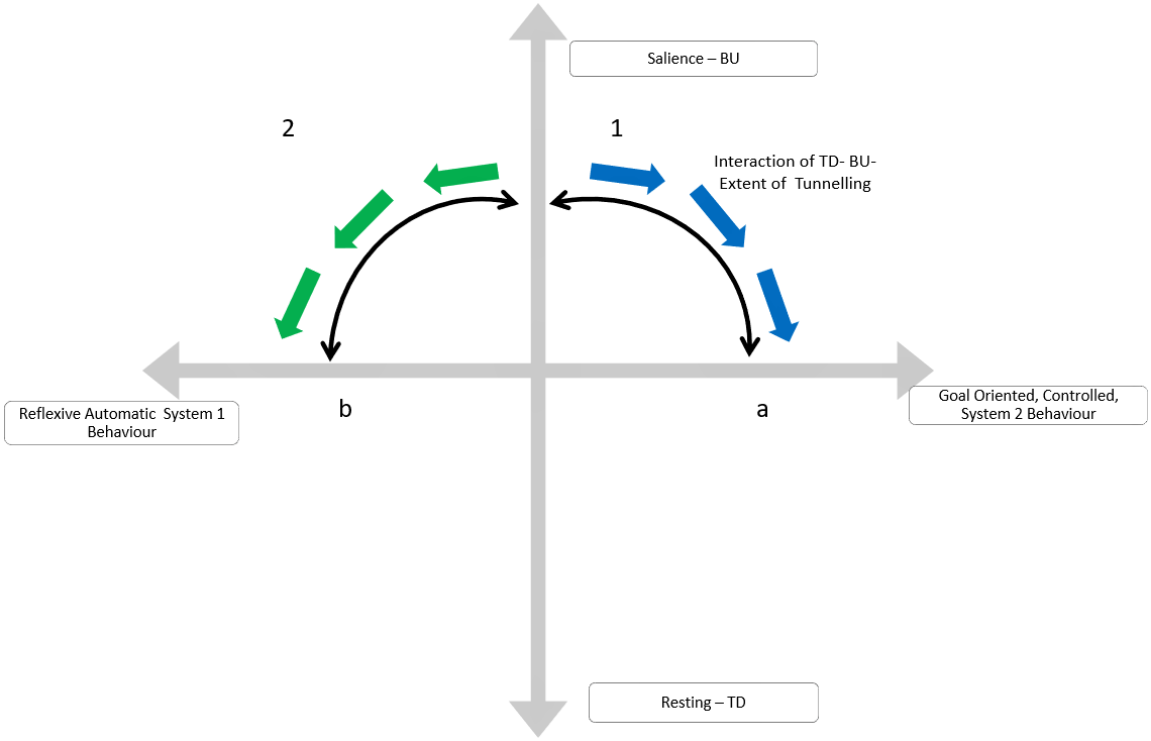


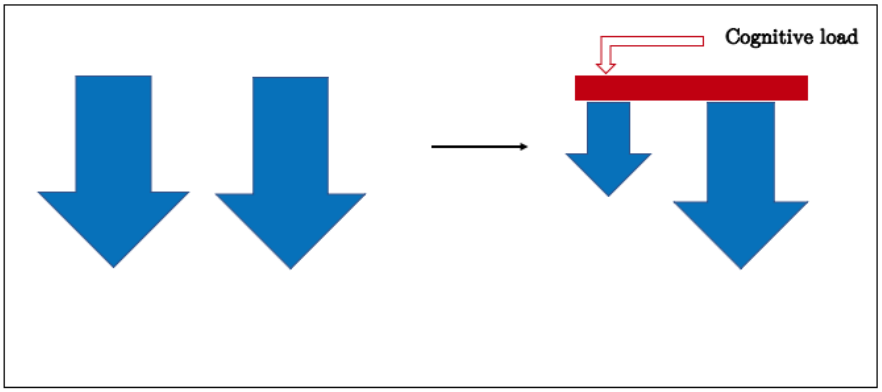
Figure 8 Tunnelling: From the Perspective of Attentional Mechanism in a Dual Cognitive System Model

This paper empirically looks at scarcity-triggered cognitive load and the point at which tunnelling begins to exert its splitting effect on the probability weighting function. Given the mechanism sketched in this section, I hypothesise an increasing degree of *tunnelling* (θ) when the congruence between scarcity relevance and goals increases. This can happen due to the following reasons –

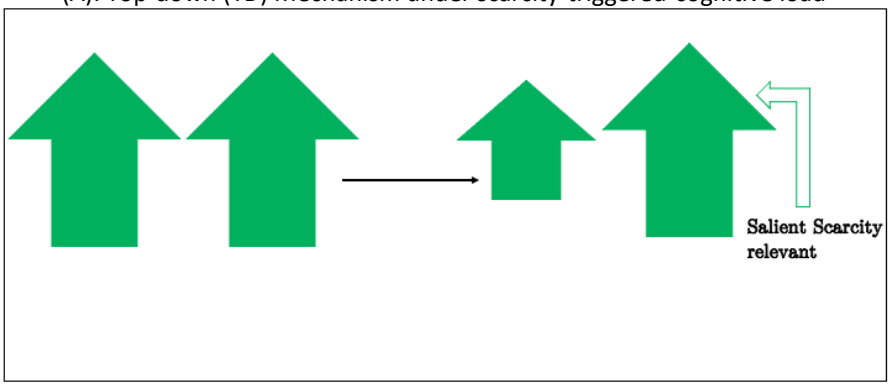
i. θ = 1, when scarcity forces, and hence the goal to resolve it is strong. A robust salience of relevant attributes also allows for a perfect split of Expected Utility Theory consistent scarcity relevant probability weighting function and a biased scarcity irrelevant pwf (Region a and b).

ii. θ = [0,1], an imperfect degree of tunnelling may be because the goal to resolve scarcity is not powerful or the relevant attribute is not salient enough for the decision maker (Quadrants 1 and 2).

iii. θ = 0, when Top-Down scarcity has no splitting effect -goals and bottom-up salience of scarcity relevant attributes.



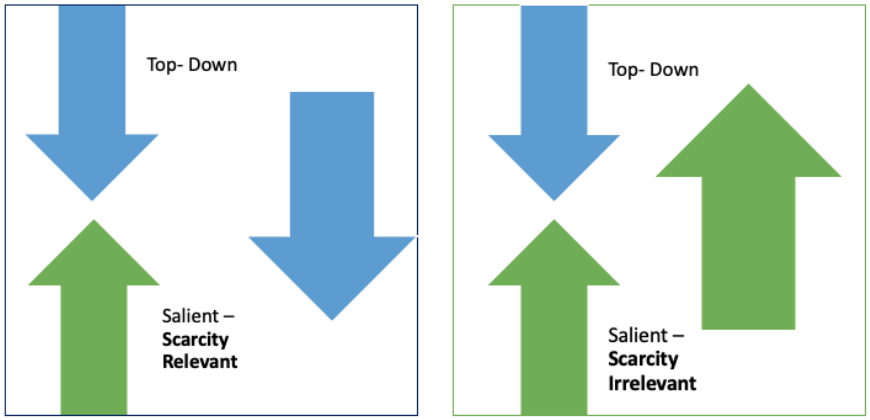
(A): Top-down (TD) Mechanism under scarcity-triggered-cognitive load



(B) : Bottom-up (BU) Mechanism of salient scarcity relevant decision attribute

System 2 heavy - Net Top down – **Rational**

System 1 heavy – Net Bottom up – **Biased choices**



(C)

Figure 9 The Scarcity Mechanism in Action

2.3 Study Design and Implementation

My work focuses on the tunnelling impact of financial scarcity on probability weighting through the cognitive load. I break down the research question into core elements – (i) the cause - the role of scarcity, (ii) the mechanism - cognitive instruments, and (iii) the effect – a decision-attribute-dependent measure of the probability weighting function. In this section, I give an overview of the design, the study setting and follow it up with a discussion of the elements in detail. Next, I identify exogenous sources of variations that can be used in conjunction with experiments. Finally, I explain

the outcomes from each, the procedural field implementation, and lay out the primary and secondary hypotheses emerging from my design.

I implement a lab-in-field between-within-subject experiment and combine it with natural instruments to determine scarcity's differential impacts. A decision-maker may face three financial shortfalls through the year –cyclical, seasonal periods of plenty and shortfall, unexpected shock, or a combination of the two. To identify all three, I cross the distinct lean and plenty periods of the annual harvest cycle of the region with priming for unexpected scarcity for randomly assigned groups in both phases. The four levels cover the permutations of the scarcity possible and give us a 2*2 between-subject design at the treatment stage (Table 1).

Table 1 Experimentally designing for scarcity

Scarcity as a force	Natural scarcity	Priming	Treatment variable
Lean only	Yes	No	Expected scarcity only
Lean and primed	Yes	Yes	Full treatment
Plenty only	No	No	Control
Plenty and primed	No	Yes	Unexpected scarcity only

Next, given my interest in understanding the psychological mechanism triggered by causal scarcity, I introduce the cognitive load test for all subjects. The two-question test follows right after the first treatment. It is intended to measure the tax on attention, inhibitory control and working memory due to the four levels of scarcity. Finally, I measure probability weighting independently for gains and losses to identify the outcome effect by implementing common consequence ladders twice for the same participant. The only feature setting the two apart is the relevance to scarcity. Given the decision attribute and controlling for all individual-level noise, any simultaneous difference in probability weighting would indicate a split in preferences or *tunnelling*. I end the experiment with a survey that collects data on basic demographics and psychological well-being.

In the following subsections, I go through each element in detail. I begin with the study setting, designing for each task and the common consequence ladders to track the probability weighting function. I end with putting all of it together in the experimental design and an illustration of how a lottery pair in the common consequence ladder may look.

2.3.1 Study Setting

The Food and Famine Security concern outlook for Uganda (FEWS, 2020) from USAID marks a minimal to stressed outlook for 2020-21 (Figure 10). The design was implemented in the Bwikhonge region in the Bulambuli district of Uganda. The region lies in the Eastern part of the country and has a pattern

of consumption insecurities. The confidence through the years has been declining with a pertinent possibility of locust attacks in the region.

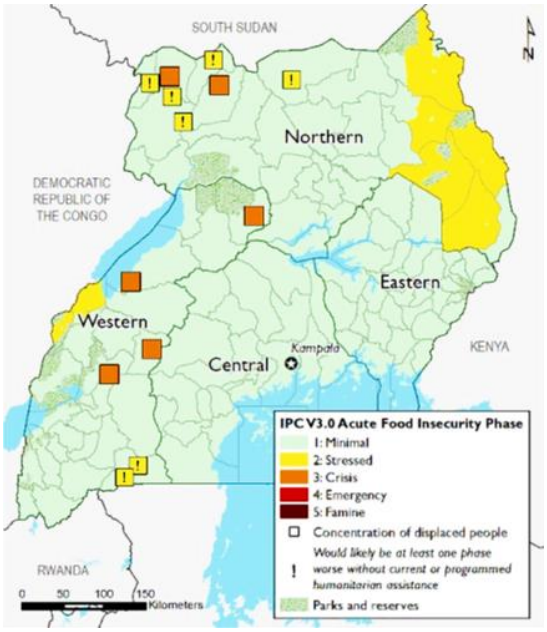


Figure 10 Famine Early Warning Systems Network (FEWS- USAID) outlook for 2020

The region is primarily rural where most of the population relies on small-scale farming with low household incomes. The region has a high dependence on rainfall, with the situation expected to worsen (FEWS-USAID, 2019). Most residents are small landholding maize farmers. They have lived through droughts, pest attacks and other hazardous situations (Figure 11).

2.3.2 Variations in Scarcity

I embed the experiment within the harvest cycle of the region. A household's financial position differs markedly throughout the year in an agrarian region with a heavy reliance on rainfall. This gives us an external source of variation in financial scarcity dependent on the timing of the experiment. Mani *et al.* (2013) used the natural monsoon cycle of Tamil Nadu, India, to study poverty's effect on cognitive function. They administered Ravens Progressive matrices, a standard measure of cognitive flexibility, to the same farmers in the harvest cycle periods to find the significant effect of financial scarcity on performances. The approach was also used in Zambia and Brazil to investigate scarcity-triggered lower seasonal differences in exchange trading asymmetries (Fehr et al., 2020) and the role of the level of income & uncertainty in cognitive effects and tunnelling (Lichand and Mani, 2020) respectively.

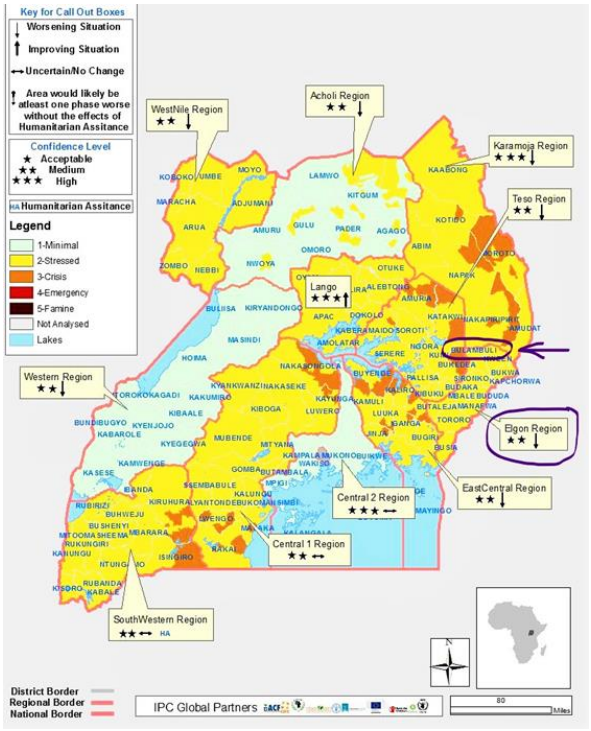


Figure 11 Famine Early Warning Systems Network (FEWS- USAID) outlook for Uganda 2018-19

Similarly, I design the experiment to include the pre-existing natural differences in financial scarcities. Such shortfalls are expected, anticipated, cyclical and common knowledge to all the residents in the area of study. Geo-sensing data from the region (FEWS- NET) showed a bimodal cycle of harvest (Figure 12). I conducted the pre-experiment focus group studies in the region to get a sense of seasons, agricultural patterns, and stress levels they undergo throughout the year. As shown in the summary findings (Figure 13), there are two major crop seasons where the first quarter of the year begins with the planting of maize and subsistence crops.

The year starts with bulk expenditures like school fees and agricultural investments to be made upfront. Therefore, cash is tight, and liquidity levels are low. It is a period marked by a heavy workload as the farmers prepare the land for the first round of planting. Peak stress levels are reached in May until the first harvest in August after the rains in June- July. The situation improves thereafter. Though still fully not at ease, money begins to come in, and there is food at home. Around the end of August, the next round of school fees needs to be paid, and the preparations for cash crops begin. It is only towards the end of the year, after the second round of rains, when the harvest is sold, are the people flush with cash. Lowest levels of self-reported stress characterise the months from September to December. This is the festive season, and the people in this state plan for the next planting season. The months from April- May and October- November are, therefore, two standout intervals in the natural harvest cycle of the region in terms of liquidity and stress. We earmarked May as the lean and

November as the plenty season as two distinct periods to give us an externally valid field variable for scarcity.

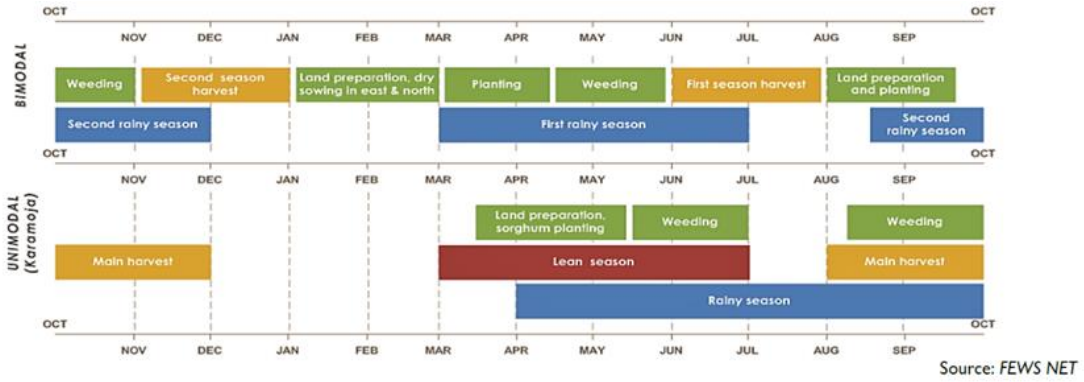


Figure 12 Annual harvest cycle for Uganda (FEWS- USAID)

Given these foreseeable shortfall periods and gluttony, we investigate the additional role of unexpected financial shocks. In their study on characteristics of scarcity as a force, Shah et al. (2018) find for those struggling financially, thoughts about money are omnipresent, challenging to suppress, are easily triggered by unrelated activities and change associations. They also find financial scarcity adds an economic angle to everyday life as it interferes in all spheres. With limited slack, they find continuous, background monetary considerations even in scenarios that may not explicitly have one.

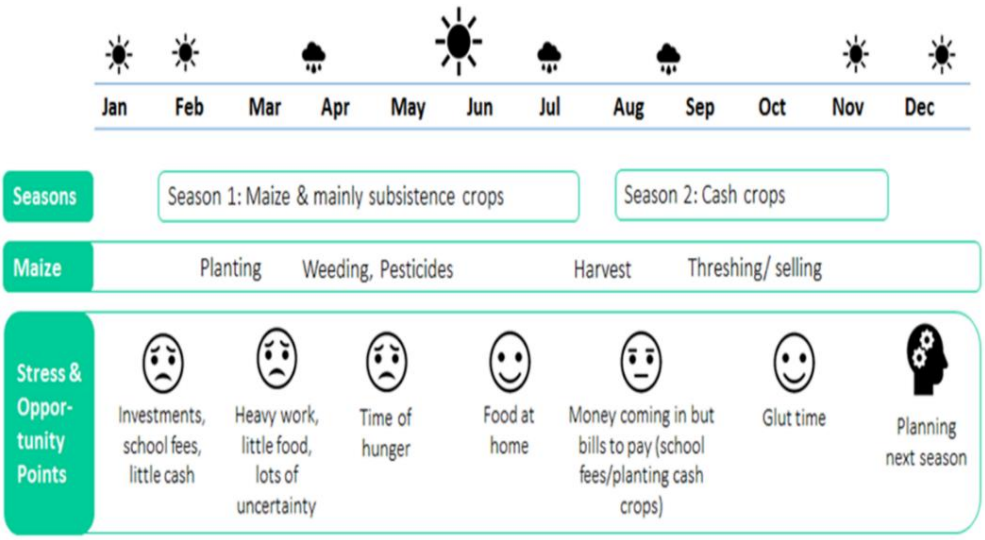


Figure 13 Findings on annual harvest cycle and stress levels from Focus Group Discussions in the region

Their findings underscore the spontaneity of monetary thoughts for those dealing with scarcity. Based on their online experiments with American respondents, we explore these scarcity features within the two seasons of the harvest cycle. I introduce three hypothetical thought scenarios for half of the randomly selected individuals in both the lean and the plenty periods. Each readout is followed by a

5-point Likert scale-type question and reports of the first three concerns after the experimenter narrates the scenario to them.

The first gets at the easily triggered nature of scarcity. Using past weather reports on crop failures, we set up a scenario of possible regional locust attacks. We asked the participant to rate the level of concern from the fictional situation. Next, to get the unprompted, persistent nature of scarcity, we describe a treatable medical ailment, and the subjects report the first three thoughts. Finally, we ask them about the significant expenditure in the next six months and the level of concern about it. The three questions together prime the participant with an additional *shock* priming and tap into the features of scarcity.

Correspondingly, the latter gets three readouts of equivalent word count to maintain time parity between the treatment and control groups. The critical difference is that they lack any mention - direct or indirect, unanticipated scarcity. This is to ensure that the scores on the follow-up cognitive load test are not due to the fatigue from the effort that the treatment group may have spent answering the scenarios. The three questions for the control group have a similar combination of response modes, with the first one asking to rate the amount of fun they had last time at a village feast on a scale from 1 to 5. The second one on three people they would like to share free grocery vouchers invite for an upcoming dinner party. Finally, the third question asked them about the last socialising event they attended and how much fun they had at that get-together.

For experimental sessions in both the lean and plenty seasons, the participants are randomly assigned to either the treatment or the control group, giving us four combinations of natural and primed scarcity. At this 2*2 between-subject level, the experimenter reads the respective scenarios dependent on the allotted group and notes the answers in the response sheet. Once the task is done, all participants proceed to the cognitive load test.

2.3.3 Cognitive Load Test

An essential part of the conceptual understanding of the functioning of scarcity is its direct effect on the decision-making system. Interference in cognitive control disrupts two core components that are intricately related – inhibitory control and working memory. To understand the causal scarcity-triggered cognitive load, all subjects, irrespective of the treatment or control group, do the cognitive load test in both seasons. Therefore, each participant gets the same test irrespective of the scarcity treatment to allow for comparisons between the four combinations of scarcity states.

While many standardised tools have been developed in the psychology literature to measure the core cognitive components[3], I was constrained by the literacy and electronic capabilities of the field settings. Given these limitations, consultations with field partners and after piloting various standard tools, I use the numerical version of the Stroop test and the Digit Span test.

In its original version, the Stroop test (Stroop, 1935) requires the subjects to read a list of words for different colours followed by words printed in colour different from the name of the colour itself. For example, in the first congruent stage, the word red is printed in red ink, while in the next incongruent round, the word red is printed in green, and the correct response in both conditions would be red. The responder in the latter must suppress their natural urge to answer it as green. The difference in performance in both rounds is the amount of attention and inhibitory control exerted. The test, in its various forms, is now a standard in cognitive psychology and has been used with different populations and contexts (Engle, 2002; Golden, 1975; Scarpina and Tagini, 2017; Strauss et al., 2006). Additionally, to account for field limitations of literacy in its original form, it has been adapted to non-verbal versions like numerical (Bellon et al., 2016; Lichand and Mani, 2020; Mani et al., 2013; Van der Sluis et al., 2004; Wolach et al., 2004) and spatial with directional arrows (Dean et al., 2017) for both electronic and paper formats. Across these variants, the core principle of the method remains the same - suppressing irrelevant information, maintaining cognitive control and selective focus (MacLeod, 1991; MacLeod et al., 2003).

While my subject population has limited mathematical and verbal literacy levels, discussions and previous field experience revealed they have basic counting numeracy experience. Therefore, I administer the numerical Stroop test wherein the participants first count the number of triangles between 1 to 5 in a 15-row - 5 column sheet, then count the number of digits in the sequence, not the numerical value of the digits in the same format. The experimenter notes the mistakes and the reading time for both conditions. For example, in the congruent condition, the participants see ΔΔ (2) triangles in one of the cells of the 15*5 table. Correspondingly, in the incongruent condition, they see sequence 33 in one of the cells in a table of a similar format. The correct answer to the latter would be 2 and *not* 3. This ability to control the impulse to respond 3 instead of 2 is assumed to be directed by the cognitively controlled selective attention process.

Having obtained a measure of attention and inhibitory control, I move to measure the second cognitive element of Executive function - memory. Its key feature is encoding, holding, club, and

[3] Dean et al. (2017) review the cognitive load tools for all the core components – Attention, Inhibitory control, Memory, and Higher order Cognitive skills.

recalling information. Though it has multiple components like visual-spatial and verbal; all can be clubbed broadly into working memory (WM) and short-term memory (STM). While both hold the information, working memory makes manipulation of that information possible. It guides the use of stimuli before it is stored in the more permanent long-term memory. In a limited cognitive system, short-term memory and working memory guide the temporary storage and use of information (Diamond, 2013). Together they process real-time information to act and unlike long-term memory, are not dependent on learning or rehearsal. Additionally, any post-retrieval active use of information from long-term memory is guided through the working memory.

Working memory is of key interest in understanding the cognitive impacts of scarcity as it is the component that is limited by load capacity (Cowan, 2008; Diamond, 2013). I use the Forward and Reverse Digit Span test to measure the effect. The experimenter reads a series of random numbers at a fixed pace to the participant and then asks them to repeat the numbers in the same (forward) or reverse order. The series of numbers gets longer with every correct response, and the final score is the longest span that was accurately recalled. Compared to a verbatim recall and repetitioning the forward digit span, the reverse span requires the subject to store the digits in the order they hear them and process it in the correct *backwards* manner. Therefore, the forward version taps and primes the short-term memory, and the backwards span additionally uses the working memory to manipulate the stored information. The task does not require complicated equipment to administer, and the experimenter only needs to note the maximum span of digits the participant could repeat back in the forward or reverse order accurately.

Since all participants get the same test immediately after the scarcity treatment, comparing the scores measures the relative cognitive load on each. Theoretically, the cognitive effect on attention, inhibitory control and working memory is hypothesised to be the first casualty, the mechanism of scarcity making its presence felt. The second casualty is its effect on preferences and the redistribution of leftover cognitive capabilities based on the relevance of scarcity. After getting at the first key component, I move to the second part of the story – the effect on the attribute-based probability weighting function.

2.3.4 Probability Weighting Function, Decision Attribute and Tunnelling

Over the years, many methods have been proposed for tracking the probability weighting function (pwf). They can be broadly clubbed into four categories – Statistical (Gonzalez and Wu, 1999), Parametric (Prelec, 1998; Tanaka et al., 2010; Toubia et al., 2013), Semi parametric (Abdellaoui et al.,

2008) and Non-parametric (Abdellaoui, 2000; Bleichrodt and Pinto, 2000; Harrison et al., 2010; van de Kuilen and Wakker, 2011; Verschoor and D'Exelle, 2020).

In this section, I describe the method for tracking the decision effects on probability weighting due to the scarcity-induced cognitive load. First, I briefly describe each method's key insights, strengths, and weaknesses and detail the approach that best fits my research aim and field setting. Next, I discuss the design element added to my chosen method that gets at the second key effect – tunnelling based on relevance to the scarcity at hand.

The statistical method is one of the most careful methods to estimate the weighting function parameters. The method was used by Gonzalez and Wu (1999) in a lab setting with 10 graduate students, where they were presented with 15 two-outcome prospects in gains for 11 different probabilities. Therefore, a total of 165 lotteries. The authors asked students for the certainty equivalents (CE) for each gamble in the series of 165 to the nearest dollar by progressively narrowing the range. For example, the student participant was asked if they would rather have a gamble that offered a 50-50 chance of $200 or a certain amount that ranged from $0 to $200 in increments of $40. If they chose $80 for sure over the gamble but would rather play the lottery over $40 for sure, then the second round would narrow the band between $40 to $80 for the next round of choices. By iterating this process until the last round, if the same participant said they would rather have $70 for sure over the prospect but the prospect over the sure $69, then the certainty equivalent for the prospect would be 69.5. The authors then used Alternating Least squares to estimate the weighting function parameters. As can be seen, while the method's strength lies in its non-parametric nature (as it does not assume any functional form of the weighting function), and low cognitive demand, it is time-consuming.

On the other hand, most parametric methods have the benefit of low time requirements for administration but tend to get cognitively demanding and may not be the best for field settings with literacy constraints. The set of methods assumes a functional form at the outset and then fits the certainty equivalent data for choices using regression, Maximum likelihood (Stott, 2006) or other statistical methods. It was initially used to estimate the 1 and 2 parameter function proposed by Kahneman and Tversky (1992) and was later extended by Prelec (1998). The major drawback of this first wave of parametric methods was the time required to administer them; hence, they allow only limited applicability outside the lab. The next group of parametric methods make up for the time but come at the cost of being too cognitively demanding, thus again heavily constraining their use in the field. Though Tanaka et al.'s (2010) three Holt-Laury-like switching point lottery experiment was conducted in Vietnam, which yields unreliable and coarse parameters of the pwf (Glimcher and Fehr,

2013), mainly attributed to its complexity. Similarly, Toubia et al. (2013) propose adaptive measures in increasing optimised informational content to estimate parameters in a Bayesian framework. The method suffers due to its high cognitive demands on the participants.

The semi-parametric methods also carry the same trade-off of administration time versus cognitive demands. The methods do not assume a functional form of the weighting function at the outset but fix a value functional form to estimate the parameters of the former. Apart from assuming a utility functional form, the three-step Certainty Equivalent methods (Abdellaoui et al., 2008) are held back by their complexity and, thus, are limited in their adaptability to field settings.

Finally, the non-parametric methods allow the experimenter the flexibility of not assuming a functional form at the outset, thus being a suitable line of methods for undertaking exploratory studies on the shape of the pwf. Most methods rely on a two-step matching process (Abdellaoui, 2000; Bleichrodt and Pinto, 2000; Etchart-Vincent, 2004) of first estimating a value function and then a weighting function by either eliciting equally spaced probabilities for each outcome such that the mixture of the highest and the lowest outcome is indifferent to the internal outcome. Another midpoint method (van de Kuilen and Wakker, 2011) fixes the probability of the middle outcome between high and low outcomes. Then it seeks to estimate the decision weights by changing the probability, keeping the value of the lottery constant. Both methods are touted to be efficient in time but are too cognitively demanding on the subjects. In van de Kuilen and Wakker's (2011) words, “respondents did not understand the choices or did not think about them seriously”.

In contrast, the common consequence ladders (CCL) method used in Ethiopia, Uganda, and India (Harrison et al., 2010; Verschoor and D’Exelle, 2020) reliably tracks the probability weighting function using the simple common consequence effect tests proposed by (Wu and Gonzalez, 1998). The design is simple enough for use in populations with limited literacy, is not complex or too cognitively demanding, and is also not time-consuming. Therefore, it fits nicely in field settings like mine with non-student populations.

Given my research aim of studying the pwf in a field setting and seeing scarcity’s cognitive effect on it, I need a method that imposes minimal additional cognitive weight because of its design complexity, is not too time-consuming and is comprehensible to a subject pool with low literacy levels (Dave et al., 2010). Common consequence ladders fit on all these counts.

Within the core method, the participant faces choices between pairs of five three-outcome lotteries. Of the pair, one is safe (S), and the other is a risky (R) lottery. The lottery pair can be conceptualised as a rung, with the entire list being a 5-step ladder. The ladder's steps are related to each other by a

shift in probability mass between them. Therefore, the safe-risky pair of rung 2 is generated respectively from the safe-risky pair of rung 1 by shifting an identical probability mass from the worst to the intermediate outcome in both. As discussed in theoretical section 2.1, a preference reversal due to the shift in identical probability mass would violate the independence axiom of Expected Utility Theory. When probability mass is moved between them, the participants must choose one out of the Risky and Safe lotteries for the five rungs. A "rational" person who chooses Risky or Safe in the first should continue until the fifth (RR or SS). A switch to safe from risky (SR) or risky from safe (RS) from the previous rung indicates probability weighting deviating from its actual value. Thus, the frequency of shifts between subsequent safe risky pairs between rungs allows me to trace the trajectory of the underlying pwf for the probability intervals.

In line with my research question, I go beyond probability weighting and look at the difference scarcity relevance causes. Therefore, I extend the original common consequence ladders design to track pwf based on decision attributes for gains and losses. To examine the effect, all participants in each treatment do the 5-rung Safe-risky decisions decision-making task for each attribute – relevant and irrelevant for alleviating the immediate scarcity at hand, making it a within-subject design at this penultimate stage. Therefore, we get five choices for each attribute, giving us ten decision points (5 for scarcity-relevant decisions and 5 for irrelevant).

2.3.5 The Common Consequence Ladders

The common consequence ladders method involves tracing the slope of the pwf by using common consequence effects. Using three-lottery menu $(x, p\,; y, q\,; z, r)$ with outcomes $(x > y > z)$ for gains, $(x < y < z)$ for losses and their associated probabilities p, q and r. The neutral outcome is established at z, days before the game begins. Continuing from Verschoor and D'Exelle (2020), I give an overview of the possibilities of the choice switches in the data. Then, I theorise the weight $w(p_i)$ for the corresponding probability (p_i) for both gains and losses. Next, I follow it up by detailing the implementation of the intervals in the design. Therefore, the method has two essential elements - coding the changes between rungs and inferring the probability weights for the two domains.

2.3.5.1 Choice Switches and the Common Consequence Ladders

My central hypothesis involves tracking the extent of the tunnelling effect on pwf with the level of scarcity and its mechanism through the cognitive load. The focus of analysis is, given the decision attribute, the proportion of subjects that choose the Risky (R) or Safe (S) lotteries for each of the five probability rungs. An individual can choose either R for the first rung, switch to S in the next or choose S then R. Alternatively, they could opt not to switch from R or S and continue to choose R/S

respectively in the next rung as well. Therefore, a total of 4 choice combinations (RR, SS, SR, RS) are possible between any two rungs with choices between R or S. In line with the standard practice for the analysis of the method (Verschoor and D'Exelle, 2020), I code the safe (S) and risky (R) prospects as 0 and 1. The four permutations can be coded as the difference between the switch rung n and n+1 (Table 2). If a subject chooses S in Rung n and R in Rung n+1, the choice switch, SR, would be coded as -1. Conversely, if the switch is from R to S, the switch code would be 1. As discussed, SS and RR switches indicate Expected Utility Theory "rational" consistent preferences, while SR and RS switches indicate non-EUT choices.

Table 2 Coding for choice switches in CCL (S = 0; R= 1)

	Rung n+1	
Rung n	S	R
S	SS (0)	SR (-1)
R	RS (1)	RR (0)

In the follow-up discussion, I derive the common consequence effects for gains and losses conditions for deducing the decision weights and slope of the pwf from them.

2.3.5.2 Common Consequence Effect in Gains

The value function of CPT for the three outcome prospects for gains can be written as –

$$V(f^+) = \pi_x^+ v(x) + \pi_y^+ v(y) + \pi_z^+ v(z) \qquad (6)$$

Expanding from the literature section, in line with Verschoor and D'Exelle (2020) –

$$\pi_x^+ = w^+(p) \qquad (7)$$

$$\pi_y^+ = w^+(p+q) - w^+(p) \qquad (8)$$

$$v(z) = 0 \qquad (9)$$

The value function from equation 1 can therefore be rewritten as –

$$v = w^+(p)v(x) + (w^+(p+q) - w^+(p))v(y) \qquad (10)$$

Now, a S (safe) - R (risky) lottery with probabilities $(p`, q`)$ and (p, q) respectively is differentiated by a higher probability of best outcome (x) and worst outcome (z). That is, $p > p'$ and $1 - p - q > 1 - p' - q'$. The next set of lottery pairs, S_ϵ & R_ϵ, can be created from the original S and R by shifting probability mass $\in$ from the worst (z) to intermediate outcome (y). S_ϵ and R_ϵ are given by $(p', q'+\in)$ and $(p, q+\in)$ respectively. As can be seen, each is connected to the other by an identical shift in probability mass or common consequence for safe and risky lotteries. These successive pairs are the common consequence ($\in$) ladders.

Table 3 Common Consequence Ladders (CCL) for Gains

Rung	Lottery – Safe or Risky	Order no.	Red (Small, z)	Green (Medium, y)	White (Large, x)
I	S_1	4a	9 (r`= 0.45)	11 (q`= 0.55)	0 (p` = 0)
	R_1	4b	13 (r =0.65)	0 (q = 0)	7 (p = 0.35)
II	S_2	3a	6 (r` = 0.3)	14 (q`= 0.7)	0 (p` = 0)
	R_2	3b	10 (r= 0.5)	3 (q = 0.15)	7 (p = 0.35)
III	S_3	2a	4 (r`=0.2)	16 (q` = 0.8)	0 (p` = 0)
	R_3	2b	8 (r = 0.4)	5 (q = 0.25)	7 (p = 0.35)
IV	S_4	5a	2 (r` = 0.1)	18 (q` = 0.9)	0 (p` = 0)
	R_4	5b	6 (r= 0.3)	7 (q = 0.35)	7 (p = 0.35)
V	S_5	1a	0 (r` = 0)	20 (q` = 1)	0 (p` = 0)
	R_5	1b	4 (r = 0.2)	9 (q = 0.45)	7 (p = 0.35)

In the domain of gains (Table 3), Rung 1 is the least attractive choice and the rungs after it follows in ascending order by expected value calculation. Participants face the relatively safe (S) and risky (R) lottery by changing the number of three-colour variations (Red, Green, and White) of balls for each. They choose one between the two for every rung. The comparisons between the choices at these rungs help us approximate the relative steepness of the pwf for that specific interval of probability mass. We compare $[p+q, p+q+\in]$ and $[p`+q`, p`+q`+\in]$ with $p`+q` > p+q$. That is, each pair of safe and risky (S_{i+1} and R_{i+1}) in the five-rung prospect list is generated from Rung 1 by shifting probability mass $\in$ from the smallest (z) Red, payoff = 4000 shillings) to the intermediate outcome (y), green, payoff = 5000 shillings).

2.3.5.3 Common Consequence Effect in Losses

Similarly, the value function of CPT for the three outcomes (x, y, z) prospects for losses can be written as –

$$V(f^-) = \pi_x^- v(x) + \pi_y^- v(y) + \pi_z^- v(z) \qquad (11)$$

Expanding from the literature section, in line with Verschoor and D'Exelle (2020) –

$$\pi_x^- = w^-(p) \qquad (12)$$

$$\pi_y^- = w^-(p+q) - w^-(p) \qquad (13)$$

$$v(z) = 0 \qquad (14)$$

The value function from equation 11 can therefore be rewritten as –

$$v = w^-(p)v(x) + (w^-(p+q) - w^-(p))v(y) \qquad (15)$$

The common consequence shift for losses involves moving probability mass from the worst (x) to the intermediate outcome (y) that changes the value of prospects different from that of gains, as the best (z) is now the neutral outcome.

A choice between safe S, (p', x, q', y) and risky lottery R $(p, x; q, y)$ where $p' < p$ and $1 - p' - q' < 1 - p - q$. That is, the probability (p) and (p') of the worst (x) and the best outcome (z) is lower in S than in R. By design, $q' > q$.

The fundamentals mirror the gains domain. As seen in Table 4, the S_{i+1} -R_{i+1} pairs in the choice list are generated from S-R by shifting probability mass, $\in$ from the worst outcome to the intermediate loss outcome. Therefore, given S (p', q') and R (p, q), S_{i+1} is characterised by $(p' - \in,\ q' + \in)$ and R_{i+1} by $(p - \in, q + \in)$.

Table 4 Common Consequence Ladders (CCL) for Losses

Rung	Lottery – Safe or Risky	Order no.	Red (Small, x)	Green (Medium, y)	White (Large, z)
I	S_1	2a	14(p`= 0.7)	6 (q`= 0.3)	0 (r`= 0)
	R_1	2b	16 (p = 0.8)	0 (q= 0)	4 (r= 0.2)
II	S_2	1a	13 (p`= 0.65)	7 (q`= 0.35)	0 (r`= 0)
	R_2	1b	15 (p = 0.75)	1 (q= 0.05)	4 (r= 0.2)
III	S_3	5a	10 (p`= 0.5)	10 (q`= 0.5)	0 (r`= 0)
	R_3	5b	12 (p=0.6)	4 (q= 0.2)	4 (r= 0.2)
IV	S_4	3a	4 (p`=0.2)	16 (q`=0.8)	0 (r`= 0)
	R_4	3b	6 (p = 0.3)	10 (q= 0.5)	4 (r= 0.2)
V	S_5	4a	1 (p`=0.05)	19 (q`= 0.95)	0 (r`= 0)
	R_5	4b	3 (p=0.15)	13 (q= 0.65)	4 (r= 0.2)

2.3.6 From Common consequence effect to Probability Weighting

Now that I have discussed the basic of the method, I layout the theoretical discussion of the common consequence ladders and its relation to the decision weights within the prospect theory framework and derivation of the slope of the pwf.

2.3.6.1 Deducing Probability Weights for Gains

A preference reversal that follows the common consequence shift will indicate the non-linear nature of probability weighting. For the probability mass $\in$, $\in > 0$, a change in the preference from safe in the first rung to risky in the subsequent one (SR) is the common consequence effect in action. This implies the change in the value of risky prospect being more than that of the safer lottery after the common consequence shift –

$$\Delta v = v_{\in} - v > \Delta v' = v'_{\in} - v' \qquad (16)$$

where,

$$v = w^{+}(p)v(x) + \big(w^{+}(p+q) - w^{+}(p)\big)v(y) \qquad (17)$$

Therefore, the curvature of the pwf can be inferred by comparing the changes in Δv and $\Delta v'$ between safe and risky lotteries after the probability mass shift of $\in$. The value of risky lottery R before the shift:

$$v = w^+(p)v(x) + (w^+(p+q) - w^+(p))v(y)$$
$$= w^+(p)v(x) - w^+(p)v(y) + w^+(p+q)v(y)$$
$$= w^+(p)[v(x) - v(y)] + w^+(p+q)v(y) \quad (18)$$

As a result of the common consequence shift, the increase in value of the risky lottery, R_ϵ in the next rung can be written as –

$$v_\in = w^+(p)v(x) + \left(w^+(p+q+\in) - w^+(p)\right)v(y)$$
$$= w^+(p)v(x) - w^+(p)v(y) + w^+(p+q+\in)v(y)$$
$$= w^+(p)[v(x) - v(y)] + w^+(p+q+\in)v(y) \quad (19)$$

Therefore, the change in the value function becomes –

$$\Delta v = v_\in - v$$
$$= w^+(p)[v(x) - v(y)] + w^+(p+q+\in)v(y) - [w^+(p)[v(x) - v(y)] + w^+(p+q)v(y)$$
$$= w^+(p+q+\in)v(y) - w^+(p+q)v(y)$$
$$= [w^+(p+q+\in) - w^+(p+q)]v(y) \quad (20)$$

Similarly, for safer lotteries -

$$\Delta v' = v'_\in - v'$$
$$= w^+(p'+q'+\in)v(y) - w^+(p'+q')v(y)$$
$$= [w^+(p'+q'+\in) - w^+(p'+q')]v(y) \quad (21)$$

Because the probability mass moved remains the same between the two, the independence axiom of EUT postulates that individuals should either always choose a safe prospect in each alternative or always choose the riskier one or remain indifferent.

An illustration of the violation of the theorem for rung 4 and 5 (Table 3) would imply – $R_4 \succ S_4$, and then $S_5 \succ R_5$ (an RS switch). This choice pattern violates the EUT. The choices switch for the same 0.1 shift in both S and R, changing the interval from [0.7, 0.9] to [0.8, 1]. Explaining this in terms of prospect theory and the red (R), green (G) and white balls (W) – For the same shift, if p_i is the decumulative probability that an outcome greater than or equal to x_i and q_i is the probability of outcome strictly greater than x_i , then –

$$V(L) = \sum_i [\pi(p_i) - \pi(q_i)]u(x_i)$$
$$R_4 \succ S_4$$
$$w(0.35)v(G) - w(0.35)v(W) > w(0.9)v(G) - 0 \text{ and} \quad (22)$$
$$S_5 \succ R_5$$

$$v(G) - 0 \; > w(0.45)v(G) - w(0.35)v(W) \qquad (23)$$

Adding (17) and (18)

$$1 - \; w(0.9) > w(0.45) - w(0.35)$$

2.3.6.2 From common consequence effect to probability weighting function slope for Gains

- For preference reversal $R \prec S$ to $R_\epsilon \succ S_\epsilon$. That is, SR-

$$\Delta v > \; \Delta v'$$

$$\Longrightarrow \; w^+(p+q+\in) - \; w^+(p+q) > \; w^+(\,p'+q'+\in) - \; w^+(p'+q') \qquad (24)$$

This inequality estimates the curvature of the pwf for specific domain intervals. If we have the interval $[\,p+q,\;(\,p'+q'+\in)]$, where $p+q < (\,p'+q'+\in)$ then-

- strict concavity of w^+ in this interval means the pwf is steeper for $[\,p+q,\;p+q+\in]$ (riskier) than for $[\,p'+q', p'+q'+\in]$ (safer) where the latter is to the right on the scale. This is a sufficient condition to uphold the inequality in (24).

- Similarly, for a preference reversal of the sort $R \succ S$ to $R_\epsilon \prec S_\epsilon$, the inequality –

$$\Longrightarrow \; w^+(p+q+\in) - \; w^+(p+q) < \; w^+(\,p'+q'+\in) - \; w^+(p'+q') \qquad (25)$$

would hold on account of $\Delta v < \Delta v'$. Thus, implying that the pwf is steeper in the interval $[\,p'+q', p'+q'+\in]$ than in $[\,p+q,\;p+q+\in]$.

For example, $\in = 0.15$ probability mass from the smallest payoff in S_1 and R_1 in Rung 1 is moved to the intermediate outcome in S_2 and R_2 to generate the subsequent rung - Rung 2 (Table 5). This makes $p` + q` = 0.7$ from $p` + q` = 0.55$ of either white or green selected for the safer option and $p + q = 0.5$ from $p + q = 0.35$ for the riskier one. Therefore, the common consequence shift of 0.15 to both S and R in Rung 2 increases the total probabilities to 0.7 and 0.50. A preference reversal on comparison within this probability interval [0.35, 0.5] and [0.55,0.70] gives the relative slope of the underlying pwf. Similarly, if we compare Rung 3 and 4, the steepness of pwf would be obtained in the interval [0.60, 0.70] and [0.8, 0.9], while comparisons for rung 4 and 5 would give the same in the interval [0.70, 0.8] and [0.9, 1]. In such a way, a total of 5*4/2 = 10 combinations can be formed across the five rungs (Table 5).

Table 5 Deducing Probability weights from the difference between rungs for Common consequence ladders (Gains)

Rung	∈	Interval	SR $\Delta \boldsymbol{v} > \Delta \boldsymbol{v}'$ (from 24)	PWF Inference	RS $\Delta \boldsymbol{v} < \Delta \boldsymbol{v}'$ (from (29))	PWF Inference
I-II	0.15	[0.35,0.70]	$w^+(0.5) - w^+(0.35) > w^+(0.7) - w^+(0.55)$	Steeper in [0.35,0.5] than [0.55,0.7]	$w^+(0.5) - w^+(0.35) < w^+(0.7) - w^+(0.55)$	Steeper in [0.55,0.7] than [0.35,0.5]
I-III	0.25	[0.35,0.80]	$w^+(0.6) - w^+(0.35) > w^+(0.8) - w^+(0.55)$	Steeper in [0.35,0.6] than [0.55,0.8]	$w^+(0.6) - w^+(0.35) < w^+(0.8) - w^+(0.55)$	Steeper in [0.55,0.8] than [0.35,0.6]
I-IV	0.35	[0.35,0.90]	$w^+(0.7) - w^+(0.35) > w^+(0.9) - w^+(0.55)$	Steeper in [0.35,0.7] than [0.55,0.9]	$w^+(0.7) - w^+(0.35) < w^+(0.9) - w^+(0.55)$	Steeper in [0.55,0.9] than [0.35,0.7]
I-V	0.45	[0.35,1]	$w^+(0.8) - w^+(0.35) > w^+(1) - w^+(0.55)$	Steeper in [0.35,0.8] than [0.55,1]	$w^+(0.8) - w^+(0.35) < w^+(1) - w^+(0.55)$	Steeper in [0.55,1] than [0.35,0.8]
II-III	0.1	[0.40,0.80]	$w^+(0.6) - w^+(0.5) > w^+(0.8) - w^+(0.7)$	Steeper in [0.5,0.6] than [0.7,0.8]	$w^+(0.6) - w^+(0.5) < w^+(0.8) - w^+(0.7)$	Steeper in [0.7,0.8] than [0.5,0.6]
II-IV	0.2	[0.40,0.90]	$w^+(0.7) - w^+(0.5) > w^+(0.9) - w^+(0.7)$	Steeper in [0.5,0.7] than [0.7,0.9]	$w^+(0.7) - w^+(0.5) < w^+(0.9) - w^+(0.7)$	Steeper in [0.7,0.9] than [0.5,0.7]
II-V	0.3	[0.40,1]	$w^+(0.8) - w^+(0.5) > w^+(1) - w^+(0.7)$	Steeper in [0.5,0.8] than [0.7,1]	$w^+(0.8) - w^+(0.5) < w^+(1) - w^+(0.7)$	Steeper in [0.7,1] than [0.5,0.8]
III-IV	0.1	[0.60,0.90]	$w^+(0.7) - w^+(0.6) > w^+(0.9) - w^+(0.8)$	Steeper in [0.6,0.7] than [0.8,0.9]	$w^+(0.7) - w^+(0.6) < w^+(0.9) - w^+(0.8)$	Steeper in [0.8,0.9] than [0.6,0.7]
III-V	0.2	[0.60,1]	$w^+(0.8) - w^+(0.6) > w^+(1) - w^+(0.8)$	Steeper in [0.6,0.8] than [0.8,1]	$w^+(0.8) - w^+(0.6) < w^+(1) - w^+(0.8)$	Steeper in [0.8,1] than [0.6,0.8]
IV-V	0.1	[0.70,1]	$w^+(0.8) - w^+(0.7) > w^+(1) - w^+(0.9)$	Steeper in [0.7,0.8] than [0.9,1]	$w^+(0.8) - w^+(0.7) < w^+(1) - w^+(0.9)$	Steeper in [0.9,1] than [0.7,0.8]

The probability weight inequalities (24) and (25) give an estimate to track the pwf in specific paired intervals. Out of the four possible S & R combinations in all the ten paired comparisons, the two of interest to estimate the nonlinearity of the pwf are – SR and RS. Their statistical significance indicates the slope in the respective intervals. The difference in weights gives the change in slopes for the safe and risky lotteries before and after the shift (∈).

As can be seen in Table 5, using paired problems in this manner, I test whether the probability weighting function is steeper for weights for the interval $[S, S_\epsilon]$ versus $[R, R_\epsilon]$. E.g., comparing rung 1 and 2, we test if the probability weighting function is steeper for [0.35,0.5] or [0.55,0.7]. The converse holds for an R to S switch. Similarly, for rungs 4 and 5, a statistical significance of SR or RS would determine the slope in the intervals [0.7, 0.8] and [0.9, 1]. Given the practical limitations, we track the pwf for gains in the ten combinations for the domain [0.35, 1].

2.3.6.3 Deducing Probability Decision weights for losses

An analogous corollary can thus be set up for losses. The safe-risky lottery pairs are presented again in the order of increasing expected values (Table 4). For losses, we compare the S, R pairs between rungs to get an idea of the slope of pwf within that interval [$p` - \epsilon$, $q' + \epsilon$] and [$p - \epsilon$, $q + \epsilon$].

A preference reversal $R \prec S$ to $R_\epsilon \succ S_\epsilon$ after the shift ϵ where $\epsilon > 0$ would again imply

$$\Delta v = v_\in - v > \Delta v' = v'_\in - v'$$

The value of risky lottery R before the shift –

$$\begin{aligned} v &= w^-(p)v(x) + (w^-(p+q) - w^-(p))v(y) \\ &= w^-(p)v(x) - w^-(p)v(y) + \left(w^-(p+q)\right)v(y) \\ &= w^-(p)\,[v(x) - v(y)] + w^-(p+q)v(y) \end{aligned} \quad (26)$$

As a result of the common consequence shift, the increase in value of the risky lottery, R_ϵ in the next rung can be written as –

$$\begin{aligned} v_\in &= w^-(p-\epsilon)v(x) + (w^-(p-\epsilon+q+\epsilon) - w^-(p-\epsilon))v(y) \\ &= w^-(p-\epsilon)v(x) - w^-(p-\epsilon)v(y) + \left(w^-(p+q)\right)v(y) \\ &= w^-(p-\epsilon)\,[v(x) - v(y)] + w^-(p+q)v(y) \end{aligned} \quad (27)$$

Therefore, the change in the value function becomes -

$$\begin{aligned} \Delta v &= v_\in - v \\ &= w^-(p-\epsilon)\,[v(x) - v(y)] + w^-(p+q)v(y) - w^-(p)\,[v(x) - v(y)] - w^-(p+q)v(y) \\ &= w^-(p-\epsilon)[\,v(x) - v(y)] - w^-(p)\,[v(x) - v(y)] \\ &= [w^-(p-\epsilon) - w^-(p)](\,v(x) - v(y)) \end{aligned} \quad (28)$$

Where, $v(x) < v(y)$ and $w^-(p-\epsilon) < w^-(p)$.

Similarly, for safer lotteries S and S_ϵ –

$$\begin{aligned} \Delta v' &= v'_\in - v' \\ &= w^-(p'-\in)v(x) - w^-(p')v(y) \\ &= [w^-(p'-\in) - w^-(p')](v(x) - v(y) \end{aligned} \quad (29)$$

This implies, for prospect S_1 and R_1, p` = 0.7 and p =0.8 (Table 4). If we shift a probability mass of $\epsilon = 0.05$ from the pairs in both rung 1 and 2, then for $S_2$ and $R_2$, p` - ϵ = 0.65 and p- ϵ= 0.75.

2.3.6.4 Inferring the Probability Weighting Slope for losses

Therefore, the curvature of the pwf can be inferred by comparing the changes in Δv and $\Delta v'$ between safe and risky lotteries after the probability mass shift of $\in$.

- For preference reversal $R \prec S$ to $R_\epsilon \succ S_\epsilon$ -

$$\Delta v > \Delta v'$$
$$\Rightarrow [w^-(p - \epsilon) - w^-(p)](v(x) - v(y)) > [w^-(p'-\in) - w^-(p')](v(x) - v(y)) \quad (30)$$

In the domain of losses, (x), (y) and (z) are the worst, intermediate and best outcomes, respectively. This would imply that the value function of the worst (x) is less than the intermediate (y) prospect. Therefore -

$$v(x) - v(y) < 0 \quad (31)$$

Using Equation (31) in (31) reverses the inequality –

$$\Rightarrow [w^-(p - \epsilon) - w^-(p)] < [w^-(p'-\in) - w^-(p')] \quad (32)$$

Since, $\epsilon > 0$, $w^-(p - \epsilon) < w^-(p)$ and $w^-(p'-\in) < w^-(p')$, therefore equation (32) can be rewritten as –

$$\Rightarrow [w^-(p) - w^-(p - \epsilon)] > [w^-(p') - w^-(p'-\in)] \quad (33)$$

Thus implying, the pwf for losses is steeper in the interval $[(p - \epsilon), p]$ than in $[(p'-\in), p']$.

- Given $p' < p$ in $[(p'-\in), p]$ the convexity of w^- is sufficiently ensured for equation (33).

- Similarly, for a preference reversal RS, i.e., from $R \succ S$ to $R_\epsilon \prec S_\epsilon$, the inequality -

$$\Rightarrow [w^-(p) - w^-(p - \epsilon)] < [w^-(p') - w^-(p'-\in)] \quad (34)$$

would hold as $\Delta v < \Delta v'$. Thus, implying that the pwf is steeper in the interval $[p' - \epsilon, p']$ than in $[p - \epsilon, p]$. An R-S or S-R switch (

Table **6**) gives us the slope of the pwf between the intervals [0.65, 0.7] and [0.75, 0.8] between the first two rungs. Similarly, if we compare Rung 3 and 4, the relative steepness would be given by choices in the interval [0.2, 0.5] and [0.3, 0.6]. Such pairwise comparisons between intervals allow us to track the pwf for losses for the domain [0.05, 0.3]. As before, we get a total of 5*4/2 = 10 comparisons.

As in

Table **6**, I test whether the pwf is steeper for weights for the interval $[S_\epsilon, S]$ versus $[R_\epsilon, R]$. E.g., comparing rung 3 and 2, we test if the pwf is steeper for [0.5, 0.65] or for [0.6, 0.75]. A switch from S to R (SR) would mean the function is relatively steeper for the former interval than the latter. The converse holds for an R to S switch. Similarly, for rungs 3 and 4, a statistical significance of SR or RS would determine the slope in the intervals [0.3, 0.6] and [0.2, 0.5]. In this way, given the practical limitations, we track the pwf for gains in the ten combinations for the domain [0.05, 0.8].

Table 6 Deducing Probability weights from the difference between rungs for Common consequence ladders (Losses)

Rung	∈	Interval	SR $\Delta \boldsymbol{v} > \Delta \boldsymbol{v}'$ (from 35)	PWF Inference	RS $\Delta \boldsymbol{v} < \Delta \boldsymbol{v}'$ (from 36)	PWF Inference
I-II	0.05	[0.65,0.80]	$w^-(0.75) - w^-(0.8) > w^-(0.65) - w^-(0.7)$	Steeper in [0.75,0.8] than [0.65,0.7]	$w^-(0.75) - w^-(0.8) < w^-(0.65) - w^-(0.7)$	Steeper in [0.65,0.7] than [0.75,0.8]
I-III	0.25	[0.50,0.80]	$w^-(0.6) - w^-(0.8) > w^-(0.5) - w^-(0.7)$	Steeper in [0.6,0.8] than [0.5,0.7]	$w^-(0.6) - w^-(0.8) < w^-(0.5) - w^-(0.7)$	Steeper in [0.5,0.7] than [0.6,0.8]
I-IV	0.50	[0.20,0.80]	$w^-(0.3) - w^-(0.8) > w^-(0.2) - w^-(0.7)$	Steeper in [0.3,0.8] than [0.2,0.7]	$w^-(0.3) - w^-(0.8) < w^-(0.2) - w^-(0.7)$	Steeper in [0.2,0.7] than [0.3,0.8]
I-V	0.65	[0.05,0.80]	$w^-(0.15) - w^-(0.8) > w^-(0.05) - w^-(0.7)$	Steeper in [0.15,0.8] than [0.05,0.7]	$w^-(0.15) - w^-(0.8) < w^-(0.05) - w^-(0.7)$	Steeper in [0.05,0.7] than [0.15,0.8]
II-III	0.15	[0.50,0.75]	$w^-(0.5) - w^-(0.65) > w^-(0.6) - w^-(0.75)$	Steeper in [0.5,0.65] than [0.6,0.75]	$w^-(0.5) - w^-(0.65) < w^-(0.6) - w^-(0.75)$	Steeper in [0.6,0.75] than [0.5,0.65]
II-IV	0.45	[0.20,0.75]	$w^-(0.3) - w^-(0.75) > w^-(0.2) - w^-(0.65)$	Steeper in [0.3,0.75] than [0.2,0.65]	$w^-(0.3) - w^-(0.75) < w^-(0.2) - w^-(0.65)$	Steeper in [0.2,0.65] than [0.3,0.75]
II-V	0.60	[0.05,0.75]	$w^-(0.15) - w^-(0.75) > w^-(0.05) - w^-(0.65)$	Steeper in [0.15,0.75] than [0.05,0.65]	$w^-(0.15) - w^-(0.75) < w^-(0.05) - w^-(0.65)$	Steeper in [0.7,1] than [0.5,0.8]
III-IV	0.30	[0.20,0.60]	$w^-(0.3) - w^-(0.6) > w^-(0.2) - w^-(0.5)$	Steeper in [0.3,0.6] than [0.2,0.5]	$w^-(0.3) - w^-(0.6) < w^-(0.2) - w^-(0.5)$	Steeper in [0.2,0.5] than [0.3,0.6]
III-V	0.45	[0.05,0.6]	$w^-(0.15) - w^-(0.6) > w^-(0.05) - w^-(0.5)$	Steeper in [0.15,0.6] than [0.05,0.5]	$w^-(0.15) - w^-(0.6) < w^-(0.05) - w^-(0.5)$	Steeper in [0.05,0.5] than [0.15,0.6]
IV-V	0.15	[0.05,0.3]	$w^-(0.15) - w^-(0.3) > w^-(0.05) - w^-(0.2)$	Steeper in [0.15,0.3] than [0.05,0.2]	$w^-(0.15) - w^-(0.3) < w^-(0.05) - w^-(0.2)$	Steeper in [0.05,0.2] than [0.15,0.3]

2.3.7 Decision-Attribute Based Common Consequence Ladders

Tunnelling operates at an agent-specific level. The relevance of attributes and their congruency with Top-Down goals can affect each subject differently. Thus, making the hypothesised splitting because of attentional capture by relevant attributes is a within-subject phenomenon. To capture this, each subject faces the common consequence ladders list for two attributes – one relevant for scarcity and the other irrelevant. The prospect lists are identical in all aspects but the decision attribute. Keeping payoffs the same, I design for relevance by changing the payoff use case. The scarcity-relevant decision is paid off on the day of the experimental session, and the irrelevant is paid 6 months after the session. Subjects in each scarcity treatment group get identical five common consequence ladders pairs twice, only differing in payoff-use case – for the same period (Decision Card Y) and six months hence (Decision Card Z).

Table 7 Designing for Scarcity Relevance

Scarcity Treatment Group	Period of decision making	Payoff Period	
	Lean – Period 1 Plenty – Period 2	Relevant (Card Y)	Irrelevant (Card Z)

(Lean, Primed)	Period 1	Period 1	Period 2
(Lean, Control)	Period 1	Period 1	Period 2
(Plenty, Primed)	Period 2	Period 2	Period 1
(Plenty, Control)	Period 2	Period 2	Period 1

A participant primed in the lean season, facing Decision Card Y, would use the payoff to alleviate the Scarcity at hand in the same period (Period 1 – lean). Thus, the payoffs from decisions made here can be used to resolve however much scarcity they feel at that point, making them Scarcity relevant (Region a, Quadrant 1, see Figure 8). When paid off 6 months from the lean season, i.e., in the plenty season (Period 2), the same payoffs would not help address the current shortfall. These decisions would become Scarcity irrelevant (Card Z). Theoretically, these would fall outside the Scarcity induced decision tunnel (Region b, Quadrant 2, see Figure 8). The corollary holds for the second part. The order gets reversed for a participant in the plenty season (Period 2). Outcomes from Card Y would be paid off in that period, and those from Card Z in Period 1.

Additionally, Dohmen (2012) have looked at overlapping, shifting, and overlapping-shifted design for measuring discount rates across various time horizons. They compare payoff delays for three periods - 0 & 6 month, 0 & 12 months and 6 – 12 months. This interchangeability sidesteps potential conflation with time preferences. People were found to be more impatient for 0- 6 months than 0-12 months but similarly impatient for 6 for 12 months compared to 0 to 6 months. Therefore, the lean- plenty-lean cycle of 0-6 and 6-12 months in payments would have similar time discounting rates.

Therefore, given the scarcity treatment group, each subject makes two rounds of Common Consequence Ladders decisions, one for scarcity relevance (Decision Card Y) and another for irrelevance (Card Z). Differences in choices that violate the independence axiom for each treatment help understand the underlying shape of the pwf. The frequency of choice switches between the rungs indicates decision weighting and hence, the slope of attribute-based- probability weighting function. As all other heterogeneous variables are controlled for, the difference between such choices would result from attributes alone. This intervention, therefore, gives us a within-subject measure of the extent of tunnelling. The comparisons indicate the degree of realignment, thus testing the primary set of hypotheses for the two domains.

2.3.8 Measuring Outcomes

In this section, I detail the outcomes from the three experiment stages and how they are used in the subsequent analysis. Before getting into the fieldwork implementation, I discuss each component's outcomes. I review each design data collection instrument of the experiment and continue to discuss the post-experiment survey briefly.

2.3.8.1 The Treatment: Scarcity

In conjunction with expected natural scarcity, the three-question priming for unexpected scarcity taps into the characteristics of the force itself. Two of the three questions are accompanied by 5-point Likert scale responses for this scarcity shock-primed group. The participants are asked to rate the difficulty and worries if faced with the given hypothetical situation. The second question asked them to report the first three thoughts in a scenario of a treatable medical ailment. This question is intended to capture the pervasiveness of thoughts related to finances even when no explicit mention is made.

Additionally, I look for differences in the frequency of problem-related thoughts by treatment. In line with theory, those facing a higher level of scarcity should have more monetary thoughts when faced with a problem that does not preclude to finances and be more focussed on resolving the problem. With the given responses, I recoded the three reported thoughts into monetary and non-monetary categories (A. Shah et al., 2018). All the responses that referred to anything related to finances ("money", "cost", "pay", "buying") are coded as 1. In contrast, all those related to the problem at hand ("medicine", "disease", "treatment") are coded as ailment specific. I expect participants facing higher scarcity to have more finance-related thoughts and thus report more money-related words. I also hypothesise that those struggling with scarcity focus even more on the majaor problem at hand. Comparing the three questions, I get the between-subject differences for the 4 scarcity groups, I show that thoughts about scarcity are easily triggered, arise unprompted and are persistent, respectively.

2.3.8.2 Measuring the Cognitive load

All participants, irrespective of the scarcity treatment group, do the cognitive load test. The tests follow up directly after the readouts and are uniform for all participants, allowing for meaningful comparisons between scarcity treatments. The two questions are introduced in the same order in all treatments. First is the numerical Stroop test that measures inhibitory control and attention. I use an untimed version to avoid conflation with time pressure effects and only to get a true effect between the randomised scarcity treatments. The outcome of interest for the test is the difference in the number of mistakes between the incongruent (counting the number of digits) and congruent condition (counting the number of triangles). While I note the time taken to complete both levels of the task, the measure is not my variable of interest as the experimental instructions made it clear to the participants that the test would be scored on accuracy and not the time taken to complete it.

The second part of the test has the forward and reverse digit span tasks. The participant must repeat back the increasing sequence of random numbers in the exact (forward) and the inverse (reverse) order. The test is scored on the longest sequence the subject can correctly repeat. It is intended to

measure short-term (forward) and working memory (reverse). I recorded the longest span of digits repeated back accurately, which became the outcome variable from this test (accuracy score).

2.3.8.3 The Effect: Decision- Attribute Dependent Common Consequence Ladders

Finally, the participants get to the common consequence ladders (ccl). As discussed in the previous section, they do the 5 choice ccl twice – once for scarcity relevant (payoff to be paid today) and the irrelevant attribute (payoff is paid 6 months from the date of the session). By its setup, the method is non-parametric in nature and does not rely on any functional or certainty equivalent assumptions for probability weight elicitation. In its standard form, the task involves choosing between pairs of safe (S) and risky (R) prospects for each rung. Suppose the participant is a "rational" decision-maker and does not violate the Expected Utility Theory assumptions. In that case, if they pick S or R in the first rung, they should also continue S or R in follow-up rungs. Contrastingly, suppose the shifts in probability mass between subsequent rungs alter choices to R or S, respectively. In that case, the decision maker can be said to exhibit a non-Expected Utility Theory "biased" probability weighting function. The frequency weights of the SR, RS choice switches give the level of slope of the probability weighting function. As I have discussed in detail, the 4 permutations of switches can be coded as the difference of S (0) and R (1). Therefore, SS , RR, SR, and RS are coded as 0, 0, -1 and 1.

Each subject makes 5 choices for relevance and irrelevance, thereby giving a total of 10 decision points. Given the attribute, I test for probability weighting by comparing consecutive paired rungs. Between them, the focus of analysis is the difference in the total number of SR RS switches versus SS RR switches for the two attributes. To check the level of Expected Utility Theory consistency for each attribute, I use the total number of SR, RS switches and use regression analysis to track the probability weighting functions.

2.3.9 Post Experiment Survey

I finish the experimental session with a short post-experiment survey with three core modules – respondent characteristics, risk preferences in different domains and psychological well-being (Haushofer, 2019). After completing the decision-making tasks, the participant's essential demographic characteristics like gender, age, level of education, land holding, household head and marital status are noted.

The participant then answers four questions taken from the German Socio-Economic Panel (SOEP) (Giesselmann et al., 2019). The multi-dimensional, socioeconomic national survey has a history of over 35 years. The survey rounds collect data on institutional, life satisfaction, domain-specific risk, fairness,

and other social variables. Of all the modules of the extensive survey, I use the risk questions across four domains – general, finances, leisure time and health. The participants rate their willingness to take risk in each domain on a scale of 0 to 10, with 0 being completely unwilling and 10 very willing to take risks.

Finally, I take forward Haushofer's (2019) survey on psychological poverty loops and wellbeing in Kenya and include elements of the life satisfaction version of the World Values Survey, Perceived Stress Scale (Cohen et al., 1983) and the CES-D self-reported scale of depression (Radloff, 1977). After repeated discussions and iterations with the field team, the modules were cut down to include the most regionally relevant and informative questions. Given the paucity of time, regional sensibilities and keeping the entire experimental session under manageable hours, I do not include the entire survey from Haushofer (2019).

After surveying both the scarcity treatment and control groups in the two seasons, I sum the responses from each module into a total score. I reverse-coded all responses to a uniform scale such that higher total scores correspond to higher worries and stress. Then, I standardised (z-scored) the total summed scores. These subjective well-being measures are combined into a single psychological index by calculating the standard weighted average. Every question from the 5 components is indexed for each respondent following Anderson's (2008) inverse covariance matrix method (swindex). The summary index uses the generalised least squares weighting procedure (GLS). Within the method, first, highly correlated variables are weighted down. Other variables that are less correlated and hence contribute more information get more weight. The generated index is then standardised. I use this index as an indicator for the overall marker for psychological wellbeing for the complete scarcity cycle.

Next, I describe the field and experimental procedures. I begin with detailing the pre-experiment pilot study, lessons learnt from it and the lab-in-field implementation. I explain the working and operationalising of the common consequence ladders in a field setting. Additionally, I discuss setting up neutral outcome before the experiment, session-setup, and payoff resolutions. I end the section with an overview of the complete experimental design.

2.3.10 On the Field: Experimental Procedures, Timeline, and Implementation

This section describes the experiment's timeline, procedures, and on-field implantation. I begin the section by detailing the experimental design, the pre-experiment pilot, revisions after the pilot, timelines, and the actual implementation of the fieldwork.

The experiment investigates the theoretical effects of cognitive load and tunnelling of scarcity on the probability weighting function (pwf). Decision-makers can face two types of scarcities – expected, cyclical downturns and unexpected shocks. For the former, because the decision makers know the shortfall cycle, they are more likely to be more prepared for it. While for the latter, as the name suggests, it can be a temporary shock to their finances. Therefore, by their very nature, they can impose different cognitive effects on the person; hence, preferences may also likely differ. I design for the two types of scarcity by placing my experiment within the harvest cycle of an agrarian region in the rural Bwikhonge district of Uganda.

In consultation and with the help of Field Lab in Uganda, I first conducted focus group studies in 2019 to get an estimate of the months of harvest cycle in the region and the participants' feelings as the deal with annual cycles of lean and plenty[4]. From these studies, it was appraised that the period where the region was most pressed for finances was around April (lean), while November was generally a period of plenty. I planned my experiments to be around these two periods of natural scarcity. I introduced three hypothetical scenarios for each of these scarcity periods that did not directly mention finances or money. The idea was predicated on Shah et al.'s (2018) finding that there need not be an explicit mention of money for scarcity to exert its force. If a participant faces financial difficulties or scarcity, even a problem that is not monetary will trigger thoughts about it. After extensive discussions with the team in Uganda and my supervisors, I devised three realistic scenarios for the primed group that was not too distressing for the prospective subjects. Once these were finalised, I designed three benign scenarios for the control group to balance the read word count. The scripts can be found in the appendix.

The next task in the design stage was the cognitive load test. The pilot draft of the test included the numerical Stroop test for inhibitory control and the Ravens' progressive matrices test for cognitive flexibility. The latter was part of studies done in India and the USA on the cognitive effects of scarcity by Mani et al. (2013). However, my experiences with the pilot were very different. The participants struggled with the difficulty level, the research team explaining the task and the entire session overran on time. I had to go back to the drawing board to reassess the cognitive tools to be used in line with my research aim. After some discussions with my supervisors, we decided it made more sense to test core cognitive components and not cognitive abilities per se. We assessed that the scarcity mechanism depends more on cognitive load and not on abilities. Abilities can moderate cognitive load, but it is more about temporal tax on primary cognitive components, which may not be reflected in tests on cognitive abilities. Therefore, we moved to include the digit span tests for working memory. Both the

[4] Detailed report on the focus group discussions and findings is attached in the appendix.

Stroop and Digit Span tests were field-friendly in terms of implementation, easy to understand and not dependent on the literacy levels of the participants.

The last stage of the experiment was the decision task. Scarcity's two effects are cognitive load and decision attribute-based tunnelling. Having designed for the first, I move to the second one. As a baseline, I use the five-rung common consequence ladders(ccl) for gains and losses and then design for scarcity relevance and irrelevance by asking the same participant to choose if the payoff is paid today (relevant) and 5 months from the date of the session (irrelevant). The same individual makes two decisions in succession, making the design within subject at this level. Therefore, the complete design (Figure 14) combines random assignment between subject elements and within-subject decision-making.

Finally, some other essential aspects of conducting experiments, like establishing the neutral outcome, payoff resolution, and logistical issues, need to be discussed before getting into the details of the session on the actual day. Three weeks before the scheduled session, the research associates from the Field Lab distributed the undersigned vouchers of 4000 shillings to the participants with their names, address, and photo. Giving the vouchers well in advance is necessary to avoid house money effect and instil a sense of ownership and entitlement for the money. The participants were asked to carry the voucher with them on the day of the experiment. During the day of the experiment, the team asked if they remembered to do so. This is a standard operating procedure in experiments, especially when decision-making for losses need to be studied. For those in the losses domain, if there were any negative earnings, we subtracted the amount from the 4000 shilling voucher amount. Additionally, at the end of the session, we gave a show-up fee of 4000 shillings atop the payoff to avoid disappointment. We used the random lottery incentive system to calculate final payoffs. Within the method, one decision of all the decisions is picked randomly to be paid off. All subjects are informed of the resolution method before they begin the experiment.

The experiment used two coordinators and associate teams from the Field Lab. The team is experienced with conducting the common consequence ladder games. While they have done these experiments before, we organised week-long training and refresher training sessions before each season. With their help, we translated the scripts to the local language, Lugisu and back-translated them to English to ensure consistency. The experimenter delivered the instructions in partial isolation in person at the community centre or the local church hall. The experiments were conducted per the covid guidelines, and waiting times were reduced by scheduling staggered sessions throughout the day.

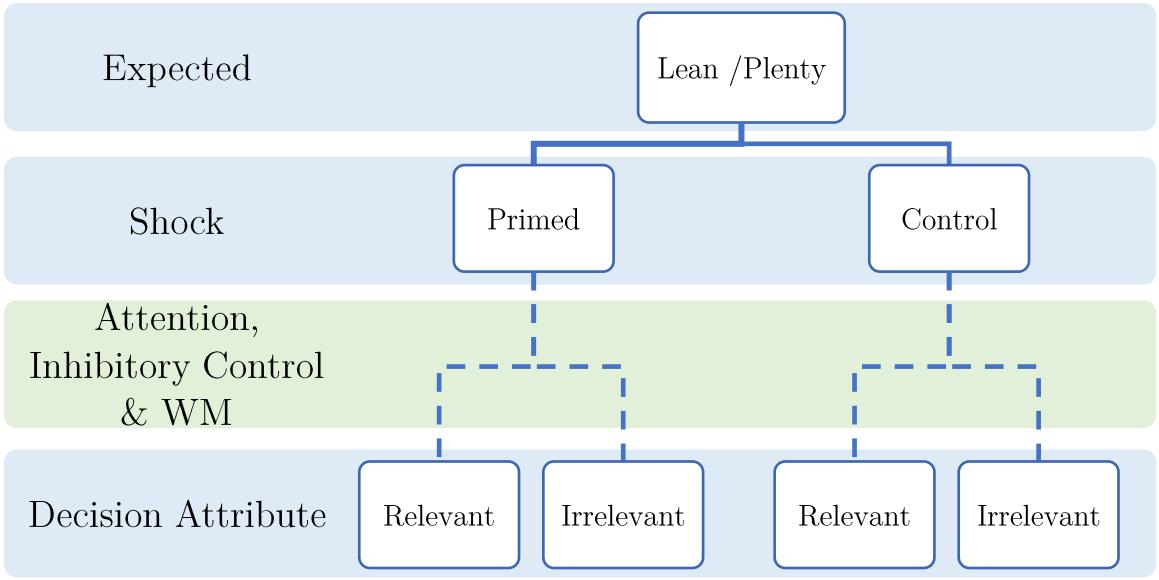


Figure 14 The experimental setup

The experimenter noted all the treatment responses and did not intervene or assist in any part of the decision-making exercise unless the participant requested clarification. Tables were laid out in the experiment hall, and the participants were guided through each as the session progressed. 20 coloured counters represent each lottery in the common consequence ladders on a separate table with two decision cards. For example, the safe lottery (Lottery 4a) in Rung 1, had 9 red and 11 green balls in a purple bag, while the risky lottery (4b) had 13 red and 7 white balls in a blue bag (Figure 15). The lottery number was marked clearly on each table. To check for understanding before the actual decision-making activity began, we asked a control question and gave a sample common consequence ladders exercise (See experimental instructions in appendix). Most instructions were clear to understand, and the total time for each participant was about one hour, where Tasks 1 and 2 took about half an hour.

We conduct our experiment in two phases of the harvest cycle of Bwikhonge. Given that this is part of a PhD project, the work is bound by the available funds and time. Therefore, I limit the total sample size to about 300 for both seasons. The treatments are delivered in chronological order to all participants in their randomly assigned groups. I did not see significant non-compliance to the four states' interventions for each season. In all, it takes a fortnight to complete data collection and reporting for each season.

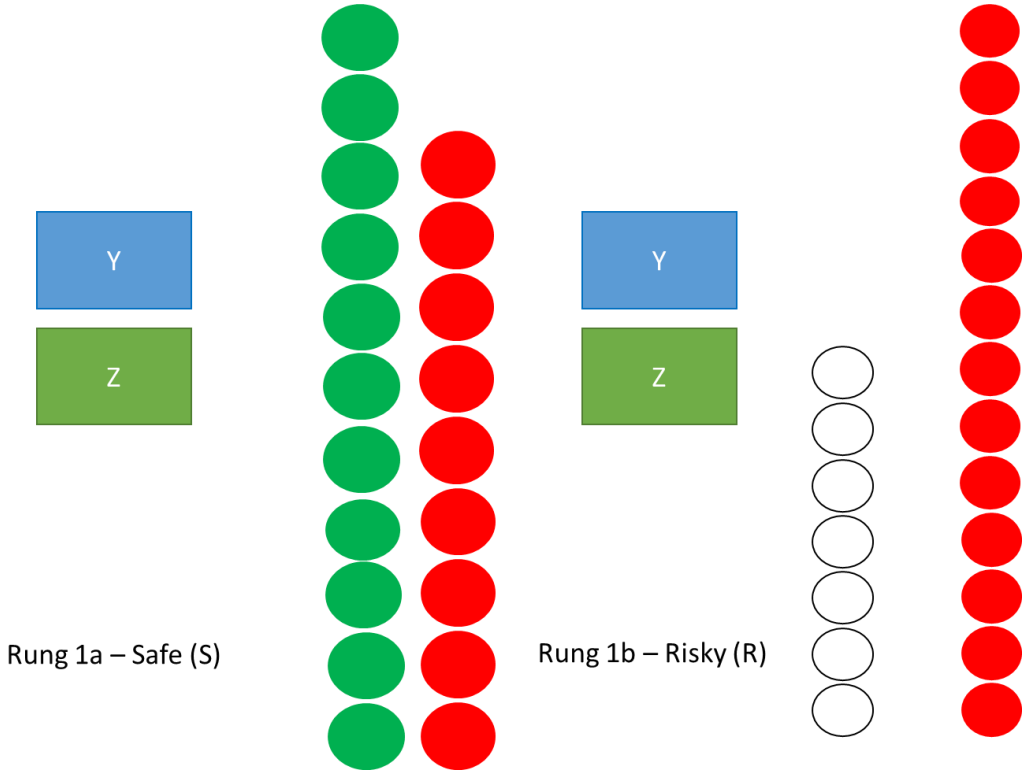


Figure 15 Sample Common Consequence Ladders for Scarcity Relevant (Card Y) and Irrelevant (Card Z) attribute.
Note: Shown here, Rung 1 (Lottery 4a, b) for gains. Green counters (worth 5000 shillings), Red (worth 4000 shillings) and white (worth 6500 shillings).

2.4 Results and Analysis

In this section, I present my main results. I begin with the summary statistics of the sample and continue into the analysis of the scarcity priming effects between the treatment and control groups. Next, I compare the cognitive load scores to assess if the treatment impacted the measures. Following this, I describe the common consequence effects for gains and losses for the different scarcity treatment groups for both scarcity-relevant and irrelevant attributes. Finally, after controlling for the correlates, I present the multivariate analysis investigating the differential tunnelling effects on the probability weighting function.

2.4.1 Sample Characteristics and Descriptive Analysis

First, I describe my sample observables and balancing tests between the different treatment conditions for gains and losses. Table 9 presents summary statistics and statistical balance tests for the experiment. The total combined sample of 679 people across all treatments can be broken down by the season, priming treatment for each season and the domain. The lean season had 347 people, of which 181 were randomly assigned to the scarcity priming treatment, and 166 were in the control

group. Within each season*shock assignment, game domains were randomly allocated into gains (94, 84) and losses (87, 82). Similarly, 332 participants were randomly allocated for the plenty season to receive the priming treatment or control scenarios (178 and 154, respectively), within which the two domains were randomised.

Overall, the sample is balanced in terms of gender, age, and mostly has primary educated people with small landholdings with a mean of 2.86 acres. As can be seen by the t-statistic and p-values in Table 9, the participant pool does not exhibit the statistical difference between treatment groups for most observables. However, variables like marital status, control question, and psychological index show statistical differences. The significance of marital status between gains and losses for primed groups in both seasons is due to chance, as the random assignment was carried out rigorously by the Field Lab team. The statistical significance of land holdings between the domains for the primed group in the lean season also can be explained to chance.

Additionally, as my primary research aim is not comparing between domains, once I carry out balance tests between seasons for primed and control groups keeping domains constant, the significance vanishes (p = 0.76). The self-reported psychological index also shows similar patterns. While significant between gains and losses for the primed group in the lean season, it is not when compared across seasons and treatments for the respective domains (p = 0.62).

A notable variable of interest is game comprehension. To test if the participant understood the common consequence ladders, the experimenter asked a dummy question about the subject's choice before beginning the actual game. The correct response to this control question was coded as 1 and used to indicate the subject's understanding of the game. Almost 86% of the respondents answered it correctly, with higher levels for gains domain for all treatments. Although game comprehension is statistically significant between gains and losses for the primed group in the plenty season, the regression of condition assignment on the null of all variables jointly being zero cannot be rejected (χ^2= 5.03, p = 0.6561). This suggests that the coincidental significance is not a major concern.

2.4.2 Scarcity Treatment: Effects of Priming

The participants in the experiment could have been in one of the two phases in the seasonal scarcity cycle. As discussed in the methods section, for the priming treatment group in each season, I introduce three difficult hypothetical scenarios that do not have any direct monetary terms and the subjects are requested to either rate the level of difficulties or the first three thoughts on their mind if they faced

those situations. The control group got equi-wordcount scenarios to control for any noise in the follow-up cognitive load test. Table 8 presents results from the priming treatment for both seasons.

Table 8 Summary of Unexpected Scarcity Treatment

Variable	Mean (standard deviation)		
	Plenty (n = 178)	Lean (n = 181)	t-statistic (p-value)
Level of Concern	4.044 (0.07)	4 (0.08)	0.38 (0.69)
Money-related thoughts	1.297 (0.07)	1.455 (0.05)	-1.96* (0.02)
Treatment-related thoughts	0.196 (0.03)	0.618 (0.04)	-7.45*** (0.00)
Concern for future	3.443 (0.10)	3.187 (0.09)	1.813* (0.03)

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The first question asked respondents about their level of concern about an unexpected financial scarcity on a 5-point scale. On average, the 178 people reported a 4.04 and 4 in the plenty and lean season with a standard deviation of 0.07 and 0.08, respectively. As can be seen in Table 8, the between-subject difference t-test is not statistically significant between the two seasons.

More interestingly, the second question required writing the first three thoughts in case of shock. The thoughts were intended to investigate whether scarcity was pervasive and came up unprompted in decision-makers minds. Figure 16 shows a frequency word cloud of the responses for the two seasons. The size of the word is proportional to the number of times it appears. We can see that money (240), medicine (170) and buying (102) top the list of voiced thoughts. Thus, for both seasons, the first three thoughts in a situation of treatable disease revolve around financial concerns.

All the reported concerns were categorised according to the types of worry - monetary or non-monetary. Of the three, I see 1.29 or at least one of three words alluded to financial concerns in the plenty season. In line with the hypothesis, there was an increase in the lean season (1.45). The difference between plenty and lean was significant at the 5% level. Within the scarcity theory, I expect the scenario also to trigger thoughts relevant to the problem at hand (treatable ailment) to be higher in the lean than in the plenty season. Between-subject t-tests confirm the hypothesis.

Finally, the third question asked about the nature and level of worry about upcoming expenditures in the next six months. By design and the cyclical nature of seasonal scarcity, participants in the plenty season foresee expenditures accrued in the next six months as falling in the lean season.

Conversely, subjects in the lean season at the time of the experiment knew the expenditure concerns asked for the next six months would fall in the harvest season – a period of plenty. Therefore, I expect and see the level of concern for the next six months to be significantly higher in the plenty season than

in the lean season. Regarding nature, Figure 17 shows a word cloud of the upcoming expenditures. Most of the concerns revolve around agriculture and allied activities, which confirms the rural nature of our field setting.

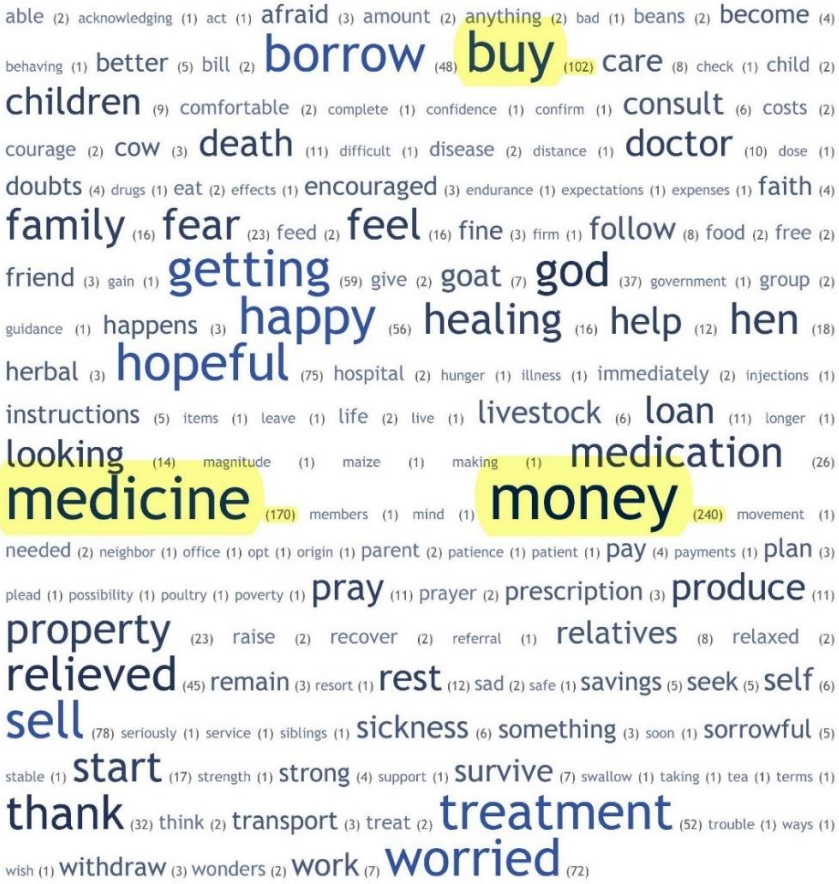


Figure 16 Frequency Word cloud for first three thoughts

Figure 17 Major expenditure in the next six months

Table 9 Summary of Sample, by treatment groups

Variable	Mean (Standard deviation)												
	Total	Lean (347)						Plenty (332)					
		Primed (181)			Control (166)			Primed (178)			Control (154)		
	(N=679)	Gains (n = 94)	Losses (n = 87)	t statistic (p-value)	Gains (n = 84)	Losses (n = 82)	t statistic (p-value)	Gains (n= 90)	Losses (n = 88)	t statistic (p-value)	Gains (n = 81)	Losses (n =73)	t statistic (p-value)
Gender	0.56 (0.49)	0.51 (0.50)	0.55 (0.50)	0.46 (0.63)	0.51 (0.50)	0.58 (0.49)	0.79 (0.42)	0.533 (0.50)	0.63 (0.48)	1.39 (0.16)	0.6 (0.49)	0.56 (0.49)	-0.54 (0.58)
Age	35.66 (13.65)	33.24 (12.25)	35.75 (15.12)	1.22 (0.22)	35.79 (13.00)	37.70 (13.30)	0.97 (0.33)	35.83 (14.95)	36.12 (12.73)	0.13 (0.88)	33.59 (11.97)	35.97 (14.08)	1.13 (0.25)
Marital Status (=1, if married)	0.8 (0.39)	0.89 (.31)	0.74 (0.43)	-2.51** (0.01)	0.83 (0.37)	.77 (0.41)	-.86 (0.39)	0.77 (0.41)	0.89 (0.30)	2.18** (0.03)	0.81 (0.39)	0.73 (0.44)	-1.11 (0.26)
Education Level (= 1 if Primary, 2 if Secondary, 3 if Tertiary, 4 if not educated)	1.57 (0.9)	1.45 (0.82)	1.64 (1.04)	1.33 (0.18)	1.44 (0.75)	1.64 (1.08)	1.34 (0.18)	1.53 (0.75)	1.72 (0.979)	1.43 (0.15)	1.55 (0.724)	1.60 (0.89)	0.36 (0.71)
Land holding (in acres)	2.86 (5.10)	1.71 (1.00)	4.29 (10.76)	2.268** (0.02)	2.41 (2.30)	2.93 (2.51)	1.37 (0.17)	2.64 (2.34)	3.74 (7.61)	1.30 (0.19)	2.42 (2.08)	2.73 (1.94)	0.95 (0.34)
Control Question correct (=1)	0.859 (0.348)	0.86 (0.34)	0.81 (0.38)	-.95 (0.34)	0.86 (0.34)	0.83 (0.369)	- 0.503 (0.61)	0.97 (0.14)	0.84 (0.367)	-3.26** (0.00)	0.81 (0.39)	0.83 (0.37)	0.33 (0.73)
Psychological Index	0 (1)	-.22 (0.66)	0.50 (0.85)	6.34 **(0.00)	-.29 (0.58)	-.22 (1.00)	0.57 (0.565)	0.17 (0.823)	-0.004 (1.04)	-1.26 (0.20)	-0.06 (0.96)	0.127 (1.627)	0.90 (0.366)

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Having setup the priming treatment for both seasons, I now move to describe the scores from the cognitive load test. For each participant within the primed and control groups for both seasons, I introduce the 2-question test. It follows up directly after the priming task and is the same for all participants to aid comparisons. I describe statistical test results for the test scores, the level of difference and the implication for the theoretical framework.

2.4.3 Cognitive Load Test

In this section, I describe the scores from the vital mechanism of interest- the cognitive load test. Besides statistically confirming scarcity's cognitive load effect, I also find a differential effect due to the nature of scarcity itself. The performance on the test indicates the load on the core cognitive components and, therefore, the expected degree of dual-process bias in decision-making. The test contained a numerical Stroop task and the digit span test, and each participant, irrespective of the scarcity treatment, did the same test in the same order. Both versions of the tests account for the region's literacy constraints and measure of Inhibitory Control, attention and Working memory, respectively. Table 10 contains the summary scores and the standard deviations by treatment group.

To recall, the Stroop test in its numerical variant displays a 15*5 table of triangles and numerals to be read aloud by the participant. First, the participant calls out the number of triangles in its congruent condition. Next, they read out the number of digits in the incongruent condition, not the digit number. The experimenter notes the time to read and the number of mistakes (interference) for the two conditions. To capture the actual effect of only scarcity, I did not want to burden participants with time pressure additionally. Therefore, the time taken to read is only for explorative purposes[5] . The primary variable of interest is the difference in the number of mistakes (interference) between the incongruent and congruent conditions.

Table 10 Summary Scores on the Cognitive Load Test by Scarcity Treatment Group

Scarcity Treatment (n)	Stroop Interference	Stroop Reaction time	Reverse Digit Span Accuracy (max 10)	Forward Digit Span Accuracy (max 5)
Plenty, Control (153)	3.503 (0.745)	10.183 (2.174)	7.058 (0.147)	2.305 (0.072)
Plenty, Primed (177)	4.634 (0.641)	14.632 (1.631)	6.825 (0.107)	2.241 (0.063)
Lean, Control (165)	6.921 (1.035)	9.769 (2.171)	7.102 (0.104)	2.369 (0.061)
Lean, Primed (181)	6.988 (0.953)	12.270 (1.289)	6.58 (0.099)	2.165 (0.071)

Note: Table contains Mean (Standard Deviation) from the two tests

[5] After checking for correlations, I find that the interference score and reaction time difference have a low correlation (0.06 , p= 0.07). This can be explained by no time pressure stipulation as part of the design.

According to the hypothesis, it is expected that the number of mistakes would be higher in the incongruent than the congruent condition for those facing a higher force of scarcity. While the ANOVA test on the level of interference between the four groups is statistically significant (p= 0.008), as seen in Table 10 and more starkly in Figure 18, there seems to be an effect of the type of scarcity faced. The scores in the lean season for primed and control groups look worse than those for the plenty season. I explore this heterogeneity in Table 11 and find statistical significance on the t-test to compare interference scores between plenty and lean season irrespective of the group. This suggests that cyclical, expected scarcity disproportionately taxes inhibitory control and attention. This can be seen in the comparison between control groups between the two seasons. Significant differences between the scores (-3.147, p = 0.00) suggest that the interference is higher for the lean season. Similarly, given shock scarcity (the primed group), the interference scores between primed and lean seasons are statistically significant at a 5% level. The analysis is supported by the inability to reject the hypothesis of the difference of scores for shock scarcities for fixed expected scarcity levels.

The differing effect of the nature of scarcity can also be seen for the reverse digit span test. All participants in my experiment do the Forward and Reverse Digit Span test. The forward version presents an increasing list of numbers (maximum span of 5) that the participant repeats in the same order. Correspondingly, the reverse digit version has them repeat the span of numbers (maximum span 10) in reverse order. The test is scored on the ability to recall the maximum span of numbers (accuracy levels). A summary of the scores can be seen in Table 10. As discussed in the previous section, the forward and reverse span test measures short-term and working memory, respectively. While I implement both, the test score of interest is from the reverse digit span[6]. ANOVA tests between the four scarcity treatment groups are significant at 1% (p = 0.0039).

Table 11 Stroop Effect Interference Scores (p values), by scarcity treatment

Scarcity Treatment (n)	Plenty, Control (153)	Lean, Control (165)	Lean, Primed (181)
Plenty, Control (153)	-	-3.417*** (0.004)	-3.485***(0.002)
Plenty, Primed (177)	-1.131 (0.124)	-	-2.353** (0.020)
Lean, Control (165)	-	-	-
Lean, Primed (181)	-	-0.067 (0.48)	-

Note: I compare the interference scores by the nature of scarcity. Scores by Expected (Plenty – Lean) and Unexpected (Control – Primed) scarcity. Difference between mean scores at between subject level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

[6] The conceptual link between short term memory priming before doing the working memory test can be seen in my data. The scores from forward digit span and reverse digit span are highly correlated (0.326) with a p value = 0.0000.

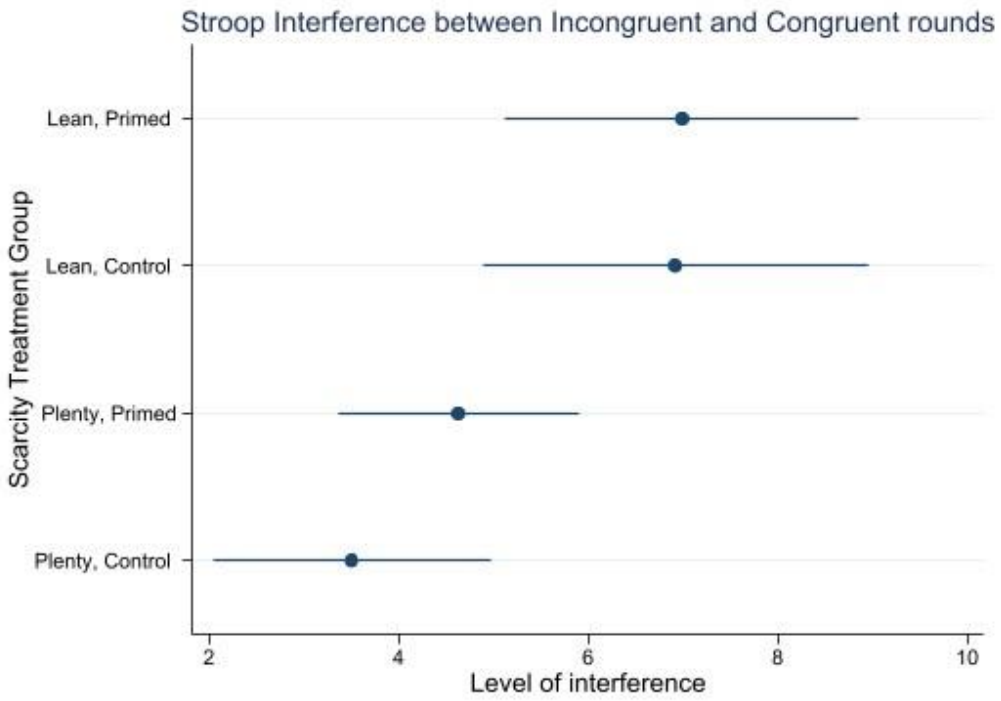


Figure 18 Stroop Interference Scores, by Treatment

Like Stroop interference scores, Table 12 and Figure 19 hint a heterogeneity in working memory scores due to the nature of scarcity. In contrast to the effects of expected scarcities on inhibitory control and attention, it looks as if the shock of unexpected scarcity loads working memory exclusively. I compare the between-subject scores for the four groups using a t-test and confirm the load on working memory (Table 12). I also see that the effects are stronger for lean season, thus implying the dual effect of a shock given the expected scarcity state. This is confirmed by further reading of Table 12. Participants in the plenty season facing unexpected scarcity perform significantly better than their counterparts in the lean season (p = 0.04).

In conclusion, the results from the cognitive load test have two key takeaways. First, there is a statistically significant load on inhibitory control, attention and working memory, confirming the hypothesis of the link between scarcity and cognitive load.

Table 12 Differences in Mean Reverse Digit Span scores for Working Memory (p-values)

Scarcity Treatment (n)	Plenty, Control (153)	Lean, Control (165)	Lean, Primed (181)
Plenty, Control (153)	-	-0.0439 (0.59)	0.478***(0.003)
Plenty, Primed (177)	0.2325* (0.09)	-	0.245** (0.04)
Lean, Control (165)	-	-	
Lean, Primed (181)	-	0.522***(0.00)	-

Note: I compare the interference scores by the nature of scarcity. Scores by Expected (Plenty – Lean) and Unexpected (Control – Primed) scarcity. By treatment differences in mean scores at between subject level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

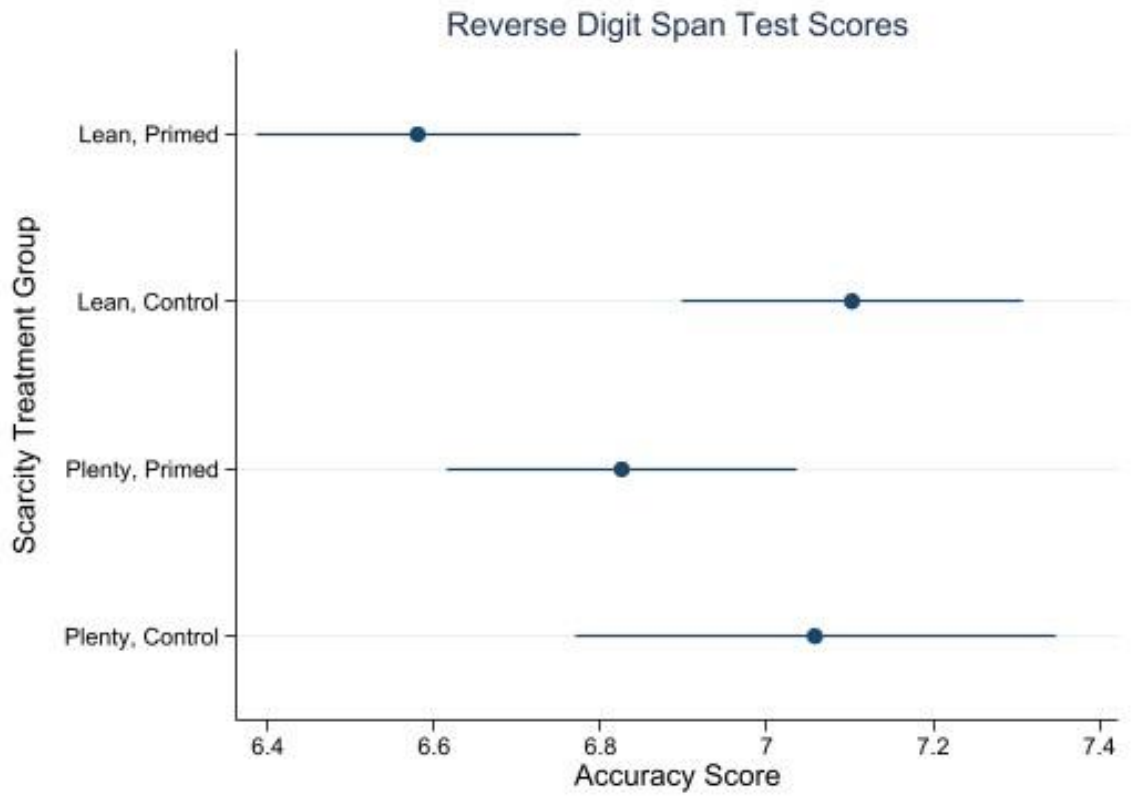


Figure 19 By treatment Reverse Digit Span Score
Note: Higher the score, the better the performance of working memory.

Second, the heterogenous analysis of test scores brings out differing effects of the nature of scarcity on core components of cognition. Stroop interference scores show that inhibitory control and attention are more loaded by expected, cyclical rounds of scarcity. Given the expected scarcity, I see that working memory is affected by unexpected scarcity.

It is also worth noting that my findings confirm the theoretical interlinkage between inhibitory control and working memory (Diamond, 2013). This can be seen with the significant effect on working memory for comparison between seasons (Plenty, Prime and Lean, Prime). Additionally, comparing working memory effects shows the most remarkable difference for participants facing both expected and shock scarcity (Lean, Primed and Lean, Control). Therefore, confirming that annually expected scarcity is encoded in memory and, when triggered, is additionally loaded in a shock scenario.

In the next section, I discuss the decision effects of the treatment and the mechanism. I begin with discussing the decision attribute-based common consequence effect choice switches and then move to multivariate analysis to assess the extent of tunnelling.

2.4.4 Probability Weighting: Common Consequence Ladders and Scarcity Relevance

Before presenting the decision-attribute-based common consequence ladders switching results, I summarise the sample by domain and scarcity treatment in Table 13. As discussed before, I have a 2*2*2 between-subject design by natural scarcity, shock-unexpected scarcity, and the decision-making domain. The table is broken down for all treatments that are assigned between subjects. Within each natural period, scarcity shock priming and control groups are randomly allocated for the gains and losses domain. Of the 679 participants across the two periods, 349 and 330 do the common consequence ladders in the gains and losses domain. On breaking the domain totals by the unexpected scarcity treatment, 184 subjects are primed with shock scarcity play the gains version of common consequence ladders. For both seasons combined, 175 subjects played the gains version from the control group. Splitting it further, 94 participants get the complete treatment with natural shock scarcity for the gains domain in the lean season. Correspondingly, 81 face neither natural nor are primed with the scarcity shock play the common consequence ladders in gains. A similar breakdown can be worked out for losses too. For the two seasons combined, 165 and 155 subjects are randomly allocated into either scarcity priming or control groups for the loss domain. Breaking down by complete treatment profile, 87 participants get the natural (lean), unexpected priming for losses.

One of the research objectives of this work is to see the difference decision attributes make for the same individual. Therefore, I introduce the scarcity relevance treatment at the final decision-making stage of my experiment.

Table 13 Sample Breakup by Treatments

Treatment Group	Natural Scarcity		Total
(Domain*Shock Scarcity)	Lean	Plenty	
Gains*Primed	94	90	184
Gains *Control	84	81	175
Total for Gains	178	171	349
Losses *Primed	87	88	165
Losses *Control	82	73	155
Total for Losses	169	161	330
Total	347	332	679

As explained theoretically in the conceptual framework and discussed in detail in the methods section, decision attribute effects of scarcity relevance are expected to be observed at a within-subject level. All participants from the 2*2*2 treatment groups make two sets of decisions- relevant or irrelevant for the scarcity at hand, thus bringing the experiment to a 2*2*2*2 between-within subject design. I use the Common consequence ladders (ccl) to see the level of Expected Utility Theory consistent behaviours by treatment. Comparing the five rungs, common consequence ladders gives rise to four permutations of choice switches – SS, RR, SR, and RS. SS and RR are Expected Utility Theory consistent

of the four, while the latter are violations of the common consequence effect and indicative of non-Expected Utility Theory behaviours. The greater the number of SR, and RS switches, the more Expected Utility Theory - inconsistent choices. In line with my framework, I expect the total number of SR and RS to rise as the decision attribute becomes more irrelevant and the force of scarcity felt becomes stronger. Therefore, the rung difference between choice switches for scarcity relevance and irrelevance should increase as the individual feels a greater force of scarcity.

Table 14 and Table 15 summarise the observed behaviour of the completely disaggregated sample for all the treatment groups in absolute numbers and percentage of sample, respectively. [7] For the difference between consecutive rungs (Rung 1 to 2, Rung 2 to 3, Rung 3 to 4, Rung 4 to 5), we see the total number of non- Expected Utility Theory switches (number of SR and RS switches combined) to be uniformly higher for irrelevant choices as compared to relevant choices for the lean season. The pattern holds for both the domains and shock scarcity treatment groups. Figure 20 and Figure 21 depict the trends for gains and losses. A lower number of switches for scarcity-relevant common consequence ladders indicates a greater propensity to stick to SS or RR choices between the consecutive rungs. The more switches, the greater propensity of the decision maker to be affected by common consequence shifts and hence, more likely to exhibit non-linear probability weighting. Since the design at this stage is at a within-subject level, the same decision maker is exhibiting more Expected Utility Theory consistent preferences for probability weighting that is scarcity relevant and switching when the decision attribute changes to irrelevance.

These trends hint towards a preliminary confirmation of the fundamental hypothesis of the within-subject split of preferences based on scarcity relevance. Next, I test these total switches statistically. The focus of the analysis here is the proportion of subjects that are Expected Utility Theory consistent versus those that are not. The fewer switches mean a preponderance of SS or RR switches and hence an Expected Utility Theory -consistent decision maker. The greater the SR, RS switches, the more nonlinear the probability weighting function is. Therefore, the null hypothesis of no difference due to decision attributes implies that the total number of SR and RS switches are equivalent.

[7] Individual slope analysis of the pwfs by treatment is attached in the appendix.

Table 14 Total Switches in Common Consequence Ladders, by treatment (in absolute numbers)

	Lean		Plenty	
Rungs	Relevant	Irrelevant	Relevant	Irrelevant
		Gains*Primed Switch (SR and RS)		
II-I	17	24	14	17
III-II	13	19	14	19
IV-III	20	19	14	26
V-IV	27	27	20	24
		Gains*Control Switch (SR and RS)		
II-I	25	29	14	23
III-II	18	22	13	22
IV-III	14	22	18	22
V-IV	22	26	16	29
		Losses*Primed Switch (SR and RS)		
II-I	18	25	27	30
III-II	20	25	32	37
IV-III	18	22	26	25
V-IV	15	21	18	26
		Losses*Control Switch (SR and RS)		
II-I	21	21	20	21
III-II	23	29	24	25
IV-III	23	25	17	20
V-IV	19	21	12	18

Table 15 Total Switches in Common Consequence Ladders, by treatment (in percentages)

	Lean		Plenty	
Rungs	Relevant	Irrelevant	Relevant	Irrelevant
		Gains*Primed Switch (SR and RS)		
II-I	18.09	25.53	15.56	18.89
III-II	13.83	20.21	15.56	21.11
IV-III	21.28	21.28	15.56	28.89
V-IV	28.72	29.79	22.22	26.67
		Gains*Control Switch (SR and RS)		
II-I	29.76	34.52	17.28	28.4
III-II	21.43	26.19	16.05	27.16
IV-III	16.67	26.19	22.22	27.16
V-IV	26.19	30.95	19.75	35.8
		Losses*Primed Switch (SR and RS)		
II-I	20.69	34.09	30.68	28.74
III-II	22.99	42.05	36.36	28.74
IV-III	20.69	28.41	29.55	25.29
V-IV	17.24	29.55	20.45	24.14
		Losses*Control Switch (SR and RS)		
II-I	25.61	25.61	27.4	28.77
III-II	28.05	35.37	32.88	34.25
IV-III	28.05	30.49	23.29	27.4
V-IV	23.17	25.61	16.44	24.66

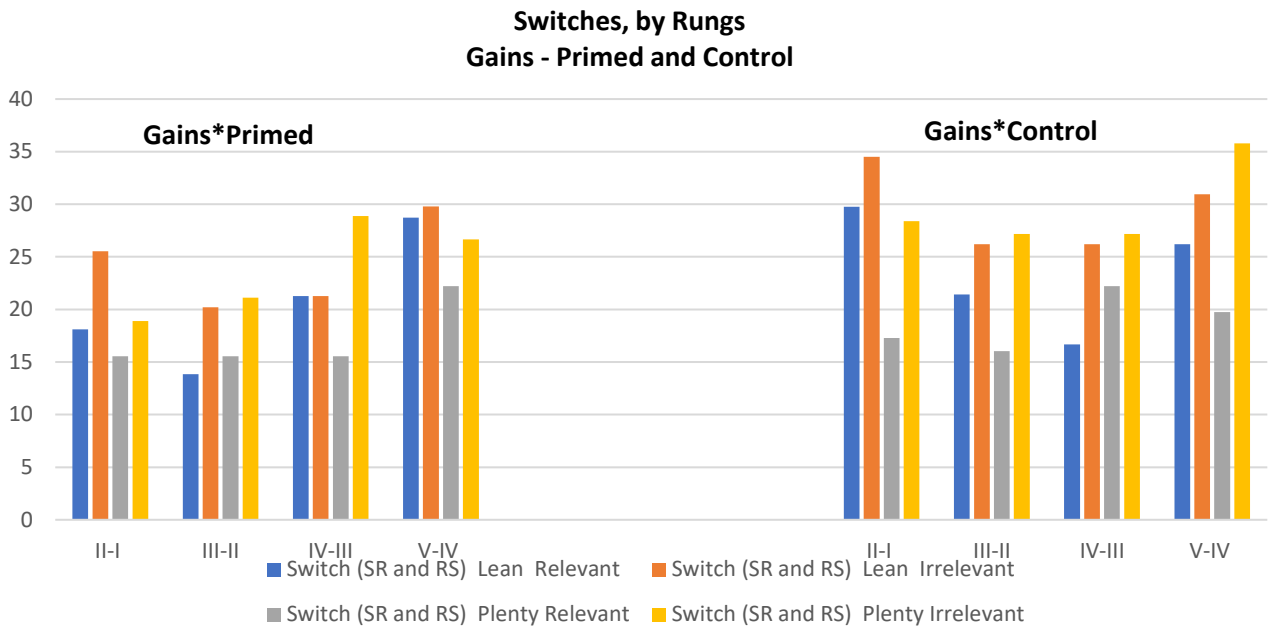


Figure 20 Total non- Expected Utility Theory switches (SR and RS) for gains, by treatment

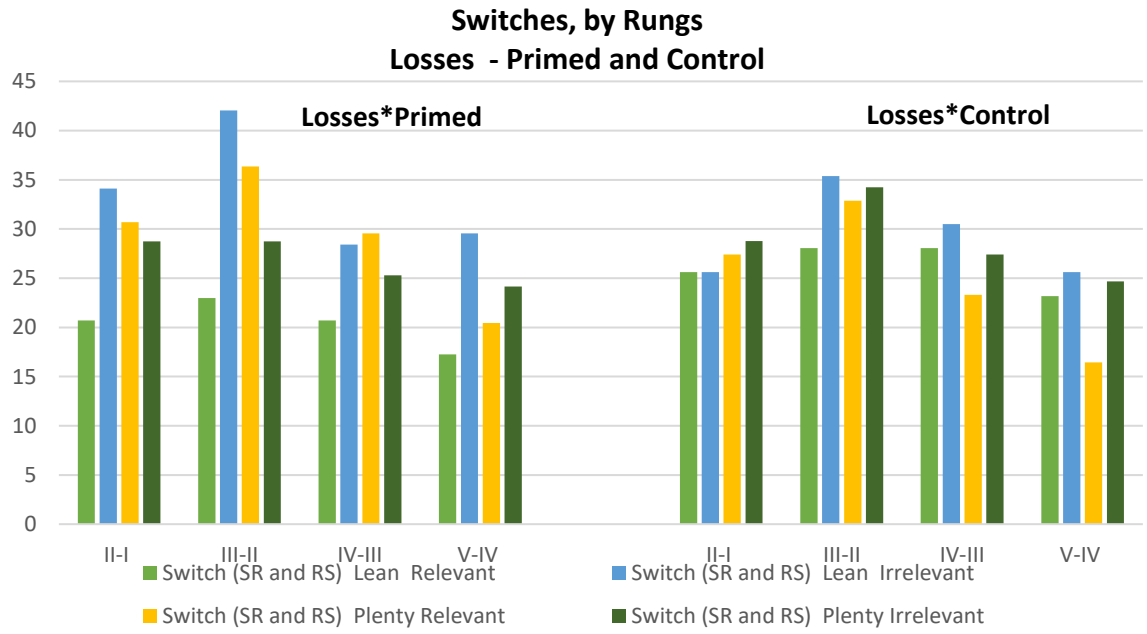


Figure 21 Total non- Expected Utility Theory switches (SR and RS) for Losses, by treatment

If the difference between total switches for relevant and irrelevant is negative and statistically significant, it would suggest that the decision maker is more likely to exhibit a nonlinear Expected Utility Theory probability weighting function for the scarcity irrelevant attribute.

I test the hypothesis statistically by taking the level of difference of total switches for the two decision attributes between the rung pairs for each treatment group. To test these within-subject differences, I need a test that does not rely on assumptions of underlying normality and ordinality of differences.

Therefore, the pairs can be tested using the sign test. I reclassify SR and RS as switches (1) and SS and RR as no switches (0). Using conventions (Verschoor and D'Exelle, 2020) described previously, RR and SS are coded as 0, and SR and RS are coded as -1 and 1, respectively. The results from the sign test can be seen in Table 16.

Aggregating over seasons, the differences between total scarcity relevant and irrelevant switches for consecutive common consequence ladder rungs from the sign test are significant for the complete sample and each domain (Table 16). Breaking down by treatment group, I see that the total non-Expected Utility Theory switches for irrelevant attributes are significantly more than scarcity relevance when the decision maker is in the lean season, primed with unexpected scarcity and making choices for the gains or the loss domain.

Table 16 Total Switches Between Consecutive Rungs for Scarcity Relevant and Irrelevant Attributes

(Relevant Switches –Irrelevant Switches < 0)	Lean	Plenty
Overall (N= 679)	0.000***	
Overall, for gains (n= 349)	0.000***	
Overall, for losses: (n= 330)	0.000***	
Gains*Primed	0.026**	0.1509
Gains*Control	0.013**	0.0717*
Losses*Prime	0.019**	0.032**
Losses*Control	0.5	0.3036

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

This aligns with my primary hypothesis as the difference between the two signals the moderating effect of the level of scarcity force and scarcity relevance on guiding Expected Utility Theory consistent choices. The insignificance also supports this and hence, the inability to reject the hypothesis for the control group in both the seasons for the loss domain. This suggests that merely the decision attribute is not strong enough to assert splitting unless there is a strong enough scarcity force. While the loss domain imposes cognitive effort, as evidenced by lower levels of accuracy for the control question, it is not scarcity triggered. And therein lies the difference. Unless the top-down (TD) scarcity goals and scarcity-triggered cognitive load are not strong enough, the differentiating effect due to bottom-up (BU) attention mechanics of scarcity relevance does not hold.

I explore this further by comparing the difference in total choice switches for all the combinations of rung pairs. As discussed in the methods section, for the five-rung common consequence ladders choice list, we can have 5*4/2 = 10 possible permutations of pairs for comparison. I use the sign test for these pairs to statistically test the difference between relevant and irrelevant based common consequence ladders.

Table 17 summarises the results. Totalling the SR, RS switches for the ten pairs for both relevant and

irrelevant attributes, I see the significance for the difference is retained for a decision-maker in the lean season for both primed and control groups in the gains domain. The number of non- Expected Utility Theory switches for scarcity irrelevant decisions is also statistically significantly higher for the decision-makers in the plenty season for the loss domain for both the shock scarcity groups.

Table 17 Total Switches for all 10 combinations of rungs for Scarcity Relevant and Irrelevant

(Relevant Switches –Irrelevant Switches < 0)	Lean	Plenty
Overall (for N= 679)	0.000***	
Overall, for gains (n= 349)	0.000***	
Overall, for losses: (n= 330)	0.000***	
Gains*Primed	0.087* (n= 94)	0.105 (n= 90)
Gains*Control	0.001*** (n=87)	0.017** (n=88)
Losses*Prime	0.061* (n= 84)	0.000*** (n= 81)
Losses*Control	0.364 (n=82)	0.021** (n=73)

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

A number of reasons can explain the significance of the losses*control group. First, the decision-makers in this group are particularly affected by changes around the endpoint. This aligns with the findings of Verschoor and D'Exelle (2020). They find support for the reference probability of 0 for losses. Therefore, it could be the case that decision-makers in this treatment assignment are switching in more significant numbers across rungs with larger probability intervals as scarcity relevance changes. Secondly, it could result from a mismatch between the cognitive effort required to make decisions in the loss domain counteracting the scarcity's cognitive load and tunnelling effect altogether.

Decision-makers better distinguish between the relevant-irrelevant attributes in the losses*control*plenty treatment than in the corresponding group in the lean season. This can be read in light of Table 11, Figure 18 and Yechiam and Hochman's (2013) findings. My findings from the heterogenous analysis of the Stroop test show that expected scarcity (lean season) impacts inhibitory control and attention disproportionately more than the unexpected scarcity shock priming (which taxes working memory). Then, given that losses impact attentional allocation more than gains (Yechiam and Hochman, 2013). In such a case, it implies that decision-makers under the losses*control*lean treatment are taxed from two different sources, and the conceptual scarcity channel (cognitive load and decision attribute-based tunnelling) gets diluted. To explore the veracity of the extent of the working of this channel, I now proceed to the multivariate analysis of the Expected Utility Theory -non-Expected Utility Theory probability weighting function in the next section.

2.4.5 Multivariate analysis

I now report on the multivariable correlates of the switching and tunnelling mechanism in the common consequence ladders. I conducted three regression analyses using the paired rung switching data by scarcity relevance and treatment group. First, I take the difference between total relevant and irrelevant switches to calculate the net tendency for non- Expected Utility Theory choices. Then, I conduct ordered logit regression on the extent of tunnelling for the decision attribute. For the second and third regression, I categorise the switches for all the ten combinations of rung differences as Expected Utility Theory consistent (SS and RR) or not (SR and RS) and then test the propensity to fall into one of the classifications for each decision attribute, given all other control variables.

Table 18 presents the results from the three separate regressions. In (1), after including the correlates, I test the significance of the difference in total irrelevant and relevant switches for all combinations of common consequence ladders rungs. The difference between the two attributes ranges from -6 to 6, with the more positive difference indicating a higher propensity for non-Expected Utility Theory preferences. This difference in the number of SR and RS switches for attributes concurs with the tunnelling effect of scarcity when it is positive (number of irrelevant switches > relevant switches).

As the results show, the difference is positively significant when scarcity's force is strong enough- at an interaction of natural and shock scarcity. This implies that the decision attributes begin to matter only after the top-down force of scarcity reaches a critical value. Anything less than that only expected or shock scarcity, is not strong enough to kickstart the decision-attribute-based attentional reallocation effects of tunnelling. The mechanism of Bottom-up attention grab of scarcity relevance, followed by its congruence with Top-down scarcity goals and the eventual redistribution of System 2 heavy (Expected Utility Theory consistent) and System 1 guided (non- Expected Utility Theory) comes into play only when there is enough felt force of scarcity, to begin with. We also see inhibitory control and attention's critical role in guiding this mechanism. Higher the interference score on the Stroop test, the greater the extent of the tunnelling split due to scarcity relevance. This again confirms a key takeaway from the conceptual framework. The stronger the cognitive load on the top-down (TD) capabilities, the more the follow-up tunnelling effect.

Expected, seasonal and shock scarcities are insufficient to enforce a scarcity-tunnelling effect. Then what explains the negative, significant coefficients? I propose their distinct cognitive mechanism as a possible reason. As was seen in Table 11 and Table 12, while expected scarcity disproportionately impacts inhibitory control and attention, in conjunction with unexpected scarcity, there is an added

effect on working memory. This strengthens the Top-down cognitive load enough to trigger the scarcity mechanism.

On the other hand, a decision maker facing expected scarcity alone is least expected to show this phenomenon (confirmed by Table 18), as the effect is on inhibitory control only, and the ability to maintain goals and manipulate choices according to relevance requires active retrieval of working memory. Within the hierarchy of core cognitive components, inhibitory control though most basic, is not necessarily dependent on working memory.

Table 18 Switch gaps and Expected Utility Theory *C*onsistency in Probability Weighting Function: Regression Analysis

	Dependent Variables		
Variables	Difference: Total Irrelevant-Relevant Switches	EUT consistent (Relevant)	EUT consistent (Irrelevant)
	(1)	(2)	(3)
Season (Lean = 1)	-.517**	.272	-.0703
	(.240)	(.308)	(.273)
Unexpected Scarcity (Primed = 1)	-.420*	0.324	.067
	(.229)	(.297)	(.261)
Seasonal and shock scarcity (Lean and Primed)	.668**	-.782*	-.212
	(.326)	(.428)	(.374)
Domain (Losses = 1)	-.199	.552**	.173
	(.165)	(.218)	(.191)
Stroop Interference score	.0213***	-.003	.0132**
	(.0069)	(.009)	(.006)
Reverse Digit Span Accuracy Score	.0362	-.001	.017
	(.0561)	(.074)	(.064)
Psychological Index	.0263	-.089	-.042
	(.0813)	(.1063)	(.087)
Landholding	.022*	-.0171	.0125
	(.0127)	(.026)	(.013)
Gender	.098	-.0109	.085
	(.1204)	(.180)	(.139)
Age	.001	.001	.002
	(.006)	(.008)	(.006)
Control Question	.2297	-.484*	-.253
	(.2369)	(.287)	(.259)
Willingness to take risks	-.0408	.022	-.0291
	(.0315)	(.041)	(.034)
Constant		-2.506***	-1.77**
N	671	671	671

Note: Ordered logit (1) and logit (2 and 3) estimated coefficients with robust clustered standard errors in parentheses. ***, ** and * indicate two-sided significance levels at 1%, 5% and 10% respectively. For (2) and (3), non- Expected Utility Theory consistent switches= 1.

While using working memory also requires the use of attentional and inhibitory control (Diamond, 2013). Therefore, expected scarcity alone is least likely to lead to a tunnelling effect as the scarcity-triggered cognitive load alone is insufficient for attribute-dependent splits in common consequence ladders switches. For the same reason, the difference between irrelevant and relevant switches falls

for scarcity shock (priming). Since, by itself, it asserts a more significant load on working memory, which may be why cognitive load becomes strong enough to allow for the Top-Down goal of meeting the scarcity far more urgent and hence the tunnelling much more likely than seasonal scarcity.

I group Expected Utility Theory -consistent choice switches as 0, and non-Expected Utility Theory switches as 1 for both models. For regressions in (2) and (3) in Table 18, I track the odds of Expected Utility Theory consistent pwf for each decision attribute separately. In line with the theory, I can see that the two scarcity forces together are significantly more likely to result in the scarcity-relevant probability weighting function moving closer to Expected Utility Theory predictions (2). The effect is more substantial for losses. This is notable as the loss domain itself is known to be effortful.

Interestingly, the movement towards "rationality" is also moderated by the decision-makers ability to understand the task, as the variable is significant at 10%. Even though insignificant, given scarcity relevance, higher Stroop interference scores are less likely to result in non-Expected Utility Theory type preferences. This finding completes the explanation when contrasted with significant findings in the opposite direction for scarcity-irrelevant attributes in (3). For the scarcity irrelevant attribute, there is an increase in odds of getting a non- Expected Utility Theory, "fanned out" pwf as Stroop interference increases.

Taken together, we can draw some critical insights about the workings of the scarcity mechanism and the point at which tunnelling begins to exert its effect on a decision-maker. First, the scarcity force must be strong enough for tunnelling. We find that in the significance of interaction effects for expected and shock scarcity. Second, the two sources of scarcity affect the potential tunnelling mechanism to different but expected degrees. This corroborates the conceptual understanding. The Top-Down Cognitive load and Bottom-Up Decision attribute effects must be strong enough for the eventual tunnelling split. If neither is strong enough in the scarcity environment, the hypothesised split may not happen. Third, there is evidence of cognitive load being the working channel for this. The finding is supported by a greater propensity of the scarcity-irrelevant probability weighting function to be non- Expected Utility Theory consistent as Stroop interference increases.

2.5 Conclusion and Discussion

In this paper, I presented the results of the tunnelling effect of financial scarcity or poverty on the probability weighting function and discussed the role of cognitive mechanisms in it. I conceptualise the interplay between scarcity-triggered-cognitive load and the top-down and bottom-up forces of attentional grab affecting the role of System- 2 versus System-1 in the decisions made. Theoretically,

I linked three strands of literature – the psychology of poverty, the dual cognitive process, and the probability weighting theory to understand the role of relevance to scarcity in simultaneously splitting the function into rational and biased.

I tested the framework and hypothesis using lab-in-field experiment in Uganda. The field setting gives me the unique advantage of seeing the effects of both expected and unexpected financial scarcity. I conducted a two-phased fieldwork in the Bwikhonge region with 679 participants split between the harvest cycle's distinct lean and plenty seasons. I primed the random half of the sample in both seasons with scarcity shock and followed it up with the cognitive load test for the entire sample. Finally, I administered the non-parametric method of common consequence ladders to track the probability weighting function for gains and losses. While the method has been used to get at the level of probability weighting in Uganda and other settings where literacy is a constraint, I take the design further and have the participants do the same decision-making activity for scarcity-relevant and irrelevant attributes. Therefore, I have a 2*2*2*2 between-within-subject design for natural, unexpected scarcity for decision-making in gains and losses for two attributes – scarcity relevance and irrelevance.

With the data collected from 2020-2021, I conclude with the following findings. First, I confirm the pervasive characteristics of scarcity. Thoughts about financial scarcity came up unprompted, supporting the idea of finances being a constant worry for those facing shortages. Second, I find significant cognitive load effects by the nature of scarcity. This differentiation provides an important insight into the heterogenous cognitive effects of expected versus unexpected financial scarcities. Using standardised tests, find inhibitory control and attention are more loaded by expected, cyclical rounds of scarcity. Additionally, working memory scores are affected mainly by unexpected scarcity and the mutual interaction between the expected and shock. Thirdly, breaking down by treatment group, in line with my primary hypothesis, I find that the scarcity-irrelevant probability weighting function is more likely to be non-linear than that for the scarcity-relevant attribute. Finally, I see that the relevant-irrelevant decision attributes begin to matter only after the top-down force of scarcity reaches a critical value. When a decision maker faces only expected or shock scarcity, the force is not strong enough to kickstart the decision-attribute-based attentional reallocation effects of tunnelling. Furthermore, I find evidence of cognitive load being the working channel for this.

To sum up, when the decision-maker faces a strong enough force of financial scarcity (and hence, cognitive load), and they face choices relevant to their current needs that align perfectly with their goal of meeting the scarcity at hand, those choices would mirror those of a “rational” decision-maker. At the same time, all other preferences of the same individual would be outcomes of the biased

System-1. The degree of split or tunnelling would depend on the force of the top-down load of scarcity needs, the ensuing cognitive load, the bottom-up force from the choice characteristics and congruence between decision attributes and the need to meet the scarcity objective.

3 Scarcity, Cognitive Load, and Risk Preferences

Having discussed scarcity's impact on probability weighting, I now move to a more fundamental choice variable - risk preferences. The exact monetary decisions become much more critical for people struggling financially and facing scarcity. The decision-maker may be rationalising the worthiness of every penny in day-to-day life while neglecting long-term investments or other decisions that may make life better in the future. Mullainathan and Shafir (2013a) call it the "scarcity trap". The theoretical framework does not negate other discussions around poverty. Instead, it takes a step back and goes behind the scenes to cognitive mechanisms that may add to the difficulties in those circumstances. The continuous worry of having less than they need with no slack to cushion those immediate expenses changes the decision-making process.

Scarcity has two direct impacts – cognitive load and tunnelling. As the mind is inescapably preoccupied with the tight financial situation, its total thinking capacity reduces as the worry itself takes up cognitive space. The involuntary load redirects the leftover slower, deliberative part of the cognitive system towards making the most rational choices for choices that would alleviate the scarcity at hand. At the same time, other preferences get overwhelmingly guided by the faster, affective system—such recalibration results in the rational-bias split or tunnelling in preferences. Pressed for resources, people tend to become judicious about relevant commitments as other beneficial but irrelevant choices suffer. This sensitivity to 'what matters' changes preferences.

In this paper, I focus on the effects of this scarcity mechanism on the second of the two components of risk preferences – the level of risk tolerance for gains and losses. This is the second part of the same two-phased lab-in-field experiment with 679 participants in Uganda. I combined natural and artefactual sources of scarcity to examine the cognitive load level they enforce. After testing for scarcity-tunnelling effects on probability weighting, I examine whether scarcity also leads to tunnelling in risk preferences. If it does, I look at the extent of the difference scarcity relevance makes.

As the first two tasks of the experiment are the same, identical results hold. Thoughts about financial scarcity are unprompted and persistent. There was an increase in cognitive load as the force of scarcity rose. Additionally, there were some disaggregated effects on the cognitive load test by the nature of scarcity. Expected, cyclical scarcity imposes a more significant load on inhibitory control and attention. Contrastingly, shock scarcity affects working memory. There is a disproportionate tax on working memory, inhibitory control and attention for decision-makers facing both expected and unexpected

scarcity. When a decision maker has lived through shortfalls and is expecting a shortfall, memories and experiences of those past cycles may have a role in cushioning the effect on working memory.

Finally, the findings on risk preferences can be summarised in two points. First, I find heterogeneous effects of dual system functioning on risk preferences by domain. In line with theory, scarcity-relevant choices in the loss domain show higher levels of System-2 guided preferences. However, the same cannot be said for gains. Though not wholly in line with the initial hypothesis, this is an insightful result. Losses motivate more cognitive effort than gains do. So, only when the bottom-up force of the choice attribute is strong enough is the dual system specialisation triggered. These results are confirmed in the within-subject analysis of the tunnelling effect for gains and losses. Secondly, while I do not see any significant difference in risk preferences by scarcity relevance for gains, the same cannot be said for losses. Decision-makers are more likely to take sure losses than the risk for scarcity-relevant choices that align with "rational" decision-making postulates.

The rest of the paper is organised in the following sections. I begin with a brief overview of where the literature stands on scarcity, cognitive load, risk preferences and where they meet. I follow it by sketching a conceptual model that links the scarcity, attentional mechanism, and the level of a decision-attribute-dependent split in preferences. Next, I discuss the experimental design to operationalise the theoretical framework. Following the methods section, I present the findings from my experiment for each element and analyse the extent of rationality in risk preferences for gains and losses.

3.1 Literature Review

How do poor people make decisions? As much as we may avoid it, we all face risk in some form in everyday life. For a decision maker facing a financial shortfall, the consequences of those decisions may be dire and potentially one step away from falling into the poverty trap. In this section, I begin by setting the ground with risk theory and then follow it up with insights from cognitive theory and where it stands on evidence on risk preferences. Finally, I discuss the scarcity theory, the mechanism it enforces and the state of the literature that links the three strands together.

3.1.1 Risk Preference Theory

Studying risk preferences has been the cornerstone of microeconomic theory and the starting point of behavioural economics developing as a subject. The theory began with the simple idea based on a rational decision maker that chose the option (x, p) with the highest expected value (EV), where EV = px. They are labelled as risk neutral if he/ she is indifferent between the lottery (x, p) and its EV, risk-

seeking if they would instead choose the risky option than a sure payment equivalent to or larger than the EV. Consequently, they are risk averse if they would rather take the sure payment than the risky prospect with an equal or higher EV. The EV maximisation principle assumes a neutral attitude to risk. While this theory gives a baseline understanding of risk preferences, it does not explain risk aversion. It cannot explain why a decision maker would pick a sure payment of £49 over a 50-50 chance of £100. Bernoulli (1954) proposed the utility framework to reconcile this behaviour better. Within his model, decision-makers do not evaluate prospects (or lotteries) based on their value but on utility. The utility function is concave over wealth and thus increases at a decreasing rate for outcome values (Figure 22). He explained that the decision-maker would choose the former because the marginal utility gained from £49 is more than the 50-50 chance of £100. Expected Utility Theory (EUT) became the primary theory of risk after Von Neumann and Morgenstern (1947) gave the necessary and sufficient axioms for rational decision-making. The decision-maker would maximise utility by satisfying the substitution (independence) and the sure-thing principle (described in detail in Chapter 1).

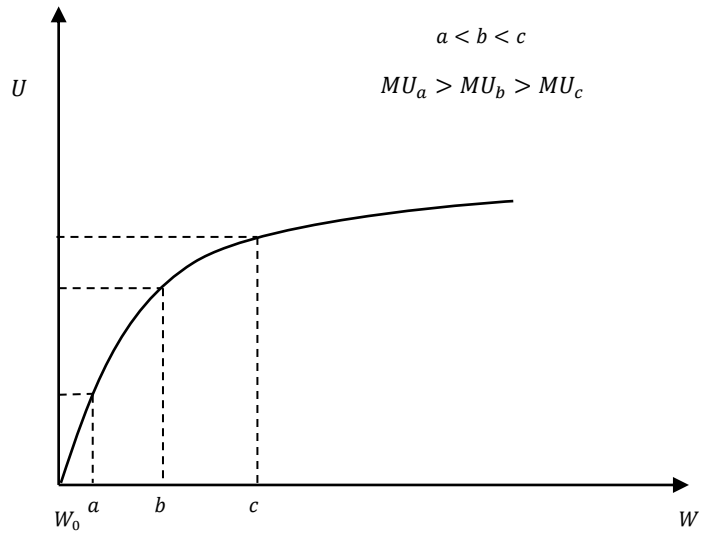


Figure 22 A representative concave utility function with $u''(x) < 0$.

However, violations of these principles soon emerged from empirical studies. They revolved around the decision-maker's sensitivity to probability endpoints (near 0 and 1) and the fourfold risk patterns. Tversky and Kahneman (1992) found the fourfold pattern of risk (Table 19) by probability levels to explain the violations, resulting in the inverse-S curve (Fehr-Duda et al., 2011; l'Haridon and Vieider, 2019). While the fundamental probability violations, including the Allais paradox, the common ratio and common consequence effects, have been discussed in the previous chapter, I focus on risk attitudes.

Table 19 The Fourfold risk pattern

	Gains	Losses
Low probability	Risk seeking	Risk aversion
High probability	Risk aversion	Risk seeking

Both the Allais paradox and the fourfold pattern were explained by Prospect theory (Kahneman and Tversky, 1979; Tversky and Kahneman, 1992). Within the theory, the value V of a prospect, x with probability p or 0 otherwise is: $V(x,p) = w(p).v(x)$, where v is the value of x and w is the weighting function of the objective probability of the prospect p. The value function, $v(.)$ is an S-shaped curve (Figure 23) that defined over gains and losses relative from a reference point[8]. The function accounts for the decreasing marginal utility with the prospect's value from the reference point. The critical intuition was that changes mattered more than the level of the final outcome. As can be seen, the curve gets flatter with increasing gains and losses, thus, showing diminishing sensitivity. Additionally, two features stand out in the value function. First, the function is concave for gains and convex for losses, and second, the curve is steeper for losses than gains.

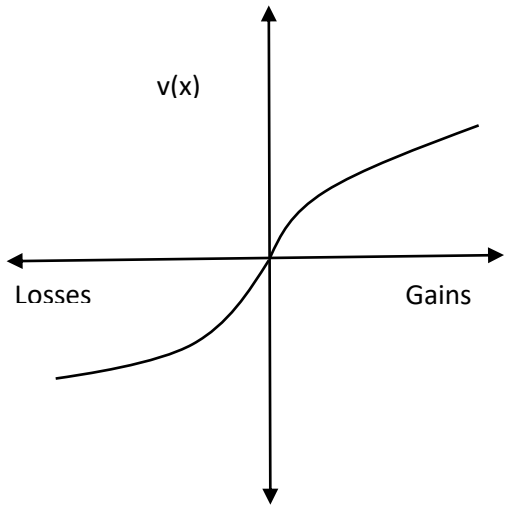


Figure 23 Representative Value function – convex for gains, concave for losses and steeper for losses than gains.

Given standard utility assumptions, the concavity for gains and convexity for losses manifests as risk aversion for moderate probability gains and risk seeking for moderate probability losses (Wakker, 2010). For example, the disutility of losing £49 for sure would be higher than taking a 50-50 chance on a £100 loss. The findings are largely supported by people selling their gains-making stocks in their

[8] The kink in the value function is determined by the reference point (Kahneman, 2003b). A natural question then arises on how the point is determined. For monetary outcomes, it is generally taken to be the status quo (Glimcher and Fehr, 2013; Samuelson and Zeckhauser, 1988). However, it is possible that expectations (Kőszegi and Rabin, 2006), riskiness of endowments, social signals and goals could also be valid reference points. Reference-point dependence is, therefore, an important aspect in understanding the formulation of gains and losses in risk preferences (Clist et al., 2021).

portfolios prematurely and holding onto the losses (Andrikogiannopoulou and Papakonstantinou, 2020; Barberis and Xiong, 2009; Odean, 1998; Shefrin and Statman, 1985). The phenomenon is called the disposition effect, where domain-based preferences are mirror reflections of each other. The reflection effect also implies risk aversion and risk seeking for equal gains and losses, respectively, that are stable across time and at an individual level (Baucells and Villasís, 2010; Edwards, 1996; Fehr-Duda et al., 2010; Myagkov and Plott, 1997; Rieger et al., 2015; Weber and Bottom, 1989; Zeisberger et al., 2012).

The second key feature of the value function is the relative steepness of losses compared to gains. For riskless choices, people generally require higher compensation to give up (Willingness to accept, WTA) an object than they would be willing to pay (WTP) for it. This inertia and the reluctance to trade is called the endowment effect (Novemsky and Kahneman, 2005; Thaler, 1980; Tversky and Kahneman, 1991). The disutility of losses is around twice the gains. People require almost twice the certain amount to tolerate losses. This distaste for losses is a crucial contribution of the prospect theory and is loss aversion.

For risk preferences it implies that the decision-maker is likely to be risk-averse to mixed gain-loss gambles. The strength of this hedonic pulldown effect of losses compared to what should be an equivalent attraction to gains is captured by the parameter (λ). While the first estimates (λ = 2.25) (Tversky and Kahneman, 1992) were critiqued for their effect sizes and power issues, several methods in multiple fields have found consistent support in the following years. Using laboratory experiments, surveys, panel data, randomized trials, field experiments and natural data, it has been quantified for monetary and non-monetary outcomes like health (Attema et al., 2013), auction markets (Banerji and Gupta, 2014), organizational theory, transport and trade. The phenomena effectively explains the equity premium puzzle (Benartzi and Thaler, 1995), insurance (Barberis, 2013), majoritarian voting behaviour in politics (Alesina and Passarelli, 2019), labour supply decisions (Camerer et al., 1997) and willingness to pay-accept trading behaviour gaps (Marzilli Ericson and Fuster, 2014).

Within prospect theory, the non-mixed gambles with either $x \geq y \geq 0$ or $x \leq y \leq 0$, i.e., either a pure loss or pure gain is evaluated as -

$$V(x, p; y) = w(p)v(x) + \big(1 - w(p)\big)v(y)$$

and the mixed prospect with $x > 0 > y$ is valued by -

$$V(x, p; y) = w^{+}(p)\, v(x) + w^{-}(1 - p)\, v(y)$$

where, $w(.) : [0,1] \rightarrow [0,1]$ is the probability weighting function for each domain with $w(0) = 0$ and $w(1) = 1$ and the utility function is a strictly increasing function $v: R \rightarrow R$ exhibiting diminishing sensitivity. The most popular parametric form for the curve is the power utility function (Tversky and Kahneman, 1992) –

$$v(p) = \begin{cases} x^{\alpha} \; if \; x \geq 0 \\ -\lambda(-x)^{\beta} \; if \; x < 0 \end{cases}$$

where $1 > \alpha, \beta > 0$ signifies concavity for gains and convexity for losses, and $\lambda > 0$ is the coefficient for loss aversion. $\lambda > 1$ implies loss aversion.

It is important to note that loss aversion is about the exchange between gains and losses, and mixed prospects are necessary to identify it (Fox et al., 2015; Wakker, 2010). Often, the existence of risk seeking for losses is mistaken for loss aversion (Gintis, 2014; Green and Myerson, 2004; Malul et al., 2013). Harbaugh et al. (2009) used pure gains and loss prospects separately and erroneously concluded that the larger gap WTA-WTP for losses is because of loss aversion. Similarly, Lusk's (2010) finding of different utilities for gains and losses using a bargaining experiment with either gains or losses and no mixed prospect does not indicate loss aversion. Therefore, when researchers investigate risk preferences using pure gains or losses, they examine the reflection effect.

3.1.2 Cognitive Theory and Risk Preferences – The Dual Process Theory

The difference in preferences by gains or loss domain has neural and biological support, suggesting more fundamental roots of these tendencies. Smith et al. (2002) used positron emission tomography (PET) to map brain activity for gains–loss payoffs, beliefs about risk and ambiguity and confirm risk averseness for gains and risk seeking for losses. They also find specific neural regions of activation for each group. Soon, other studies using functional magnetic imaging (fMRI) on loss aversion and risk preferences followed.

Overall, three neural regions have been identified as playing prominent roles – the anticipatory (central striatum), parts involved with maintaining and manipulating information (prefrontal cortex - pFC) and structures involved in emotional, affective responses like fear (amygdala) (Bechara et al., 1994; Elliott et al., 2003; Trepel et al., 2005). Tom et al. (2007) showed higher activities in all three when the level of gains increased. Additionally, they found that losses inflicted a sharper decrease in the regions' activities compared to gains. This steeper decline in losses has been characterised as the neural basis of loss aversion. The role of the emotional amygdala has been the focus of recent neuro-economists. De Martino et al. (2010) and find an essential role of the amygdala in moderating loss

aversion. Similarly, Weber et al. (2007) link amygdala activity to the endowment effect. Corresponding biological links come from stronger skin conductance responses for losses than gains (Sokol-Hessner et al., 2009).

To explain these neural pieces of evidence, the decision-making process has been debated actively. Almost consistent findings of the emotional region highlight the role of regulation and controlled cognitive processes. Following McClure et al.'s. (2004) seminal paper on separate cognitive regions interacting to affect impatience, dual system theories have been proposed to explain the risk preferences, reflection effect and loss aversion (Ashraf et al., 2005; Camerer et al., 2005). The theories conceptualise total cognitive systems as outcomes of a "hot", intuitive, affective, automatic, emotional System 1 and an effortful, deliberative System 2 (Kahneman and Egan, 2011; Stanovich and West, 2000). Although McClure et al.'s. (2004) original study looked at neural correlates for immediate versus delayed monetary rewards; the choices showed clear bifurcation of relative engagement of the two systems.

The dual processes are distinguished by their mechanistic flows. The controlled System 2 functions in a top-down (TD) manner. Attention and cognitive resources are effortfully directed consciously, a collection of essential functions termed Executive functions (EF) (Diamond, 2013). The broad umbrella term comprises three core features: inhibitory control, working memory and cognitive flexibility. Different combinations of the three feed into higher-order cognitive functioning like reasoning, problem solving and planning. These three mental operations, subsumed by the term "cognitive control," are involved in goal-directed activity.

Any other external, salient stimulus can involuntarily distract the decision-maker in a bottom-up (BU) manner. Inhibitory control must ward off that interference to control and sustain attention on the goal. It allows guiding selective attention to the relevant stimuli in the presence of other disturbances. Another aspect is the ability to not act on first instinct, delay gratifications and stay fixed on a task despite distractions. This self-control and selectivity in where cognitive resources are used, determine the decisions made at the end. Therefore, any goal completion requires self-control and resisting distractions while doing so.

To exert self-control in line with goals, a decision-maker needs to be able to recall those goals. This ability to hold information and use it comes from the second core component of Executive function: Working memory (WM). Definitionally, dependent on the level of permanence of storage, it involves both holding information for active use (Short term memory, STM) and the capability to recall and manipulate prior information and cues (Working memory). Inhibitory control and Working memory,

in most cases, function complimentarily (Diamond, 2013). The two support each other and involve two-way active feedback. Momentary concentration on a goal necessarily requires an additional ability to sustain the current goal in active memory to decrease the probability of inhibitory control errors. Similarly, to effectively retrieve and combine the stored information, the decision maker needs the ability to inhibit distractions and focus on the problem at hand.

While retrieving and manipulating information may be essential, the decision maker may need to update priors and change perspectives when approaching a choice. Such higher-order functioning requires the third component - Cognitive flexibility (CF). This part senses trends, picks up on patterns, engages in logical reasoning and feeds into fluid intelligence. It uses core functions of both Working memory and Inhibitory control to change decision paths midway or make a choice to switch between tasks. Eventually, Cognitive flexibility takes a call on whether the decision maker may need to change course to solve a problem, the best way to do so (problem-solving), reason it out and plan ahead.

Exerting Executive function or System 2 is cognitively costly. It is much more challenging to re-evaluate first instincts, and resist defaults than give in to automatic responses. Processing and sustaining selective attention to stay on goal takes up cognitive space. This effort, or cognitive load, is a tax on total mental resources. It is a combination of divided attention, inhibitory control and working memory. It curtails the ability to simultaneously attend to more than one stimulus, spatial sector, or modality and overlaps with Executive function.

The terms indicate the specialised features of the processes. While System 1 is the mode of thought where thinking is fast and used for routine decisions, System 2 is slow and rationalising. A broad consensus within the literature now agrees that System 1 uses fewer resources (Evans and Stanovich, 2013) and is prone to bias and error. In contrast, System 2's pondering is more likely to give way to balanced and accurate results. As System 2 monitoring is more effortful, it depends on cognitive ability and motivation. Stanovich (2011) traces any bias due to failure at two levels – System 1 generating "faulty" judgment and System 2's inability to detect or modify it.

That is, an aberration from "rationality" can result from either the System 1 intuition being too strong to be overridden or the depleted capacity of the decision-maker to be motivated enough to engage in deliberative processing. Motivation, attention, and cognitive control are components of the net cognitive effort that mediates preferences. Suppose the cognitive strength required for the System- 2 engagement is too costly or depleted at the final choice formation step. In that case, it is less likely that the deliberative system would move decisions away from the "affective optimum" of System 1 (Loewenstein et al., 2015; Westbrook and Braver, 2015).

Emotions and cognitive processes influence final risk preferences (Shiv and Fedorikhin, 1999) themselves. Therefore, given the almost specialised functions of processing systems and the differing impacts of gains versus losses, choices may change when faced with an additional emotional or cognitive trigger. In such a scenario, when a trigger that imposes cognitive stress will alter the erstwhile balance of dual system functions and change preferences.

3.1.3 Scarcity

Financial scarcity is one such force. Novemsky and Kahneman (2005) noted that loss aversion would be the greatest under tight budgets. They differentiate between the nature of constraints and the pre-decision earmarked use case on the level of effects. They explain this as a result of emotional states. From a dual-system perspective, if the decision-maker has thought about the trading scenario and deliberated the endowment that he/she needs to trade, then those preferences are guided by system-2 preferences and would exhibit rational, Expected Utility Theory consistent preferences.

Mullainathan and Shafir (2013a) explain decision-making under constraints or *scarcity* taking by proposing a unifying theory from dual system models to cognitive effect. They define scarcity as the feeling of having less than you need. While monetary scarcity or poverty is not the only type of scarcity an individual may face, it is the most consequential. Insufficient resources incommensurate with demands, tight budgets, and income uncertainty whilst managing expenditures may add to the vicious cycle effects of poverty.

Looking at behaviours from this perspective is not about rejecting or critiquing other explanations in the literature. I seek to offer additional insights into how decision-making under poverty works through mechanisms beyond the control of the decision-maker. It can be likened to filling a leaking bucket with water. The idea is to explain the context of decision-making where financial pressures take over all mental space and paint all the decisions in its light. The behavioural lens could explain many of the far-reaching implications of neglect of essential things when trying to manage daily life in the most efficient way possible in an environment of limited means. Within these behavioural analyses, Scarcity theory provides a unified, parsimonious explanation of economic decisions using insights from cognitive psychology.

Faced with such scarcities, the daily juggling of choices has two natural characteristics – a tax on total mental resources (bandwidth tax) and tunnelling (Mullainathan and Shafir, 2013). Day-to-day decisions weigh down the mental capacity (Banerjee and Mullainathan, 2008). The strain, with limited resources (Schilbach et al., 2016; Shafir, 2017; Shah et al., 2012), loads cognitively and results in

bandwidth tax. Such impaired cognitive abilities have real-world consequences which escaped scholarly attention until recently. Measurements of the cognitive capabilities of the same Indian sugarcane farmers before and after harvest show significant differences (Mani et al., 2013) on standardised cognitive tests. By controlling for all other variables, the authors could filter out the effect of distress caused by cyclical financial variation. The results also extend to otherwise "non-poor" American subjects in a New Jersey mall. Using identical methods, analogous differences were found between participants primed to think about financial expenditures at a New Jersey mall. These ever-present concerns leave lower available bandwidth for the decision-makers after loading the cognitive resources. The scenario becomes increasingly consequential as the scarcity-led stress, limited attention, and the negative affective state may lead to short-sighted, risk-averse behaviour that may form a vicious feedback loop (Haushofer and Fehr, 2014).

A direct consequence of this bandwidth tax is the second characteristic that looks at the involuntary realignment of focus or *tunnelling* (Mullainathan and Shafir, 2013) on the scarce need. For example, when pressed for time, we automatically concentrate on the deadline for the immediate work to be handed in and are more responsive to food-related cues when hungry or dieting (Piech et al., 2010; Radel and Clément-Guillotin, 2012; Shapiro and Burchell, 2012). In financial terms, it may include immediate rent payments or other impending expenditures. As more cognitive resources tend to get engaged in meeting these needs, the cognitive costs of dealing with everything else get magnified. For poverty, such a scarcity state implies efficiency and judiciousness for an immediate concern at the expense of all else. As the focus shifts, the mindset rebalances the after-tax cognitive resources and moves perceptions of value closer to its economic value (Shah et al., 2015, 2012). By repeating the classic WTP (willingness to pay) experiments (Thaler, 1985), the authors find a higher propensity to engage in trade-off thinking as income falls.

Understanding preferences in this context of altered cognitive mechanisms necessitates evaluating the decision-making problem itself. Erstwhile preference theories in economics predominantly assume a monolithic cognitive system of decision-making. The subjective values are considered outcomes of a unitary cognitive system perceiving probabilities, not accounting for mechanics and contextual features. Thus, the normative theories in microeconomics have presumed fixed preferences. This is quite different from psychology, where there is a broad consensus that human behaviour is a result of the interaction of two frames of thinking – the dual thinking modes (Cristofori et al., 2019; Evans, 2008; Miller and Buschman, 2015; Morvan and Jenkins, 2017; Thompson et al., 2009). However, economics has recently begun to recognise the fundamental role of attention allocation in choice theory (Bordalo et al., 2022; Gabaix, 2014; Maćkowiak et al., 2023).

Most research has focussed on proxying cognitive processing through cognitive and numerical abilities. Possibly the most influential study linking cognitive abilities to risk was done by Frederick (2005). He uses the cognitive reflection test to assess the level of thinking, risk preferences and time preferences. He also finds that more intelligent subjects are risk-seeking, even when it exceeds expected value maximisation. Burks et al. (2008) measure cognitive abilities and risk aversion and find a positive correlation between high abilities, low-risk aversion for gains and low-risk seeking for losses. Their results support the notion of preferences moving closer to expected value maximisation under rationality. This aligns with other, albeit statistically weaker, findings on increasing the likelihood of expected utility consistency as cognitive abilities rise (Herrmann et al., 2017; Jasper et al., 2013; Patalano et al., 2015; Wang et al., 2010). Similar results have been found by Dohmen et al. (2010) and confirmed in their follow-up paper (2018) using survey measures of self-reported risk measures. Focussing on specific elements of risk preferences within the prospect theory framework for medical decisions, Fraenkel et al. (2015) link status quo bias to lower numeracy levels. They conceptualise reduced biases to higher cognitive sophistication.

3.1.4 Bringing Together Scarcity, Cognitive Dual Process Theory and Risk Preferences

Recent research has begun including insights from dual process theories in decision-making. Kirchler et al. (2017) conducted a cross-national study on decision-making under time pressure in Sweden, the US and Austria. They found an increase in the reflection effect of Prospect Theory due to time pressure. They interpret these results as outcomes of an increased role of System-1 versus the deliberative, rational System -2. The results are again confirmed by Kocher et al. (2019). They look into correlates of expected value maximisation using time pressure and Raven's progressive matrices. They find significant effects of time pressure on rational preferences and a weak but significant relationship with IQ scores.

These contributions, when looked at from the System 1-System 2 lens, imply –

i. System 2, or the Deliberative system, perceives risk neutrally, thus mimicking EUT predictions.
ii. System 1 or Affect- heavy responses are driven by less effort and prone to biases.

While there is an active debate on the chronology and the form of interaction of the two systems (Diederich and Trueblood, 2018; Fudenberg and Levine, 2006; Grayot, 2020; Shiv and Fedorikhin, 1999), none of them undermines the fact that System-1 rapidly evaluates and ends up generating preferences before System-2 does (Dhar and Gorlin, 2013). In terms of risk preferences, under serial processing, System-1 assigns Prospect theory (PT) preferences, and then System 2 enters and

evaluates choices with Expected Utility (EU) parameters (Evans, 2003; Kahneman and Egan, 2011; Stanovich and West, 2000). In contrast, the parallel analysis proposes that System-2 combines EUT and PT with System-1, firmly directing the process through the complete process (Loewenstein et al., 2015; Loewenstein and O'Donoghue, 2004; Mukherjee, 2011, 2010).

The relative influence of each would depend on the extent to which they occupy essential cognitive elements like working memory (Dhar and Gorlin, 2013). Any manipulation or external stimuli would change the process and the choices made. Scarcity-led-cognitive load is one such involuntary force that changes things bottom-up. This understanding of positive and negative affect dimensions and the dual-process theory make room for studying choices that engage both systems and can be decomposed into cognitive and economic dimensions (Schonberg et al., 2011).

The standout feature of scarcity-enforced- cognitive load is the focus on what is scarcity relevant. This means the decision attribute is pivotal in determining where the focus dividend is felt. By "dividend", we suggest moving towards "economic rationality" and a greater deliberative System-2 heavy response. This automatically means that what is not scarcity-irrelevant gets tuned out purely due to this attribute. The "irrelevant" decision is an outcome of System 1 and is expected to be more "biased". Therefore, we expect a bifurcation in risk preferences by combining the scarcity-cognitive load and prospect theory literature. The degree of tunnelling (θ) is a function of the cognitive load and decision attribute (relevance) and has the following properties –

1. $\theta \in [0,1]$ depending on the degree of scarcity relevance - irrelevance and cognitive load.
2. $\theta = 1$ for a perfect rational-bias split, which may be possible under – scarcity-relevant decisions under a scarcity-led-cognitive load
3. $\theta = 0$ for no split in decisions which may be possible either as a result of insufficient scarcity relevance or an absence of cognitive load.

Current academic literature has begun to look at the overall effects of scarcity while barely addressing the underlying mechanism or the resulting bifurcation. The literature has begun to gain enough traction to generate broad academic interest, and parts of theoretical linkages have begun to be explored. Scarcity mechanism and the changes in thinking style layout a mediating role for the cognitive load. Financial scarcity can influence lifelong development outcomes and preferences through mental channels that remain relatively unexplored—these are over and above the documented social process, mental health, and heritable effects. The poverty-triggered mechanisms make economic decisions more difficult by curtailing cognitive control and leading to more impulsive,

mixed evidence of risk-averse decisions (de Bruijn and Antonides, 2021; Mullainathan and Shafir, 2013a; Schilbach et al., 2016; Spears, 2011).

Haushofer and Fehr (2014) found increased risk aversion due to poverty-related stress. Feelings of poverty affect discounting rates between work and entertainment in lab-in-field experiments in Uganda (Bartos et al., 2018). Similarly, Deck and Jahedi (2015) introduce cognitive load by asking participants to recall digit spans and find higher risk aversion and impatience as cognitive load increases. This finding is supported by Ong et al.'s (2019) work on debt relief and lower risk aversion. On the other hand, in a sample of Vietnamese micro-entrepreneurs, Dalton et al. (2020) found lower risk aversion with higher financial worries. Apart from these positive and negative effects, there is evidence of no impact too (Andersson et al., 2016; Gerhardt et al., 2016).

Survey measures on before and after payday for monetary versus nonmonetary tasks (Carvalho et al., 2016) find mixed evidence in the United States. Intertemporal choices are more present biased for financial rewards between the two periods, while no differences in risk-taking or cognitive functions were observed. Ongoing work reassesses these aberrations (Mani et al., 2020) and finds behavioural effects around paydays. Besides confirming the financial scarcity hypothesis by analysing cognitive functions before and after paydays, they also explain the inconclusive findings from Carvalho et al. (2016). They reason the surprising results principally due to two design issues – (i) Insufficient uncertainty in payday randomisations. To be eligible, the participants were required to give a detailed history and upcoming dates of payments for the duration of the study. This suggests a substantial absence of financial uncertainties in their lives, thus the insufficient magnitude of scarcity as a trigger force. (ii) High frequency of payments in their study setting. The design randomised time from pay date to study cognitive effects, risk, and intertemporal choices. However, the American households in the original study received up to four payments in their 1-month study period, out of which one incident was chosen randomly for the experiment. There is then a chance that the period randomly chosen for the "before" payday was very close to the expected, predictable payday. Therefore, there is a chance that the noise in treatment allocation design may drive their insignificant findings.

While recent theories (Adamkovič and Martončik, 2017) propose theoretical models that integrate poverty – cognitive load- executive functions- and decision-making, they miss the element of tunnelling and the selective reorientation of cognitive systems discussed in erstwhile literature (Mullainathan and Shafir, 2013a; Spears, 2011). This may be one reason behind the inconclusive evidence on risky preferences. Additionally, a study that looks at the complete mechanism for both gains and losses risk preferences remains to be seen, particularly for field studies (de Bruijn and Antonides, 2021).

Therefore, I address some of the critical gaps in the subject with my work. First, I add to the limited available evidence for "decision neglect" or "tunnelling" for a critical aspect of risk preferences for gains and losses. Second, I document the effects of the primary mechanism for the tunnel split - cognitive load and the decision attribute for both gains and losses. This answers a vital question of the underlying mechanism. Finally, after these conceptual clarities, I question how much this theoretical explanation holds up in the real world.

I add to the emerging literature that has begun to inspect parts of the framework in field settings. The telephonic version of the Stroop task on farmers in Brazil shows significant increases in cognitive load with scarcity levels and relevance (Lichand and Mani, 2020). Fehr et al. (2019) find partial evidence of “rationality” for endowment effects. Their randomized field experiment with 3000 farmers in Zambia found lowered exchange asymmetries when farmers are financially constrained. Additionally, their evidence supports the cognitive mechanism of scarcity. They use seasonal differences in the harvest cycle and show higher decision stakes in the scarcity-laden- lean season, increasing the propensity to trade.

With these contributions in mind, I seek to provide a conceptual, empirical account that proposes a single phenomenon, financial scarcity, as the underlying cause for various economic decisions and behaviours. This is achieved by identifying two fundamental psychological mechanisms: tunnelling and cognitive load. I add to the existing literature by moving the analysis of decision-making under poverty closer to reality and reassessing the process. The different strands result in the following overarching research question -

How does scarcity-led-cognitive load alter risk preferences?

To answer the research question, in the next section, I detail a conceptual framework that links the scarcity theory with the risk and risk preferences working through the mechanics of cognitive load, attentional processes and the dual system framework of cognition. Next, I discuss the study design that seeks to answer the primary research question and the emerging hypotheses. Following this, I describe summary results and analysis to lead into the concluding discussion.

3.2 Scarcity, Cognitive Load, Risk and Loss Aversion: Conceptual Framework

In this section, I set up the theoretical framework and possible explanations in the literature to answer the research question. The discussion begins with a summary of the scarcity theory, followed by a short discussion of the available empirical models that examine the interaction of cognitive mechanisms with risk preferences. Next, I delve into alternative theories and place them in the context

of the previously proposed top-down- bottom-up conceptual framework of tunnelling in scarcity. Finally, I map how risk preferences change when the cycle is operational (Figure 24).

As detailed in the previous chapter, decision-making under scarcity is characterised by two phenomena – *cognitive load* and *tunnelling*. Cognitive systems are redirected to meet urgent, unmet needs. Thus, scarcity-relevant choices get disproportionately more deliberative thought, making them System-2 heavy to be maximally "efficient". This disproportionate focus on what matters comes at a cost. As mental resources are pulled involuntarily towards the relevant needs, capabilities left for other choices that may not be directly relevant to the scarcity at that stage reduce. Therefore, scarcity-led psychological *cognitive load* triggers a mechanism where resource efficiency is at the cost of other biased choices.

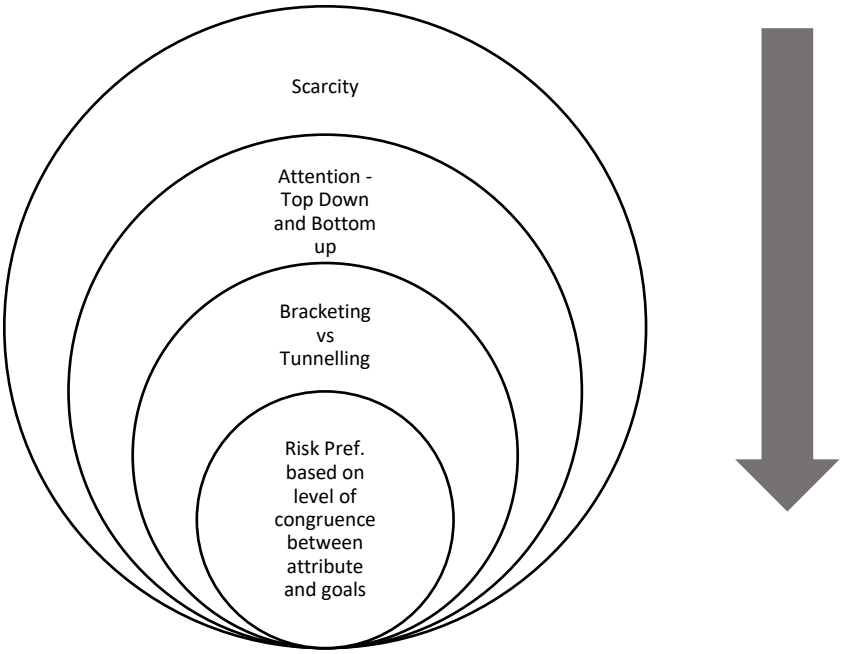


Figure 24 Sketching the Conceptual Framework

Within the theory, this efficiency is a function of the choice attribute. The extent to which that choice is relevant to the scarcity at hand would determine the attentional weight it receives. In such a scenario, given that the total resources are limited, other choices receive less deliberative attention and are likely to be outcomes of greater affective or system-1 functioning. This simultaneous realignment of cognitive resources based on scarcity relevance is *tunnelling*.

Decision-making is, thus, an interplay between the two thinking systems. Recent literature has begun looking at risk preferences as a result of dual system models (Kahneman and Frederick, 2002; Stanovich and West, 2000). The two systems are broadly conceptualised by their key characteristics.

System 1 is fast, affect-driven, and automatic, while System 2 is the thoughtful, deliberative, controlled, slow system.

Mathematical models on the interplay of thinking modes begin with defining the total utility of a prospect as a functional combination of the two systems. Mukherjee (2010) proposes a model of risky decision-making where the total value of the gamble ($V(G)$) is guided by a combination ($\oplus$) of the deliberative ($V_D(G)$) and the affective system ($V_A(G)$) –

$$V(G) = V_A(G) \oplus V_D(G)$$

He proposes the parameter γ, defined as the level of involvement of the affective system in the decision-making under risk. The weight to the affective system, γ can range from 0 (no affective component) to 1 (wholly guided by System 1). The factor depends on three characteristics - individual thinking styles, the emotional nature of outcomes and how the task is construed. The preferences would then be dependent on the level of joint system engagement. In the follow-up paper, Mukherjee (2011) finds evidence for cognitive load manipulations and affective priming on the value function. First, he shows that cognitive load increased the likelihood of use of System 1. More importantly, he finds affective system increases the concavity of the value function, thus, higher risk-averse behaviour.

Similarly, Loewenstein et al. (2015) proposed an alternative model where the balance between the two systems is moderated by willpower. Cognitive effort feeds into the willpower function ($h(W, \sigma)$). The weight of functioning on System 1 depends on the level of willpower depletion. Diederich and Trueblood (2018) take it further by evaluating these models on experimental data in a dynamic setting to look for the nature of the interaction of the two systems. They found support for a two-separate-stage decision process where System 1 guided choices are more prone to prospect theory predictions while System 2 is in line with the rational predictions of Expected Utility Theory.

The dual process theory is supported by neural and behavioural evidence. The former was chosen inordinately when the emotional amygdala was activated for choices between sure options and lotteries. At the same time, more rational behaviour was seen when there was an increased activation of the prefrontal cortex (De Martino et al., 2006). Correspondingly, De Martino et al.'s (2006) and Guo et al.'s (2017) experimental data showed higher framing effects under time pressure. They showed behaviours primarily driven by System 1 and lower deliberative engagement of System 2 when time pressure increased. While these have looked at static effects of the functioning of the dual system, more recent works have begun linking at the allocation of selective attention and risky choice theory.

Pachur et al. (2018) find causal correspondence between gain and loss, attention and differences in the risk aversion parameter. They plot changing value function slopes as attention varies. Additionally, they find the role of internal disposition in guiding the role of attention in choice formation. This internal disposition, they conclude, can be a key factor in modulating individual differences in the aversion-attention relationship.

One of the factors that can guide the internal disposition is goals. As discussed in Chapter 1, the deliberative part of System-2 retains, guides, and plans goals (Miller and Buschman, 2015). In a world with no exogenous variations, these internal goals would predetermine the weight of attentional allocation and hence the decisions made. However, in the real world, where decision-makers face multiple choices with many attributes, some characteristics of those decisions may be in line with his/her goals, while some are not.

Two theoretical channels and decision theories have been proposed for the two mechanisms of attentional allocation. The first is the top-down channel (TD), and the other is the bottom-up (BU) (Engelmann et al., 2021). Recalling the discussion from the previous chapter, top-down is the endogenous, agent-specific attentional mechanism which accounts for goals, expectations and is in more direct control. In contrast, the Bottom-Up mode is an exogenous mode of attentional redirection, guided more by the immediate capture by virtue of some characteristic of the choice itself. As pointed out by Bordalo et al. (2022, 2020, 2012a, 2012b) in their salience theory, it could be the novelty of choice, its prominence, its contrast or surprise. The most relevant information gets overweighted in the erstwhile cognitive processing balance in their bottom-up guided decision-making formulation. Selective attention can therefore be focused on the most task-relevant stimuli. The models propose a competitive mechanism where the Bottom-Up force is so strong that initial top-down goals are neglected in light of the complete attention capture. This type of top-down – Bottom-Up interaction, where Bottom-Up determines perceptions, side-lines goals and supersedes top-down, operates at a within-subject level (Engelmann et al., 2021) and is shown to direct attention to attributes that capture attention and are ultimately chosen.

Broadly, two clear lines have been drawn between goal-directed and stimulus-driven (Corbetta and Shulman, 2002), dependent on how the brain processes the two attentional processes. Now, while it is known that both Top-Down and Bottom-Up play specialised roles in decision-making (Orquin and Lagerkvist, 2015; Orquin and Loose, 2013), there are only limited unified models that bring the two mechanisms together. Kluwe- Schiavon et al. (2017) and Engelmann et al. (2021) propose dynamic and empirical studies that look at their interplay. While Engelman et al. (2021) experimentally prove the separation between agent-specific (Top-Down) and Decision-specific variation (Bottom-Up) and

their contributions to the choice variable. Kluwe- Schiavon et al. (2017) extend the partitioned Dual Process Theory model and hypothesise an interactive model where executive functioning plays an adaptive role. They conceptualise cognitive systems away from the straitjacketed System-1 – System-2 duality to a more continuum-like process. It balances the System-1 (automatic) and System-2 (controlled) state when faced with a bottom-up salience state. In this way, it acts as a mediator by providing the most efficient balance of attention between the two states.

Therefore, when salient choice triggers the Bottom-Up mode of attentional capture, the pro-active executive function coordinates for attributes that align with the Top-Down goals. For those relevant choices, goal-oriented behaviour is instigated. Thus, there is a net Top-Down functioning. The decisions receive a bulk of Controlled- System 2 processing. Parallelly, given that the total System-2 capability is fixed, other irrelevant attributes receive the bulk of System-1 functioning. The split between the outcomes from the two mechanisms depends on how much executive function can sense goal relevance from Bottom-Up attention and how much it can pull towards System-2 processing after sensing congruence with Top-Down goals.

It is not a zero-sum game between the Top-Down and Bottom-Up mechanisms and the Automatic (System-1) – Controlled (System-2) duality. Decisions depend on the strength and congruence between goals and the salience of goal-relevant attributes. If the goal-relevant information is salient, the executive function assesses the congruence with the Top-Down mechanism and allocates the bulk of controlled System-2 processing. If the two are perfectly congruent and robust, then choices perfectly coincide with the region (a) on the goal-oriented, System-2 rational behaviour line (Figure 25). It is possible that sometimes the two are not strong enough to pull towards a complete System-2 functioning, and then the level would fall in quadrant 1.

In contrast, for goal-irrelevant attributes, choices get predominantly guided by automatic System-1. If all System-2 resources are completely occupied for resolving goal-relevant decisions (Region a), then there is a perfect split, and all irrelevant needs get System-1 and fall into Region b. Correspondingly, if not an outcome of complete, but a majority of System-1 functioning, they fall in quadrant 2.

I refine this core framework from Chapter 1 by bringing in additional heterogeneous forces that may moderate the extent of Top-Down - Bottom-Up interaction. Until now, attentional capture from the Bottom-Up scarcity relevant attributes leading to “rational” choices would be seen if it perfectly aligns with the Top-Down goals and the cognitive effort required is enough to trigger the mechanism. However, there may be situations when that will not happen. Within the theory, the differential

cognitive impacts of (i) the domain (gains, losses) itself and (ii) choice-making in probabilistic (the probability weighting function) versus outcome space may have a role in this.

First, as compared to gains, losses motivate more cognitive effort even after controlling for noises (Levin et al., 1998; Massar et al., 2020; Pachur et al., 2018; Yechiam et al., 2019, 2015). This implies for equivalent choices, there is an increased attentional allocation for losses. They are weighted more heavily. As Wakker (2010) suggests, they require more cognitive functioning on account of the strengthened feelings due to the domain nature itself. In the context of my framework here, it means keeping all other attributes the same, the bottom-up attentional force would be stronger for losses than gains. A similar reason has been put forth in the literature on comparing the cognitive effects of probability weighting and outcomes. Probability weighting requires more cognitive effort than simple choice-making for riskless or risky outcomes (Wakker, 2010). This may explain more robust support for the relationship between probability weighting and cognitive mechanisms and, at best, mixed findings for risk preferences for losses and gains (Lilleholt, 2019).

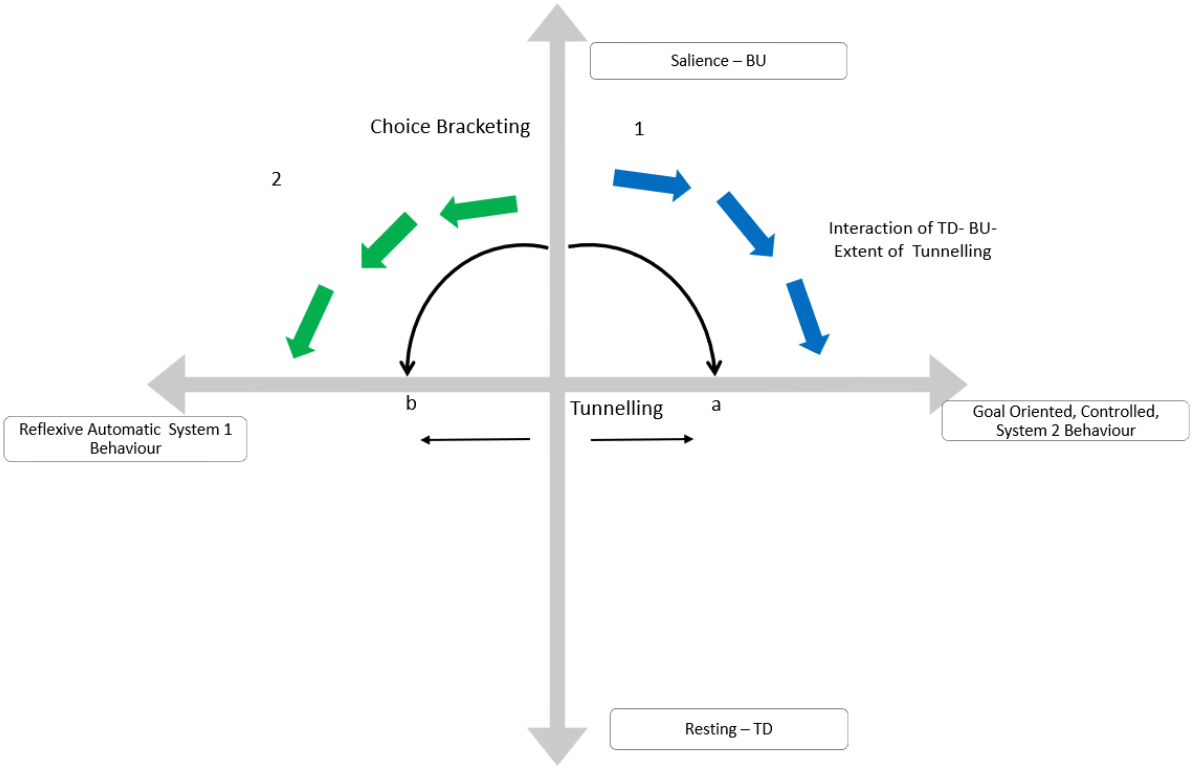


Figure 25 Interaction of System 2-1 mechanisms and the Top-down – Bottom-up attentional processes

Explaining these in the context of the Top-Down - Bottom-Up interplay means that scarcity-relevant probability weighting for losses will have the strongest Bottom-Up attentional force, followed by probability weighting for gains, loss outcomes and then gains. This is key to understanding how and whether the follow-up interaction with Top-Down will move in the conceptual direction. While part of the probability weighting for gains and losses has been discussed in the previous chapter, here I will

focus on the impact of losses versus gains outcomes and what happens when the Bottom-Up force itself may not be strong enough to trigger the neat split to a and b (Figure 25).

From the restive Top-Down state, scarcity imposes an involuntary cognitive load (Figure 26 (A)), and goals for resolving the scarcity are set. As discussed, cognitive load is absorbed by System-2, reducing the strength of the remaining total available Top-Down resources. Next, functioning with these taxed abilities, the decision-maker faces choices with different attributes – some relevant to the scarcity at hand and some irrelevant. The salient scarcity relevance attribute captures attention in a Bottom-Up manner (Figure 26 (B)). The relevance stimulus imposes a counteracting bottom-up force on the conscious top-down process. Finally, on sensing the congruence between scarcity goals and what is salient (scarcity relevance), the cognitive Executive Function directs the bulk of System 2 functioning in a Top-Down manner. Simultaneously, all others are Bottom-Up mechanism-heavy and are more likely to be System-1-heavy (Figure 26 (C)). This concurrent perfect bifurcation, or *tunnelling,* would split choices into economically rational (System-2) and biased (System-1) preferences. As discussed in the literature review section, theoretically, this would imply $\theta = 1$.

When facing choices in the real world, there is a possibility that the strength of salient attributes or the pull of goal-relevant System-2 attention is not enough for a perfect decision tunnel to form (Quadrants 1 and 2, Figure 25). The split or tunnelling would lie between 0 and 1 in such a scenario. It is here that the strength of the Bottom-Up force becomes pivotal. When facing outcomes in either gains or losses domains, it is possible that the Bottom-Up level is insufficient to match congruence with Top-Down goals and begin the tunnelling mechanism. This could be a result of the nature of choice or insufficient salience. While I have discussed the latter factor in the previous chapter, here I focus on the former.

Given the decision attribute, gains attract less attention than losses. Therefore, for a cognitively loaded decision-maker, the Bottom-Up force from losses would be stronger than gains, hence more likelihood of goal integration with the Top-Down forces and the tunnelling mechanism. In a scenario where the Bottom-Up force is not strong enough, attention would be guided in isolation without integrating with the broader goal of meeting the scarcity at hand. Therefore, narrow bracketing of choices would take primacy over the deliberative, efficient thinking like a “trader”, which reduces loss aversion (Sokol-Hessner et al., 2009). Choice bracketing is a behavioural response to meet self-control goals and is correlated with cognitive capacity limitations (Koch and Nafziger, 2019). The more the decisions are evaluated in isolation, the more likely they are to be risk-averse in gains (Rabin and Weizsäcker, 2009). Therefore, when the congruence between initial Top-Down goals and Bottom-Up forces is not enough, scarcity-relevant choices may result in narrow bracketing where there is an

increased risk aversion for gains (Figure 25). The opposite holds for losses. Because losses themselves have a more substantial attentional effect, it is more likely that there is an interaction with Top-Down scarcity goals. Thus, more likely to trigger a tunnelling effect and more System-2-guided choices for scarcity-relevant decisions as compared to irrelevant attributes.

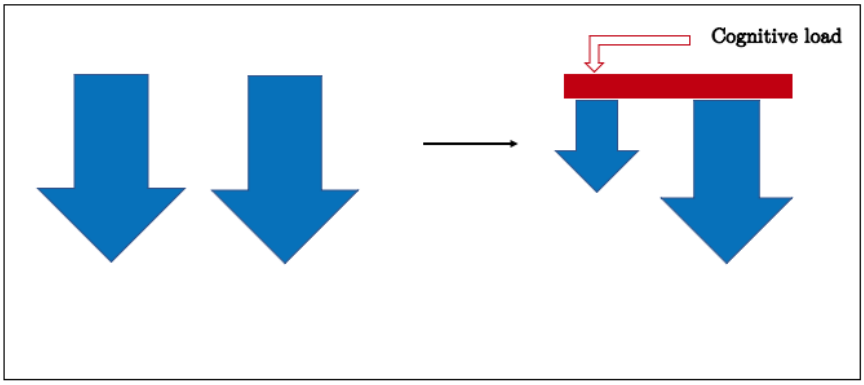
I look at the scarcity-triggered cognitive load and the point at which tunnelling begins to exert its splitting effect on the risky choices for gains and losses. Given the mechanism sketched in this section, I hypothesise an increasing degree of *tunnelling* when the congruence between scarcity relevance and goals increases. I can derive the following testable primary and secondary predictions with this framework.

1. For losses, in tunnel (scarcity-relevant) choices are less risk-seeking than scarcity-irrelevant decisions.
2. For gains, in tunnel (scarcity-relevant) choices are closer to risk-neutral or Expected Utility Theory predictions than scarcity-irrelevant decisions.
3. For both gains and losses, the difference between scarcity-relevant and irrelevant choices (tunnelling) increases with scarcity.
4. The tunnelling effect is larger for losses than gains.

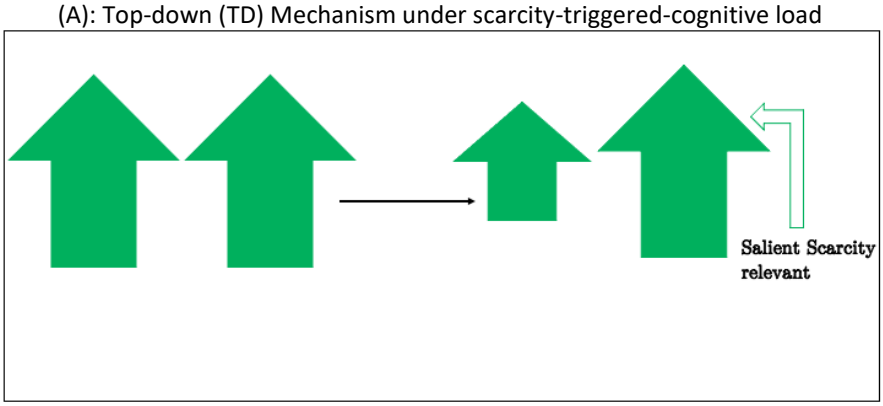
Along with the predictions, some open questions remain about the comparative effects of different elements of the mechanism like –

5. The nature of scarcity on tunnelling: That is, the level of impact of expected (natural, seasonal) and artificial priming (unexpected, shock) on choices and tunnelling.
6. The components of cognitive load: Do Inhibitory control-attention and working memory affect the mechanism in different magnitudes?

In the next section, I detail the study design of the experiment on the field to explore these open questions and the hypotheses. After the short discussion on the methods, I move into the empirical findings and place them in the context of the predictions here.



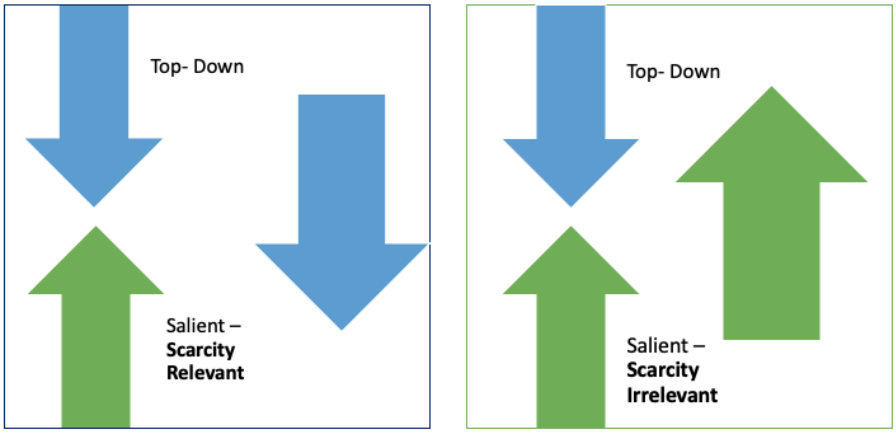
(A): Top-down (TD) Mechanism under scarcity-triggered-cognitive load



(B) : Bottom-up (BU) Mechanism of salient scarcity relevant decision attribute

System 2 heavy - Net Top down – **Rational**

System 1 heavy – Net Bottom up – **Biased choices**



(C)

Figure 26 The Scarcity Mechanism in Action

3.3 Study Design and Implementation

I present the experimental design in three subsections. First, I briefly describe the common elements from the previous chapter, timelines, and fieldwork implementation. Second, I detail the risk preference-specific tools within the overall experiment used to answer the research question. Finally, I describe the outcome variables of interest and how they feed into the follow-up analysis.

While this paper shares many of the elements from the previous chapter, it differs in what it intends to achieve. Here, I focus on the impact of financial scarcity on risk preferences. I break down the

research question into three elements in chronological order – (i) the cause - the role of scarcity, (ii) the mechanism - cognitive instruments, and (iii) the effect – a decision-attribute-dependent risk preferences. As can be seen, the first two elements are common and have been described in detail previously. The Eckel Grossman task is embedded in the same design and script as the first paper and follows right after the measure for probability weighting.

3.3.1 Common Elements of the Design

I implement a lab-in-field between-within-subject experiment in Bwikhonge, Uganda, a predominantly rural agrarian region. I combine natural instruments with artefactual experimental methods to determine scarcity's differential impacts. A decision-maker may face three financial shortfalls through the year –cyclical, seasonal periods of plenty and shortfall, unexpected shock, or a combination of the two. To identify all three, I cross the distinct lean and plenty periods of the annual harvest cycle of the region with priming for unexpected scarcity for randomly assigned groups in both phases. The four levels cover the permutations of the scarcity possible and give us a 2*2 between-subject design at the treatment stage (Table 20).

Table 20 Experimentally designing for scarcity

Scarcity as a force	Natural scarcity	Priming	Treatment variable
Lean only	Yes	No	Expected scarcity only
Lean and primed	Yes	Yes	Full treatment
Plenty only	No	No	Control
Plenty and primed	No	Yes	Unexpected scarcity only

The priming scenarios are intended to investigate the role of shock and unexpected scarcity in risk preferences. I use the work of Shah et al. (2018) on characteristics of financial scarcity to design the priming treatment for my experiment. In a series of online experiments with American participants, they find for those struggling financially, thoughts about money are omnipresent, challenging to suppress and easily triggered by unrelated activities and change associations. They also find that financial scarcity adds an economic angle to everyday life as it interferes in all spheres. With limited slack, they find continuous, background monetary considerations even in scenarios that may not explicitly have one. Their findings underscore the spontaneity of monetary thoughts for those dealing with scarcity.

I explored the existence of these characteristics in a field setting in a low-income country like Uganda by introducing three hypothetical thought scenarios. Using natural variation in scarcity gives me the advantage of seeing the differences across treatments. I introduce three hypothetical thought scenarios for half of the randomly selected individuals in both the lean and the plenty periods. Each

scenario readout is followed by one of the two self-report measures - a 5-point Likert scale-type question or the first three concerns on the mind after the experimenter narrates the scenario.

The first scenario for the treatment group is the easily triggered nature of scarcity. Using past weather reports on crop failures, I set up a scenario of possible regional locust attacks. I asked the participant to rate the level of concern from the fictional situation. Next, I describe a treatable medical ailment to get the unprompted, persistent nature of scarcity, and the subjects report the first three thoughts. Finally, I ask them about the significant expenditure in the next six months and the level of concern about it. The three questions together prime the participant with an additional *shock* priming and tap into the features of scarcity.

Correspondingly, the control group gets three readouts of equivalent word count to maintain time parity between the treatment and control groups. The critical difference is that they lack any mention - direct or indirect, unanticipated scarcity. This is to ensure that the scores on the follow-up cognitive load test are not due to the fatigue from the effort that the treatment group may have spent answering the scenarios. The three questions for the control group have a similar combination of response modes, with the first one asking to rate the amount of fun they had last time at a village feast on a scale from 1 to 5. The second one on three people they would like to share free grocery vouchers invite for an upcoming dinner party. Finally, the third question asked them about the last socialising event they attended and how much fun they had at that get-together.

For experimental sessions in both the lean and plenty seasons, the participants are randomly assigned to either the treatment or the control group, giving us four combinations of natural and primed scarcity. At this 2*2 between-subject level, the experimenter reads the respective scenarios dependent on the allotted group and notes the answers in the response sheet.

Next, given my interest in understanding the psychological mechanism triggered by scarcity, I introduce the cognitive load test for all subjects. Once the task is done, all participants proceed to the two-question cognitive load test. It is intended to measure the tax on attention, inhibitory control and working memory due to the four levels of scarcity. Though there are field limitations and literacy constraints, in consultation with the field partners and through extensive discussions, I was told that the participant population had basic counting numeracy experience. After piloting various standard tools, I shortlisted the numerical version of the Stroop and Digit Span tests for use in the experiment.

I administer the numerical Stroop test wherein the participants first count the number of triangles between 1 to 5 in a 15-row - 5 column sheet, then count the number of digits in the sequence, not the numerical value of the digits in the same format. The experimenter notes the mistakes and the reading

time for both conditions. For example, in the congruent condition, the participants see ΔΔ (2) triangles in one of the cells of the 15*5 table. Correspondingly, in the incongruent condition, they see sequence 33 in one of the cells in a table of a similar format. The correct answer to the latter would be 2 and *not* 3. This ability to control the impulse to respond 3 instead of 2 is assumed to be directed by the cognitively controlled selective attention process.

Having obtained a measure of attention and inhibitory control, I move to measure the second cognitive element of Executive function - memory. Its key feature is encoding, holding, clubbing, and recalling information. Though it has multiple components, like visual-spatial and verbal, all can be clubbed broadly into working memory and short-term memory. While both hold the information, working memory makes manipulation of that information possible. It guides the use of stimuli before it is stored in the more permanent long-term memory. In a limited cognitive system, short-term memory and working memory guide the temporary storage and use of information (Diamond, 2013). Together they process real-time information to act and, unlike long-term memory, are not dependent on learning or rehearsal. Additionally, any post-retrieval active use of information from long-term memory is guided through the working memory.

Working memory is of crucial interest in understanding the cognitive impacts of scarcity as it is the component that is limited by load capacity (Cowan, 2008; Diamond, 2013). I use the Forward and Reverse Digit Span test to measure the effect. The experimenter reads a series of random numbers at a fixed pace to the participant and then asks them to repeat the numbers in the same (forward) or reverse order. The series of numbers gets longer with every correct response, and the final score is the longest span that was recalled accurately. Compared to a verbatim recall and repetition, the reverse span requires the subject to store the digits in the order they hear it and process it in the correct *backwards* manner. Therefore, the forward version taps and primes the short-term memory, and the backwards span additionally uses the working memory to manipulate the stored information. The task does not require complicated equipment to administer. The experimenter only needs to note the maximum span of digits the participant could repeat back in the forward or reverse order accurately.

Scarcity has two casualties – cognitive load and its effect on decision-making. Having discussed the tools for measuring the cognitive impact, I now lay out the risk preference task and the design element for tunnelling.

3.3.2 Risk Preferences, Decision Attribute and Tunnelling

Finally, I measure risk preferences independently for gains and losses to identify the outcome effect by implementing the Eckel Grossman-ordered lottery task twice for the same participant. The only feature setting the two apart is the relevance to scarcity. Given the decision attribute and controlling for all individual-level noise, any simultaneous difference in probability weighting would indicate a split in preferences or *tunnelling*. I end the experiment with a survey that collects data on basic demographics and psychological well-being.

The idea of risk preferences is regarded as one of the critical building blocks of studies on economic decision-making. While the measurement of risk preference has a long history, there is no solid consensus on how it should be measured. The choice of measure depends on the intent, field setting, participants' numerical skills and logistical concerns (Dave et al., 2010). They may vary on incentives, complexity in terms of task design, the time required, fineness of measures, stability, and link to theories.

In this section, I describe the method for tracking the decision effects on risk preferences due to the scarcity-induced cognitive load. First, I briefly describe each method's key insights, strengths, and weaknesses and detail the approach that best fits my research aim and field setting. Next, I discuss the design element added to my chosen method that gets at the second key effect – tunnelling based on relevance to the scarcity at hand.

The first broad categorisation is between survey and incentivised measures (Eckel, 2019). Survey measures can be multi-question domain based like the German Socio-Economic Panel (Dohmen et al., 2011; Wagner et al., 2007) and the Domain-Specific Risk-Taking scale (Blais and Weber, 2006). The question sets ask the responders to self-report their willingness to take/avoid risks in multiple domains of their lives, like leisure, sports, and finances. While the responses correlate well with real-world behaviour and measures from standard experimental tasks, concerns remain regarding economic incentives to respond honestly, thus making them unreliable sources of primary risk measures.

However, incentives are critical in economic measurements on the grounds of possible misrepresentation by the responders in their absence. Several measures have been developed that can be broadly categorised as - valuation, choice and framed incremental tasks. Valuation tasks like the Becker-Degroot-Marschak procedures are some of the earliest developments in measuring risk preferences. The tasks require the subjects to state the minimum price they are ready to pay to sell the lottery back to the experimenter. Then, a price is randomly generated from a uniform distribution.

If the stated minimum price is less than the randomly generated one, the participant sells the lottery at that price. If it is larger, then they can play the lottery to determine their earnings. This is done for 10 – 20 lotteries which are then used to determine risk aversion. The method has also been extended to determine certainty equivalents in more complicated methods (Abdellaoui et al., 2011).

Choice-based tasks are methods where the subject must choose between or among lotteries. The most prominent method under this ambit is the Holt and Laury (HL) paired lottery lists (Holt and Laury, 2002). The task requires the participant to make 10 decisions between lottery A and B where A is safer than B and the pairs are presented in order of increasing expected values. Subjects begin with A and switch to the risky B at any of the 10 lotteries. A risk-neutral subject would start with A and, after the midpoint, switch to B. The switch point is a measure of individuals' risk preferences. Assuming constant relative risk aversion (CRRA), this point estimates the risk parameter interval (r). The method is one of the most popular methods in the subject. It has been used in various contexts and versions – joint estimation of time and risk preferences in Double price lists (Andersen et al., 2008), probability weighting and value functions (Tanaka et al., 2010). Despite its popularity, there is a consensus that the method is fairly complex, leading to considerable data loss due to inconsistency emanating from multiple switching points (Charness et al., 2013; Crosetto and Filippin, 2016).

A simpler, coarser alternative to the HL method is the Eckel-Grossman Method (EG) (Eckel and Grossman, 2002). The participants are presented with a set of low and high payoffs with an equal 0.5 chance. In the original version, there are 5 lotteries with increasing risk from 1 to 5, and the decision-makers need to pick 1 of the 5. This version made it difficult to differentiate between risk-neutral and risk-seeking behaviours (Crosetto and Filippin, 2016). The most recent version (Dave et al., 2010) corrected that. The authors introduced a sixth lottery with the same expected value as lottery number 5 but with more variance between the safe and the risky payoff. This allows separating the mildly risk-averse from risk seekers. However, risk-neutral and seekers cannot be entirely differentiated as theoretically they would be indifferent between lottery 5 and 6 (Charness et al., 2013). The risk coefficient can be calculated using the CRRA function with $U(x) = x^{1-r}$ with r representing the risk parameter. The measure has been used to show the difference in risk-averse attitudes between men and women (Eckel and Grossman, 2008). It significantly correlates with other methods in field experiments (Reynaud and Couture, 2012), even in populations with limited quantitative skills (Dasgupta et al., 2016).

Another simple group of methods are framed incremental methods like the investment game (Gneezy and Potters, GP) (Gneezy and Potters, 1997) and the Bomb Risk Elicitation tasks (BRET) (Crosetto and Filippin, 2013). In the former, subjects allocate the given allotment to a lottery that pays 2.5 times the

amount invested with a 50% chance and 0 otherwise. A risk-neutral subject would invest all of his/ her endowment. The invested amount would be lower for the more risk-averse subject. Therefore, the task cannot differentiate between risk seeking and neutrality and tends to overestimate risk averseness.

The bomb risk task, on the other hand, asks the subject to specify the boxes up to which they would choose to collect. Any of the boxes could contain the “bomb", nullifying all the earnings. Risk preferences are measured by the number of boxes the subjects choose before starting the game. It also biases risk averseness upwards (Crosetto and Filippin, 2016). The task, though intuitive, has limited field applicability as it cannot be administered with pen-paper with a sample with limited literacy as the participants may have difficulty grasping it.

Given the wide range of tools available, it is evident that some tradeoffs need to be made when choosing the method for risk preference elicitation. Comparing the most prominent methods – Holt-Laury, Gneezy-Potters and Eckel-Grossman, Dave et al. (2010) suggest the numerical skills of the participant should dictate the complexity of the method to be used. While more complicated methods give finer estimates but also generate noisier parameters with a subject population that is not as literate. Overall, they find evidence favouring Eckel-Grossman for a field population with not-so-sophisticated mathematical skills.

In line with these critical assessments of the methods and detailed discussions with the team at Field Lab, Uganda, I chose to use the Eckel-Grossman task in both gains and losses for my experiment. The choices are presented in Table 21 for gains and Table 22 for losses. Choices for both domains are increasing in expected values and variance. The participants do not see this information and are only presented with equal probability payoffs. They pick one out of the six options. A highly risk-averse subject would pick gamble one and take the sure amount. A moderately risk-averse person would choose between 2 to 4, while risk neutral would pick 5, and a strictly risk-seeking participant would pick 6.

Table 21 Eckel Grossman Choices, Gains in Ugandan Shillings (UGX)

Choice	Low payoff	High payoff	Expected value	Standard Deviation	Implied CRRA range
1	5600	5600	1600	0	3.46<r
2	4800	7200	2000	1200	1.16<r<3.46
3	4000	8800	2400	2400	0.71<r<1.16
4	3200	10400	2800	3600	0.50<r<0.71
5	2400	12000	3200	4800	0<r<0.5
6	400	14000	3200	6800	r<0

The coefficient of risk aversion is calculated by assuming CRRA. (Low and High payoff probability = 0.5)

Table 22 Eckel Grossman Choices, Losses in Ugandan Shillings (UGX)

Choice	Low payoff	High payoff	Expected value	Standard Deviation	Implied CRRA range
1	1600	1600	1600	0	3.46<r
2	800	3200	2000	1200	1.16<r<3.46
3	0	4800	2400	2400	0.71<r<1.16
4	-800	6400	2800	3600	0.50<r<0.71
5	-1600	8000	3200	4800	0<r<0.5
6	-3600	10000	3200	6800	r<0

The coefficient of risk aversion is calculated by assuming CRRA. (Low and High payoff probability = 0.5)

I extend the original Eckel-Grossman design to track differences due to scarcity relevance or tunnelling. Tunnelling operates at an agent-specific level. The relevance of attributes and their congruency with Top-Down goals can affect each subject differently. Thus, making the hypothesised splitting because of attentional capture by relevant attributes a within-subject phenomenon. To capture this, each subject faces the Eckel-Grossman task for two attributes – one relevant for scarcity and the other irrelevant. The prospect lists are identical in all aspects but the decision attribute. Keeping the payoffs the same, I design for relevance by changing the payoff use case. The scarcity-relevant decision is paid off on the day of the experimental session, and the irrelevant is paid 5 months after the session. Subjects in each scarcity treatment group get identical five common consequence ladder pairs twice, only differing in payoff-use case – for the same period (Decision Card Y) and five months hence (Decision Card Z). Therefore, at a subject level, we get one choice for each attribute, giving us two decision points (1 for scarcity-relevant decisions and 1 for irrelevant) separately for gains and losses.

Table 23 Designing for Scarcity Relevance

Scarcity Treatment Group	Period of decision making	Payoff Period	
	Lean – Period 1 Plenty – Period 2	Relevant (Card Y)	Irrelevant (Card Z)
(Lean, Primed)	Period 1	Period 1	Period 2
(Lean, Control)	Period 1	Period 1	Period 2
(Plenty, Primed)	Period 2	Period 2	Period 1
(Plenty, Control)	Period 2	Period 2	Period 1

A participant primed in the lean season, facing Decision Card Y, would use the payoff to alleviate the Scarcity at hand in the same period (Period 1 – lean). Thus, the payoffs from decisions made here can be used to resolve how much scarcity they feel, making them Scarcity relevant (Region a, Quadrant 1, see Figure 25). When paid off 6 months from the lean season, i.e., in the plenty season (Period 2), the same payoffs would not help address the current shortfall. These decisions would become Scarcity irrelevant (Card Z). Theoretically, these would fall outside the Scarcity induced decision tunnel (Region b, Quadrant 2, see Figure 25). The corollary holds for the second part. The order gets reversed for a

participant in the plenty season (Period 2). Outcomes from Card Y would be paid off in that period, and those from Card Z in Period 1.

Additionally, Dohmen (2012) has looked at overlapping, shifting, and overlapping-shifted design for measuring discount rates across various time horizons. They compare payoff delays for three periods - 0 & 6 months, 0 & 12 months and 6 – 12 months. This interchangeability sidesteps potential conflation with time preferences. People were found to be more impatient for 0- 6 months than 0-12 months but similarly impatient for 6 for 12 months compared to 0 to 6 months. Therefore, the lean-plenty- lean cycle of 0-6 and 6-12 months in payments would have similar time discounting rates.

Therefore, given the scarcity treatment group, each subject makes two rounds of Eckel Grossman decisions, one for scarcity relevance (Decision Card Y) and another for irrelevance (Card Z) (Table 23). Differences in choices for each treatment help understand the risk preference. The choice number, from 1 – 6, indicates increasing risk-seeking and hence, attribute-based- risk preferences. As all other heterogeneous variables are controlled for, the difference between such choices would result from attributes alone. Therefore, this intervention gives us a within-subject measure of the extent of tunnelling in risk preferences. The comparisons indicate the degree of realignment, thus testing the primary set of hypotheses for the two domains.

3.3.3 Post Experiment Survey

I finish the experimental session with a short post-experiment survey with three core modules – respondent characteristics, risk preferences in different domains and psychological well-being (Haushofer, 2019). After completing the decision-making tasks, the participant's essential demographic characteristics like gender, age, level of education, land holding, household head and marital status are noted.

The participant then answers four questions taken from the German Socio-Economic Panel (SOEP) (Giesselmann et al., 2019). The multi-dimensional, socioeconomic national survey has a history of over 35 years. The survey rounds collect data on institutional, life satisfaction, domain-specific risk, fairness, and other social variables. Of all the modules of the extensive survey, I use the risk questions across four domains – general, finances, leisure time and health. The participants rate their willingness to take risk in each domain on a scale of 0 to 10, with 0 being completely unwilling and 10 very willing to take risks. I discuss the reasons and implications for doing so in the next chapter, where I detail risk preferences in my experiment.

Finally, I take forward Haushofer's (2019) survey on psychological poverty loops and well-being in Kenya and include elements of the life satisfaction version of the World Values Survey, Perceived Stress Scale (Cohen et al., 1983) and the CES-D self-reported scale of depression (Radloff, 1977). After repeated discussions and iterations with the field team, the modules were cut down to include the most regionally relevant and informative questions. Given the paucity of time, regional sensibilities and keeping the entire experimental session under manageable hours, I do not include the entire survey from Haushofer (2019).

After surveying both the scarcity treatment and control groups in the two seasons, I sum the responses from each module into a total score. I reverse-coded all responses to a uniform scale such that higher total scores correspond to higher worries and stress. Then, I standardised (z-scored) the total summed scores. These subjective well-being measures are combined into a single psychological index by calculating the standard weighted average. Every question from the 5 components is indexed for each respondent following Anderson's (2008) inverse covariance matrix method (swindex). The summary index uses the generalised least squares weighting procedure (GLS). Within the method, first, highly correlated variables are weighted down. Other variables that are less correlated and hence contribute more information get more weight. The generated index is then standardised. I use this index as an indicator for the overall marker for psychological well-being for the complete scarcity cycle[9].

Next, I describe the field and experimental procedures. I begin with detailing the pre-experiment pilot study, lessons learnt from it and the lab-in-field implementation. I explain the working and operationalising of the Eckel Grossman game in a field setting. Additionally, I discuss setting up neutral outcome before the experiment, session setup, and payoff resolutions. I end the section with an overview of the complete experimental design.

3.3.4 On the Field: Experimental Procedures, Timeline, and Implementation

This section describes the experiment's timeline, procedures, and on-field implantation. I begin the section by detailing the experimental design, the pre-experiment pilot, revisions after the pilot, timelines, and the actual implementation of the fieldwork. Since the risk preference task was part of the same experiment I ran for the probability weighting function, I go through the common elements briefly before detailing the implementation of the Eckel Grossman task.

[9] I find statistical difference between the two seasons for the psychological index (p-value = 0.062), confirming the real life cognitive effect of seasonal scarcity.

This part of the experiment investigates the theoretical effects of cognitive load and tunnelling of scarcity on risk preferences. Decision-makers can face two types of scarcities – expected, cyclical downturns and unexpected shocks. For the former, because the decision makers know the shortfall cycle, they are more likely to be more prepared for it. While for the latter, as the name suggests, it can be a temporary shock to their finances. Therefore, by their very nature, they can impose different cognitive effects on the person; hence, preferences may also likely differ. I design for the two types of scarcity by placing my experiment within the harvest cycle of an agrarian region in the rural Bwikhonge district of Uganda.

In consultation and with the help of Field Lab in Uganda, I first conducted focus group studies in 2019 to get an estimate of the months of harvest cycle in the region and the participants' feelings as they deal with annual cycles of lean and plenty. It was appraised that the period where the region was most pressed for finances was around April (lean), while November was generally a period of plenty. I planned my experiments to be around these two periods of natural scarcity. I introduced three hypothetical scenarios for each of these scarcity periods that did not directly mention finances or money. The idea was predicated on Shah et al.'s (2018) finding that there need not be an explicit mention of money for scarcity to exert its force. If a participant faces financial difficulties or scarcity, even a problem that is not monetary will trigger thoughts about it. After extensive discussions with the team in Uganda and my supervisors, I devised three realistic scenarios for the primed group that were not too distressing for the prospective subjects. Once these were finalised, I designed three benign scenarios for the control group to balance the read word count.

The next task in the design stage was the cognitive load test. The pilot draft of the test included the numerical Stroop test for inhibitory control and the Ravens' progressive matrices test for cognitive flexibility. The latter was part of studies done in India and the USA on the cognitive effects of scarcity by Mani et al. (2013). However, my experiences with the pilot were very different. The participants struggled with the difficulty level, the research team with explaining the task and the entire session overran on time. I had to return to the drawing board to reassess the cognitive tools to be used in line with my research aim. After some discussions with my supervisors, we decided it made more sense to test core cognitive components and not cognitive abilities per se. We assessed that the scarcity mechanism depends more on cognitive load than on abilities. Abilities can moderate cognitive load, but it is more about temporal tax on primary cognitive components, which may not be reflected in tests on cognitive abilities. Therefore, we moved to include the digit span tests for working memory. Both the Stroop and Digit Span tests were field-friendly in terms of implementation, easy to understand and not dependent on the literacy levels of the participants.

The last stage of the experiment was the decision task. As a baseline, I use the six-choice Eckel Grossman task for gains and losses and then design for scarcity relevance and irrelevance by asking the same participant to choose if the payoff is paid today (relevant) and 5 months from the session date (irrelevant). The same individual makes the two decisions in succession, making the design within-subject at this level. Therefore, the complete design (Figure 27) combines random assignment between subject elements and within-subject decision-making.

Finally, some other essential aspects of conducting experiments, like establishing the neutral outcome, payoff resolution, and logistical issues, need to be discussed before getting into the details of the session on the actual day. To recall from the first chapter, three weeks before the scheduled session, the research associates from the Field Lab distributed the undersigned vouchers of 4000 shillings to the participants with their names, address, and photo. Giving the vouchers well in advance is necessary to avoid the house money effect and instil a sense of ownership and entitlement for the money. The participants were asked to carry the voucher with them on the day of the experiment. During the day of the experiment, the team asked if they remembered to do so. For those in the losses domain, if there were any negative earnings, we subtracted the amount from the 4000 shilling voucher amount. This is a standard operating procedure in experiments, especially when decision-making for losses needs to be studied.

Additionally, at the end of the session, we gave a show-up fee of 4000 shillings atop the payoff to avoid disappointment. We used the random lottery incentive system to calculate final payoffs. Within the method, one decision of all the decisions is picked randomly to be paid off. All subjects are informed of the resolution method before they begin the experiment.

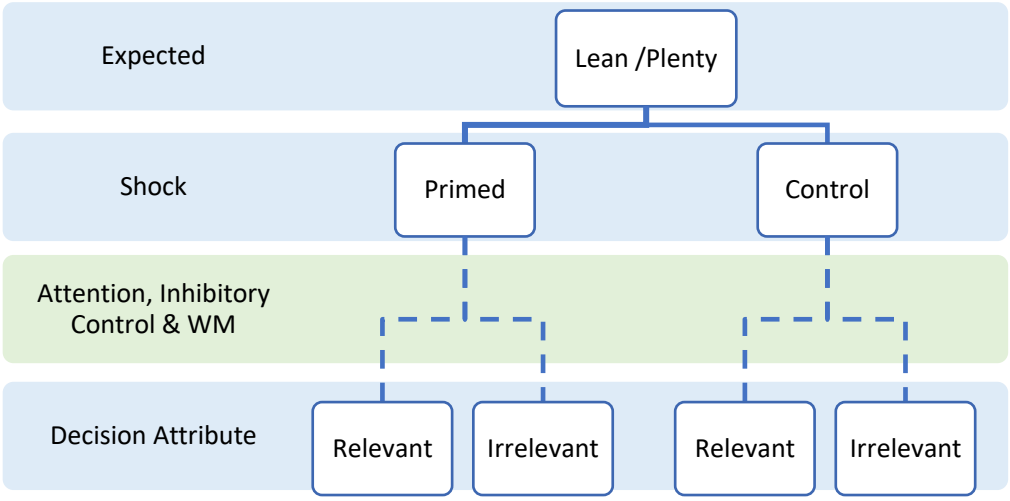


Figure 27 The experimental setup

The experiment used two coordinators and associate teams from the Field Lab. The team is experienced in conducting field experiments and has successfully implemented risk preference

measures like the Gneezy-Potters investment game and the common consequence ladders in the past (Verschoor et al., 2016; Verschoor and D'Exelle, 2020). While they have done these experiments before, we organised week-long training and refresher training sessions before each season. With their help, we translated the scripts to the local language, Lugisu, and back-translated them to English to ensure consistency. The experimenter delivered the instructions individually, in partial isolation, at the community centre or the local church hall. The experiments were conducted per the covid guidelines, and waiting times were reduced by scheduling staggered sessions throughout the day.

The experimenter noted all the treatment responses and did not intervene or assist in any part of the decision-making exercise unless the participant requested clarification. Tables were laid out in the experiment hall, and the participants were guided through each as the session progressed. After completing the common consequence ladders tasks, they reach the table with the Eckel Grossman task with decision cards Y (scarcity relevant) and Z (irrelevant). The experimenter also shows the participant a coin at this stage and makes it clear that the participants' payoff from the game would be decided after the toss of a coin ("After you tell me which row you prefer, I'll toss this coin, which has A on one side and B on another"). Most instructions were clear to understand, and the total time for each participant, including the common consequence ladders and the Eckel Grossman task a little more than an hour, where Tasks 1 and 2 took about half an hour.

We conduct our experiment in two phases of the harvest cycle of Bwikhonge. Given that this is part of a PhD project, the work is bound by the available funds and time. Therefore, I limit the total sample size to about 300 for both seasons. The treatments are delivered in chronological order to all participants in their randomly assigned groups. It took a fortnight to complete data collection and reporting for each season. I did not see significant non-compliance to the four states' interventions for each season.

3.4 Results

In this section, I present my main results. Like the previous section, I briefly describe the results from the common elements. I begin by analysing the scarcity priming effects between the treatment and control groups. Next, I compare the cognitive load scores to assess if the treatment impacted the measures. Following this, I describe the Risk preference results for gains and losses for the different scarcity treatment groups for both scarcity-relevant and irrelevant attributes. Finally, after controlling for the correlates, I present the multivariate analysis investigating the differential tunnelling effects on the risk preferences.

3.4.1 Summary of Results from the Common Elements

First, I describe my sample observables and balancing tests between the treatment conditions for gains and losses. Table 9 from Paper 1 presents the demographic variables' summary statistics and the experiment's statistical balance tests. Overall, the sample is balanced in terms of gender, age and mostly has primary educated people with small landholdings with a mean of 2.86 acres. The significance of marital status between gains and losses for primed groups in both seasons is due to chance, as the random assignment was carried out rigorously by the Field Lab team. The statistical significance of land holdings between the domains for the primed group in the lean season also can be explained to chance.

The participants in the experiment could have been in one of the two phases in the seasonal scarcity cycle. As discussed in the methods section, for the priming treatment group in each season, I introduce three difficult hypothetical scenarios that do not have any direct monetary terms and the subjects are requested to either rate the level of difficulties or the first three thoughts on their mind if they faced those situations. The control group got three benign scenarios with equal word count to control for any noise in the follow-up cognitive load test.

The first question to the treatment group asked respondents about their level of concern about an unexpected financial scarcity on a 5-point scale. On average, the 178 people reported a 4.04 and 4 in the plenty and lean season with a standard deviation of 0.07 and 0.08, respectively. The between-subject difference t-test is not statistically significant between the two seasons. More interestingly, the second question required writing the first three thoughts in case of shock. The thoughts were intended to investigate whether scarcity was pervasive and came up unprompted in decision-maker's minds. Plotting the frequency word clouds in Figure 16 in Chapter 1, money (240), medicine (170) and buying (102) top the list of voiced thoughts. Thus, for both seasons, the first three thoughts in a situation of treatable disease revolve around financial concerns. All the reported concerns were categorised according to the types of worry - monetary or non-monetary.

Of the three, we see 1.29 or at least one of three words alluded to financial concerns in the plenty season. In line with the hypothesis, there was an increase in the lean season (1.45). The difference between plenty and lean was significant at the 5% level. Within scarcity theory, I expect the scenario to trigger thoughts relevant to the problem at hand (treatable ailment) to be higher in the lean than in the plenty season. Between-subject t-tests confirm the hypothesis. Finally, the third question asked about the nature and level of worry about upcoming expenditures in the next six months. By design and the cyclical nature of seasonal scarcity, participants in the plenty season foresee expenditures

accrued in the next six months as falling in the lean season. Conversely, subjects in the lean season at the time of the experiment knew the expenditure concerns asked for the next six months would fall in the harvest season – a period of plenty. Therefore, I expect and confirm that the level of concern for the next six months will be significantly higher in the plenty season than in the lean season (t −statistic = 1.813, p = 0.03).

Having set up the priming treatment for both seasons, I now move to describe the scores from the cognitive load test. For each participant within the primed and control groups for both seasons, I introduce the 2-question test. It follows up directly after the priming task and is the same for all participants to aid comparisons. I describe statistical test results for the test scores, the level of difference and the implication for the theoretical framework.

The test contained a numerical Stroop task and the digit span test, and each participant, irrespective of the scarcity treatment, did the same test in the same order. Both versions of the tests account for the region's literacy constraints and measure of Inhibitory Control, attention and Working memory, respectively. The performance on the test indicates the load on the core cognitive components and, therefore, the expected degree of dual-process bias in decision-making.

To recall, the Stroop test in its numerical variant displays a 15*5 table of triangles and numerals to be read aloud by the participant. First, the participant calls out the number of triangles in its congruent condition. Next, they read out the number of digits in the incongruent condition, not the digit number. The experimenter notes the time to read and the number of mistakes or interference for the two conditions. The primary variable of interest is the difference in the number of mistakes (interference) between the incongruent and congruent conditions. According to the hypothesis, it is expected that the number of mistakes would be higher in the incongruent than the congruent condition for those facing a higher scarcity force. While the ANOVA test on the level of interference between the four groups is statistically significant (p= 0.008), there is also a heterogenous effect of the type of scarcity faced.

Besides statistically confirming scarcity's cognitive load effect, I also find a differential effect due to the nature of scarcity itself. Cyclical expected scarcity disproportionately taxes inhibitory control and attention. Significant differences between the scores can be seen (-3.147, p = 0.00), suggesting that the interference is higher for the lean season. Similarly, given a shock scarcity (the primed group), the interference scores between primed and lean seasons are statistically significant at a 5% level. The analysis is supported by the inability to reject the hypothesis of the difference of scores for shock scarcities for fixed expected scarcity levels.

The differing effect of the nature of scarcity can also be seen for the reverse digit span test. All participants in my experiment do the Forward and Reverse Digit Span test. The forward version presents an increasing list of numbers (maximum span of 5) that the participant repeats in the same order. Correspondingly, the reverse digit version has them repeat the span of numbers (maximum span 10) in reverse order. The test is scored on the ability to recall the maximum span of numbers (accuracy levels). While I implement both, the test score of interest is from the reverse digit span. [10] ANOVA tests between the four scarcity treatment groups are significant at 1% (p = 0.0039).

In contrast to the effects of expected scarcities on inhibitory control and attention, the shock of unexpected scarcity loads working memory exclusively. I compare the between-subject scores for the four groups using a t-test and confirm the load on working memory. I also see that the effects are stronger for lean season, thus implying the dual effect of a shock given the expected scarcity state. Participants in the plenty season facing unexpected scarcity perform significantly better than their counterparts in the lean season (p = 0.04).

In conclusion, the results from the cognitive load test have two key takeaways. First, there is a statistically significant load on inhibitory control, attention and working memory, confirming the hypothesis of the link between scarcity and cognitive load. Second, the heterogenous analysis of test scores brings out differing effects of the nature of scarcity on core components of cognition. Stroop interference scores show that inhibitory control and attention are more loaded by expected, cyclical rounds of scarcity. Given the expected scarcity, I see that working memory is affected by unexpected scarcity.

My findings confirm the theoretical interlinkage between inhibitory control and working memory (Diamond, 2013). This can be seen with the significant effect on working memory for comparison between seasons (Plenty, Prime and Lean, Prime). Additionally, comparing working memory effects shows the most remarkable difference for participants facing both expected and shock scarcity (Lean, Primed and Lean, Control). Therefore, confirming that the annually expected cyclical scarcity is encoded in memory and enforces an additional load when triggered in a scenario of shock scarcity.

In the next section, I discuss the decision effects of the treatment and the mechanism. I begin with discussing the decision attribute-based Eckel Grossman choices and then move to multivariate analysis to assess the extent of tunnelling.

[10] The relationship between priming short term memory through forward digit span test before doing the working memory test can be seen in my data. The scores from forward digit span and reverse digit span are highly correlated (0.326) with a p value = 0.0000.

3.4.2 Risk Tasks: Choice patterns

In this section, I first summarise the aggregate risk behaviour for all treatments in the Eckel Grossman task. I then present the treatment averages of the choice patterns disaggregated by treatments and basic demographics. I end the section by discussing the regressions for within and between subject differences.

3.4.2.1 Summary of Risk Behaviour

Before presenting the decision-attribute-based risk preferences, I summarise the sample by domain and scarcity treatment in Table 24. As discussed before, I have a 2*2*2 design at a between-subject level by natural, shock-unexpected scarcity and the domain of choice-making (gains or losses). The table is broken down by all treatments assigned between subjects. Within each natural period, scarcity shock priming and control groups are randomly allocated for the gains and losses domain. Of the 679 participants across the two periods, 349 and 330 do the Eckel-Grossman task in the gains and losses domain. On breaking the domain totals by the unexpected scarcity treatment, 184 subjects are primed with shock scarcity play the gains version of the Eckel-Grossman task. For both seasons combined, 175 subjects played the gains version from the control group. Splitting it further, 94 participants get the complete treatment with natural shock scarcity for the gains domain in the lean season. Correspondingly, 81 who face neither natural nor are primed with the scarcity shock play the Eckel-Grossman in gains. A similar breakdown can be worked out for losses too. For the two seasons combined, 165 and 155 subjects are randomly assigned into either scarcity priming or control groups for the loss domain. Breaking down by complete treatment profile, 87 participants get the natural (lean), unexpected priming for losses.

Table 24 Sample Breakup by Treatment

Treatment Group	Natural Scarcity		Total
(Domain*Shock Scarcity)	Lean	Plenty	
Gains*Primed	94	90	184
Gains *Control	84	81	175
Total for Gains	178	171	349
Losses *Primed	87	88	165
Losses *Control	82	73	155
Total for Losses	169	161	330
Total	347	332	679

Table 25 and Table 26 summarise the decision patterns split by scarcity relevance-irrelevance in the ordered Eckel-Grossman game for gains and losses. 68.01 per cent of subjects are risk averse (those who choose gambles 1-4) for scarcity-relevant choices in the gains domain. To recall, the same people face scarcity-irrelevant attributes. 63.40 per cent are risk averse for scarcity-irrelevant decisions in

gains. Conversely, for losses, we see 42.55 per cent of subjects exhibit risk-averse behaviour for choices that are scarcity relevant. When faced with irrelevant decisions, the same people slightly fall in risk averseness (40.12 per cent).

Participants are more risk-averse for gains and losses when making decisions relevant to the scarcity at hand. Even at this basic summary level, this is interesting. The relevant attribute of the choices for gains seems insufficient in triggering a tunnelling mechanism. The decisions likely result from narrow bracketing rather than System-2 "rational" deliberation. In line with the conceptual framework, we also see hints of a higher role of System-2 functioning for losses than gains, as the subjects choose sure losses rather than risk loss of higher amounts. This can be seen in the marginally higher risk neutrality and seeking for scarcity-irrelevant losses (2 per cent more than scarcity relevant). The choices between the domains are statistically different for both scarcity-relevant and irrelevant attributes (t-test, p-value = 0.000). While these patterns are aggregated over scarcity treatments, they give us a broad sketch to further explore the heterogeneous treatment effects.

Table 25 Scarcity Relevant and Irrelevant Choice Patterns for Gains (Total 347)

Choice	Low payoff	High payoff	Expected value	Standard Deviation	Implied CRRA range	Number of subjects chose (Relevance)	Number of subjects chose (Irrelevance)
1	5600	5600	1600	0	3.46<r	68 (19.60%)	74 (21.33%)
2	4800	7200	2000	1200	1.16<r<3.46	45 (12.97%)	44 (12.68%)
3	4000	8800	2400	2400	0.71<r<1.16	50 (14.41%)	45 (12.97%)
4	3200	10400	2800	3600	0.50<r<0.71	73 (21.04%)	57 (16.47%)
5	2400	12000	3200	4800	0<r<0.5	41 (11.82%)	54 (15.56%)
6	400	14000	3200	6800	r<0	70 (20.17%)	73 (21.04%)

Table 26 Scarcity Relevant and Irrelevant Choice Patterns for Losses (Total 329)

Choice	Low payoff	High payoff	Expected value	Standard Deviation	Implied CRRA range	Number of subjects chose (Relevance)	Number of subjects chose (Irrelevance)
1	1600	1600	1600	0	3.46<r	47 (14.29%)	44 (13.37%)
2	800	3200	2000	1200	1.16<r<3.46	45 (13.68%)	36 (10.94%)
3	0	4800	2400	2400	0.71<r<1.16	20 (6.08%)	28 (8.51%)
4	-800	6400	2800	3600	0.50<r<0.71	28 (8.51%)	24 (7.29%)
5	-1600	8000	3200	4800	0<r<0.5	39 (11.85%)	62 (18.84%)
6	-3600	10000	3200	6800	r<0	150 (45.59%)	135 (41.03%)

We start looking into the disaggregated trends by treatment in Figure 28. The 16 cells show choice patterns for all the possible between-within-subject treatment combinations. As discussed in the methods section, the decision maker can choose one lottery from an increasing order of riskiness from 1 to 6. While the expected value between choices 5 and 6 is the same, the latter has a higher variance (Dave et al., 2010). Although a risk-seeking subject would choose 6 because the expected values are the same, a risk-neutral agent would be indifferent between the two (Crosetto and Filippin, 2016).

Overall, there is a good spread of choices for gains. There is an almost uniform pattern of risk-seeking for losses, as choice number 6 is typical. Figure 28 shows primed subjects in both seasons making risk-seeking decisions in the losses domain. The patterns look slightly more homogenous for gains. Plotting the distance of individual choices from strict risk neutrality (removing all those who were pure risk seekers and chose number 6) in Figure 29, we see that decisions for plenty, primed treatment for irrelevant choices in the loss domain as closest to neutrality. Additionally, we see a uniform higher concentration around risk neutrality for irrelevant attributes across the loss domain and the scarcity treatment.

Figure 28 Lottery Choices by domain, season, priming status, and scarcity relevance

Figure 29 Lottery Choices for distance from risk neutrality (choice number 5), by domain, season, priming status, and scarcity relevance

Placing these lottery choices in the conceptual framework context, we see building evidence of mixed findings. For gains, we see that scarcity-relevant choices are more risk averse (closer to 1) than irrelevant choices for all treatments but the control group. This can be seen in Table 27 and Figure 30, where the scarcity-relevant choices 3.46, 3.51 and 3,30 are lower than the corresponding values for irrelevant decisions. However, for losses, the trends align with what we expect for the primed group ($4.27 < 4.55$ and $4.47 < 4.5$) as we see that individuals prefer sure over risking potentially higher losses.

In terms of the level of scarcity and tunnelling, there is again mixed evidence, mainly due to the difference caused by the control group in the gains domain. The within-subject differences between scarcity-relevant and irrelevant choices or tunnelling throws from Columns 4 and 8 in Table 27 and Figure 31, we see that the absolute value of the difference is the greatest for Plenty*Control (0.39) for Gains and Lean*Primed (0.28) for losses. Therefore, hinting to the fact that, for gains, as scarcity force increases, the level of tunnelling goes down ($0.39 > -0.12 > -0.1 > -0.22$). While for losses, the difference is the largest under the full treatment of scarcity (Lean*Prime), which aligns with our expectations. However, as shown in Figure 31, the differences do not seem statistically significant.

Table 27 Mean for the Eckel Grossman Task (1-6), by treatment

Domain	Treatment	Lean				Plenty			
		Total	Relevant	Irrelevant	Tunnel[11]	Total	Relevant	Irrelevant	Tunnel
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Gains	Pooled (1)	3.47	3.39	3.55	-0.16	3.61	3.67	3.55	0.12
	Primed (2)	3.57	3.46	3.68	-0.22	3.57	3.51	3.63	-0.12
	Control (3)	3.35	3.30	3.40	-0.1	3.66	3.85	3.46	0.39
Losses	Pooled (4)	4.34	4.30	4.38	-0.08	4.22	4.22	4.21	0.01
	Primed (5)	4.41	4.27	4.55	-0.28	4.48	4.47	4.50	-0.03
	Control (6)	4.27	4.33	4.20	0.13	3.90	3.93	3.87	0.06

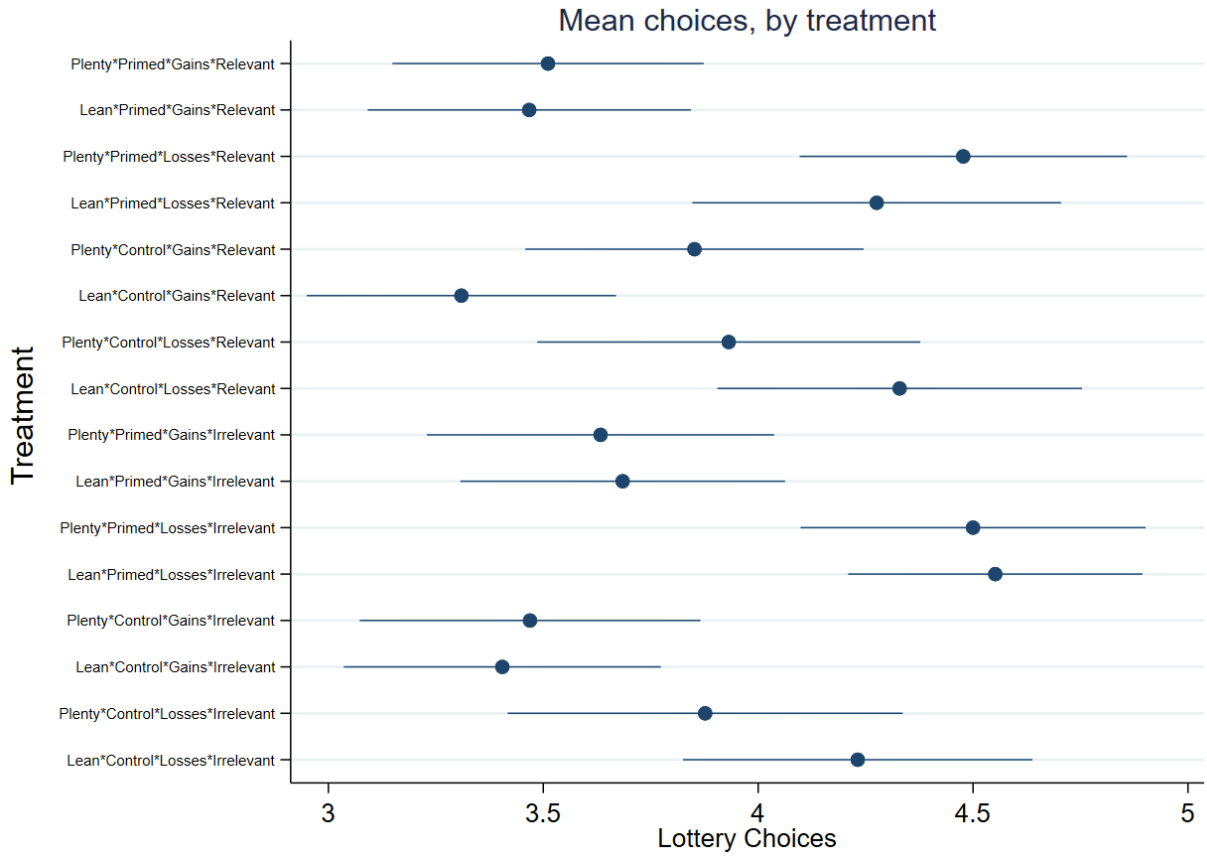


Figure 30 Mean Lottery Choices by treatment groups

[11] Tunnelling = (Relevant – Irrelevant) Choices

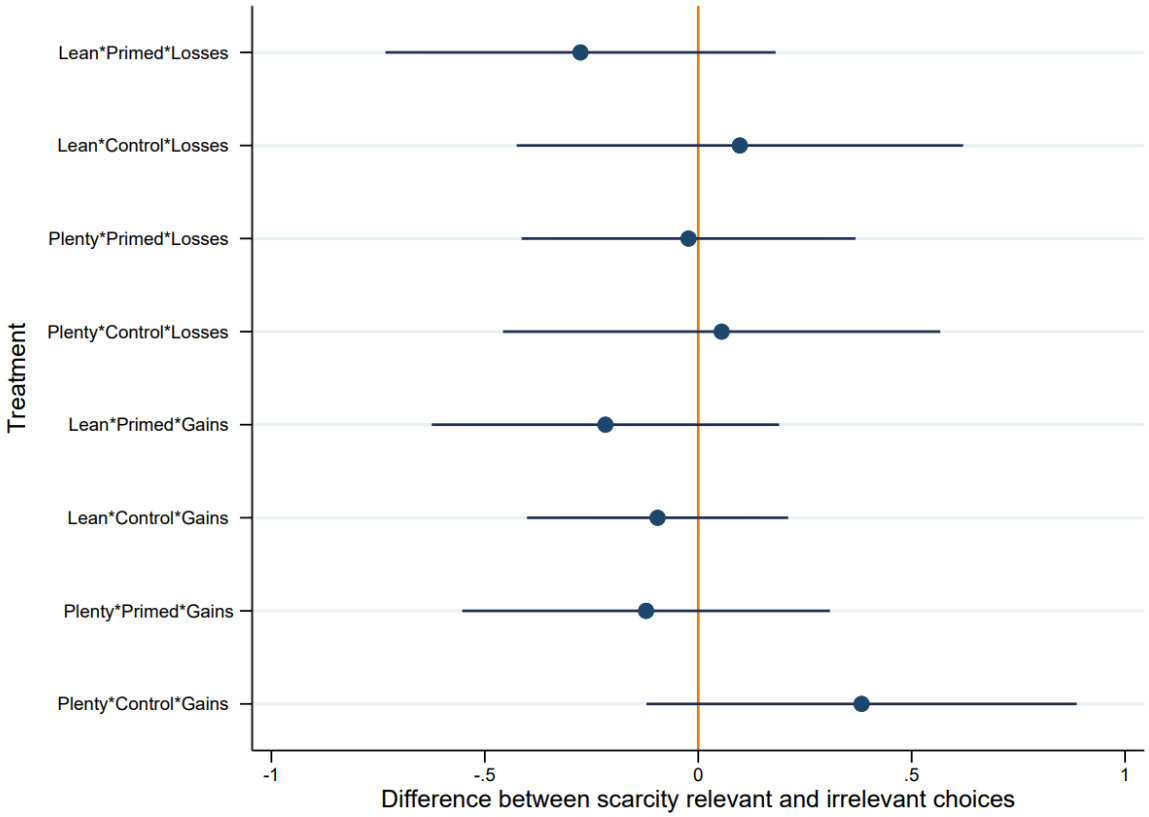


Figure 31 Difference between scarcity relevant and irrelevant choice – Tunnelling by treatment

3.4.2.1 Testing the Theoretical Predictions

In this section, I use multivariate regressions to test for the theoretical hypotheses and offer explanations for the empirical results from my experiment. I will begin each part with a brief introduction about the following results and then place it in the context of what I expected theoretically and what I found.

Table 28 and Table 30 present the regressions for loss lottery choices and the distance of choices from the risk-neutral choice for gains (the risk-neutral choice being lottery number 5 on the Eckel Grossman Game), respectively. Additionally, I include demographic characteristics and cognitive test scores as control variables and robust standard errors clustered at the individual level. In each table, Columns (1), (3), (5) are regressions without these control variables, looking at the pure effects of associated treatment groups. Columns (2), (4), (6) are the results for the same combinatorial treatment variable after including the control variables.

In the loss domain (Table 28), controlling for all else, compared to the complete control group of (plenty*control), choices move towards the riskier option (as the coefficient is positively significant). This is in the direction of what we would expect. On an aggregate, individuals become statistically significantly more risk-seeking for losses for the primed group in both plenty and lean season.

However, the decision-attribute by itself has no statistical impact on the choices in the loss domain. Therefore, on average, decisions are not driven by whether decisions are made for current needs at hand (scarcity relevance) or not (scarcity irrelevance 5 months from the experiment). When the factors are interacted, apart from the Lean*Control treatment, choices are more risk-seeking for scarcity irrelevant choices than relevant ones.

In contrast, when we look at the difference in the choices from the risk-neutral mark (subtracting the choice made from the 5) for gains (Table 30), none of the variables are significant apart from the gender and cognitive measure of inhibitory control and attention. Though not significant, better working memory scores tend to reduce the difference in choices from risk neutrality. This is somewhat in line with what we expect, though the non-significance of other treatment variables makes it difficult to draw a more robust conclusion.

Looking at these regression results and the post-estimation test results containing effect sizes of interest and the corresponding p-values for losses (Table 29) and for gains (Table 31), we are now in a position to evaluate the first set of theoretical predictions.

> Hypothesis 1: For losses, in-tunnel (scarcity-relevant) choices would be less risk-seeking than scarcity-irrelevant decisions.

While Table 28 suggests a significant role of treatment variables in the losses domain increasingly moving choices away from risk-seeking when interacted, there is no conclusive evidence that a statistical difference exists between scarcity-relevant and irrelevant choices.

Devoid of decision -attribute and compared to the reference control group (plenty*control), choices are statistically more risk-seeking. There is also evidence of increasing joint force of scarcity and scarcity relevance in the loss domain. Choices move to be less risk-seeking (as the coefficients are lower in magnitude than those for scarcity irrelevance for corresponding treatment groups, except for the control groups in both seasons). The results suggest that unexpected scarcity has a more prominent role in the movement of choices compared to expected scarcity.

Table 28 Regressions on Choices from the Eckel Grossman Game for Losses

Dependent Variable: Lottery Choice in the Eckel Grossman Game (1-6) for Losses	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
Scarcity Irrelevance	0.0365	0.0337	0.0365	0.0337		
	(0.30)	(0.28)	(0.30)	(0.28)		
Plenty Season x Primed			0.585**	0.563**		
			(2.28)	(2.16)		
Lean Season x Control			0.367	0.379		
			(1.46)	(1.48)		
Lean Season x Primed			0.510**	0.546**		
			(2.06)	(2.14)		
Relevant x Plenty x Control					3.932***	3.360***
					(17.69)	(7.08)
Relevant x Plenty x Primed					4.477***	3.876***
					(22.12)	(8.01)
Relevant x Lean x Control					4.333***	3.765***
					(20.54)	(7.93)
Relevant x Lean x Primed					4.276***	3.732***
					(21.01)	(7.99)
Irrelevant x Plenty x Control					3.877***	3.289***
					(17.45)	(6.93)
Irrelevant x Plenty x Primed					4.500***	3.899***
					(22.24)	(8.06)
Irrelevant x Lean x Control					4.210***	3.642***
					(19.96)	(7.67)
Irrelevant x Lean x Primed					4.552***	4.008***
					(22.36)	(8.58)
Land Holding		0.00347		0.00113		0.00113
		(0.46)		(0.16)		(0.10)
Sex (Female)		0.113		0.0956		0.0956
		(0.61)		(0.52)		(0.61)
Age		0.006		0.006		0.00632
		(0.98)		(0.99)		(1.13)
Psychological Index		-0.0562		-0.0691		-0.0691
		(-0.71)		(-0.79)		(-1.04)
Stroop Accuracy Score		-0.0073		-0.0101		-0.0101
		(-0.89)		(-1.22)		(-1.38)
Reverse Digit Span Score		0.0219		0.0244		0.0244
		(0.35)		(0.39)		(0.48)
Willingness to take Risks (0-10)		0.0295		0.0218		0.0218
		(0.99)		(0.73)		(0.85)
Constant	4.267***	3.616***	3.886***	3.307***		
	(39.80)	(7.35)	(19.63)	(6.35)		
N	658	652	658	652	658	652

t-statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

This can be seen more clearly in Table 29, which reports the difference in scarcity-relevant and irrelevant choices for the loss domain for each treatment group. According to our theoretical prediction, the lesser scarcity-relevant (in-tunnel) choice is risk seeking than irrelevant, the more negative difference will be for the respective treatment group. From Table 29, though the difference is not statistically significant (which may be due to low power), we still have a trend where the difference is most negative for groups facing the maximum force of scarcity (expected and shock) followed by those facing only shock scarcity. Therefore, for losses, on the whole, while there is no

statistical significance of the difference, we see the direction of the effects broadly in line with the hypothesis that follows from the framework.

Table 29 Post-Regression Estimation Effect sizes and p-values for Losses (Hypothesis 1)

Treatment Group	Effect Size (p −value)
Plenty, Control	.0704 (0.825)
Plenty, Primed	-.0229 (0.936)
Lean Control	.1234 (0.679)
Lean, Primed	-.2758 (0.338)

Comparison between Scarcity relevant and irrelevant choices for each treatment group. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Hypothesis 2: For gains, scarcity-relevant choices are closer to risk-neutral or Expected Utility Theory predictions than scarcity-irrelevant decisions.

Table 30 reports results for regression for the distance of choices from the risk-neutral point for gains. In line with other empirical evidence, women seem to make choices further away from risk neutrality, i.e. they are more risk-averse (as the coefficient is positively significant). Furthermore, there seems to be no statistically significant role of decision attribute (scarcity-irrelevance) in moving choices in the gains domain away from risk neutrality. In fact, in terms of the direction, scarcity-relevant choices in the lean season group for both primed and control (Columns 5 and 6) are further away from risk neutrality than irrelevant ones (1.264 >1.2 and 1.34 > 1.286).

This can be seen more clearly in Table 31, which contains the difference in distances for each treatment group for gains. In addition to none of the difference in choice distance between scarcity relevant and irrelevant being significant, there is also a marked reversal of trend with the control group (plenty *control) showing the maximum absolute difference. Thus, implying that the scarcity-relevant choices in the group are the closest to risk neutrality than irrelevant ones. This is not in line with what we would expect. The inverse direction for the lean season may result from the combined effect of choice bracketing and low attentional grab of gains, which is insufficient to trigger the splitting mechanism. Therefore, there is no conclusive evidence of the distance from risk neutrality reducing due to scarcity relevance.

Table 30 Regressions on Distance of Choices from Risk Neutrality for gains

Dependent Variable: (5- Lottery Choice in gains)	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
Scarcity Irrelevance	0.00840	0.00234	0.00928	0.00183		
	(0.07)	(0.02)	(0.07)	(0.01)		
Plenty Season x Primed			-0.0256	-0.0179		
			(-0.14)	(-0.10)		
Lean Season x Control			0.0233	-0.0559		
			(0.13)	(-0.31)		
Lean Season x Primed			0.0816	0.0264		
			(0.45)	(0.14)		
Relevant x Plenty x Control					2.018***	1.242**
					(10.43)	(2.52)
Relevant x Plenty x Primed					2.027***	1.246***
					(11.94)	(2.59)
Relevant x Lean x Control					2.139***	1.264**
					(12.42)	(2.46)
Relevant x Lean x Primed					2.192***	1.340***
					(12.82)	(2.85)
Irrelevant x Plenty x Control					2.138***	1.328***
					(11.80)	(2.68)
Irrelevant x Plenty x Primed					2.087***	1.295***
					(11.87)	(2.66)
Irrelevant x Lean x Control					2.070***	1.200**
					(11.94)	(2.33)
Irrelevant x Lean x Primed					2.132***	1.286***
					(12.04)	(2.70)
Land Holding		0.0312		0.0329		0.0328
		(1.06)		(1.10)		(1.09)
Sex (Female)		0.278**		0.276**		0.276**
		(2.16)		(2.13)		(2.13)
Age		0.00651		0.00657		0.00652
		(1.39)		(1.39)		(1.38)
Psychological Index		-0.126		-0.128		-0.126
		(-1.53)		(-1.53)		(-1.51)
Stroop Accuracy Score		0.009*		0.008		0.008
		(1.67)		(1.52)		(1.52)
Reverse Digit Span Score		-0.0212		-0.0159		-0.0161
		(-0.47)		(-0.33)		(-0.34)
Willingness to take Risks (0-10)		0.0445		0.0457		0.0458
		(1.46)		(1.49)		(1.49)
Constant	2.098***	1.321***	2.077***	1.284***		
	(23.97)	(2.95)	(14.06)	(2.69)		
N	549	544	549	544	549	544

t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 31 Post-Regression Estimation Effect sizes and p-values for Gains (Hypothesis 2)

Treatment Group	Effect Size (p −value)
Plenty, Control	-.0855 (0.746)
Plenty, Primed	-.0495 (0.838)
Lean Control	.0634 (0.795)
Lean, Primed	.0542 (0.826)

Comparison between Scarcity relevant and irrelevant distance from risk neutrality for each treatment group. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Next, I describe the regressions for the tunnelling effects. Table 32 and Table 33 have the regression and the post-regression tests for the within-subject difference in lottery choices for scarcity relevance and irrelevance. Columns (1), (2), and (3) in Table 32 are the results from the linear regression, with the dependent variable being the difference in choices for the decision attributes. Given the dependent variable, it is important to control for the baseline anchor from where the individual begins making his/ her choice. The lottery choice is the control for the decision-maker to move. Therefore, I add the choice as a control variable in the regressions to isolate the by-treatment difference due to decision attributes. I run the regressions and find that the differences are statistically significant for all the treatment groups. In Column (3), I see that the largest magnitude for tunnelling is for the treatment group Lean*Losses*Primed, which aligns with what we would expect. I check for the differences in tunnelling by treatment group in the post-estimation test in Table 33. For losses, I find a differing role for the kind of scarcity and the overall magnitude of scarcity having an effect. The same cannot be said for gains.

The differences in Table 33 control for payoffs today (scarcity relevant) and 5 months (Irrelevant) for both the groups. Therefore, I counterbalance any potential effects of time preferences. As the lean and the plenty season are separated by 6 months, any difference obtained after counterbalancing is due to the decision attribute alone. If losses grab more attention, then I expect to find the greatest difference for losses when the scarcity force is the strongest, i.e. between lean, primed and plenty, control.

> Hypothesis 3: For both gains and losses, the difference between scarcity-relevant and irrelevant choices (tunnelling) increases with scarcity.

The largest expected effect is indeed the largest and significant at the 5% level. Other results are mainly in the same direction, though they are not significant. No result is close to significant in the opposite direction (Table 32). Within the fully controlled model, the difference is the greatest for the full treatment group facing the highest scarcity force – Lean *Primed in the loss domain. For gains, however, the results are not as conclusive. While the magnitude of the difference is largest for the full treatment group (Table 32), albeit in the opposite direction from what was expected, suggesting that throughout the 4 treatment groups of the domain, scarcity relevance is pushing decisions closer to risk-averse choices when controlled for all other covariates.

Table 32 Difference in Lottery choices between Scarcity relevant and irrelevant choices (tunnelling)

Dependent Variable:	(1)	(2)	(3)
Scarcity Relevant – Irrelevant Choice	OLS	OLS	OLS
Plenty x Gains x Control	-2.027***	-2.087***	-2.535***
	(-7.97)	(-6.62)	(-5.30)
Plenty x Gains x Primed	-2.336***	-2.396***	-2.829***
	(-10.18)	(-8.02)	(-6.37)
Plenty x Losses x Control	-2.424***	-2.467***	-2.882***
	(-8.95)	(-7.21)	(-5.97)
Plenty x Losses x Primed	-2.845***	-2.927***	-3.370***
	(-10.96)	(-8.68)	(-7.07)
Lean x Gains x Control	-2.182***	-2.238***	-2.708***
	(-11.21)	(-5.94)	(-5.94)
Lean x Gains x Primed	-2.403***	-2.448***	-2.881***
	(-10.68)	(-8.55)	(-6.45)
Lean x Losses x Control	-2.609***	-2.675***	-3.112***
	(-9.69)	(-8.55)	(-6.72)
Lean x Losses x Primed	-2.972***	-3.060***	-3.510***
	(-12.53)	(-9.95)	(-7.72)
Lottery Choice	0.630***	0.631***	0.632***
	(16.61)	(16.59)	(16.47)
Land Holding		0.0166	0.0174
		(1.40)	(1.46)
Sex (Female)		0.0332	0.0439
		(0.24)	(0.31)
Age		-0.0000581	-0.00152
		(-0.01)	(-0.32)
Psychological Index			0.0381
			(0.52)
Stroop Accuracy Score			0.00629
			(1.01)
Reverse Digit Span Score			0.0288
			(0.61)
Willingness to take Risks (0-10)			0.0290
			(1.09)
N	675	674	669

t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

To test this thoroughly, I report the post-estimation effects as the difference between the treatment groups for the two domains (Columns 1 and 2, Table 33). A significant effect can be seen for losses (Column 2 in Table 33) when the full treatment group is compared with the fully controlled group. Additionally, I see statistically significant evidence of tunnelling when the decision-maker faces a shock scarcity alone. This between-treatment group difference in choices due to decision attributes does not hold for gains.

The effects in Table 33 are noteworthy. This within-subject difference-in-difference between treatment groups controls for all possible noise due to intertemporal preferences and are pure differences due to the decision-attribute of the choices. I find the effect broadly holds for losses, especially when the force of scarcity is large enough. The absolute difference is the largest when we

compare the full treatment (lean*primed) with complete control (plenty*control), implying that the difference due to relevance-irrelevance is the greatest when the force of scarcity is the greatest.

Hypothesis 4: The tunnelling effect is larger for losses than gains.

To get at the effect of the domain-driven tunnelling effect, I compare the individual effects of different treatment groups for each domain (Columns 1 and 2, Table 33) and calculate the difference between them. If the hypothesis were true, then I should be able to see a statistically significant difference (Δ, Column 3, Table 33) between the two domains. As can be seen, while there is individual evidence of the tunnelling effect for losses, there is no statistical evidence that the tunnelling effect is larger for losses than gains.

Table 33 Post-regression tests for tunnelling by treatment

Treatment group	(1) Gains	(2) Losses	(3) Δ
Lean Primed – Plenty Control	-0.3461 (0.20)	-0.6275 (0.027**)	0.2814 (0.473)
Lean Primed – Lean Control	-0.1736 (0.469)	-0.3979 (0.149)	0.224 (0.540)
Lean Primed – Plenty Primed	-0.052 (0.844)	-0.1391 (0.579)	0.0866 (0.816)
Plenty Primed – Plenty Control	-0.2935 (0.30)	-0.488 (0.098*)	0.194 (0.635)
Plenty Control– Lean Control	0.1724 (0.507)	0.2295 (0.461)	-0.0570 (0.887)

Δ = Effect of Gains – Effect of Losses. Effect sizes (p-value). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Having discussed the key hypotheses in detail, I now look at some open questions that emerged from my conceptual framework and attempt to suggest some answers to better explain the link between financial scarcity, cognitive load and risk preferences.

Open Question 1: The nature of scarcity and tunnelling: That is, the differential level of impact of expected (natural, seasonal, expected) and artificial priming (unexpected, shock) on choices and tunnelling.

I see mixed evidence of differential effects of type of scarcities on tunnelling and risk preferences. The effect holds to a greater degree for losses than gains, which can be explained by the fact that losses by themselves capture greater attention than equivalent gains. Shock and unexpected scarcity play a significant role in tunnelling between the two types of scarcities. However, the effect only holds when the choices are made in the loss domain. Table 33 and Table 29 show the difference is large when the force is strong enough. Therefore, after the combined expected shock, it looks as if shock scarcity matters more in potentially splitting the preferences by relevance-irrelevance followed by expected shortfall and the control group.

Open Question 2: The components of cognitive load: Do Inhibitory control-attention and working memory affect the mechanism in different magnitudes?

From my regressions on choice patterns (Table 28) for losses, the distance of choices from risk neutrality (Table 30) for gains and the difference in choices by scarcity relevance-irrelevance (Table 32), I find trends but no consistent evidence of working memory or attention playing a role. While the cognitive load test scores are statistically significant between the scarcity treatment groups, there is are hints of greater working memory (higher scores on the reverse digit span test) reducing the distance from the risk-neutral choice (Table 30) for gains and moving loss choices closer to risk-seeking (Table 28). Similarly, there are traces of inhibitory control and attention (the lower the factor, the higher the interference score from the Stroop Test), making choices in the loss domain less risk-seeking (Table 28) and increasing the distance from risk neutrality for gains. I also find hints (though not significant) that both more interruption of inhibitory control and attention (more interference score on the Stroop test) along with greater working memory (higher reverse digit span test score) would lead to a higher decision-attribute-dependent split or tunnelling.

3.5 Conclusion and Discussion

These mixed results of scarcity, tunnelling and risk preferences need to be reconciled with the conceptual framework. First, there is evidence of tunnelling for losses and a marked absence for gains. The cognitive effort and top-down-bottom-up mechanics can explain this. Due to higher cognitive effort imposed by losses, there is a stronger demand on the cognitive systems and a greater propensity for the dual systems to split by attributes. Given the Top-Down goals of meeting the scarcity, we can expect tunnelling to happen in such a scenario. That may explain the differing results by domain.

Second, there is a marked absence of any effects for gains. This may be because gains alone do not attract enough System-2 functioning, so aligning with the goal of "meeting the scarcity at hand" does not happen. In fact, in contrast to our hypothesis, we find scarcity-relevant choices are more risk-averse than irrelevant choices. For example, In the lean *primed group, the bottom-up force of scarcity relevance leads to higher risk-aversion in-tunnel than out-tunnel decisions. This may be a result of choice bracketing in decisions. The reverse results for losses support this explanation. If choices in the loss domain are guided more by the deliberative system, the decision maker should be more willing to accept certain losses. Therefore, it is risk-averse for losses and reverses the reflection effect of prospect theory. We see the framework partially holding in our results.

Thirdly, I do not find any significant role of treatment variables in moving choices closer to risk neutrality for gains. Finally, slight evidence exists that shock scarcity has a role in moving choices towards risk neutrality when controlling for all other variables. While it is not wholly significant across regressions, the finding points to expectations' role in the mechanism.

Together, the results imply that if the decision-maker faces financial difficulties that he/she has faced in the past, those memories enforce an inordinate load on working memory. In such a scenario, if they make decisions in the gains domain, we expect to see small but insignificant differences in choices between what is relevant and irrelevant for the current scarcity. If, however, they are making decisions in the loss domain, then two forces of scarcity will work together and lead to tunnelling in risk preferences. Additionally, it implies that the decision-maker may be able to withstand the effects of expected scarcity by itself and not show any tunnelling effects, which may be because expected scarcity by itself does not affect working memory unless combined with shock. However, if the bottom-up force of the loss domain is combined with the top-down load of shock scarcity, we can expect the relevance-based split to happen. In our setting, expected and shock scarcity affects people's risky choices, making them more risk-averse for losses and more risk neutral for gains if that choice is scarcity-relevant. The same people are more risk-seeking and risk-averse for losses and gains, respectively, when the same choice is irrelevant. Consequently, depending on the level of scarcity and the domain in which they make choices, risk preferences are split by decision attributes.

4 Risk Preferences and Cognitive Load: The Case of Intimate Partner Violence

Violence against women is a widespread problem, with one-third of all women experiencing emotional, physical or sexual abuse during their lifetime. Effects of Intimate Partner Violence (IPV) on women's physical and mental health and its influence can last long after the violence has stopped. IPV has economy-wide repercussions, with global economic costs of violence against women estimated at 2% of global GDP. Reducing IPV has therefore emerged as an important policy priority accounted for in the fifth Sustainable Development Goal (Assembly, 2015). Women are not the only victims of IPV. Children exposed to violence are prone to cognitive impairment (including impaired school and work performance), developmental and behavioural consequences, and they are also at risk of further victimisation later in life (Wolfe et al., 2003). Violence is a socially learned behaviour for children, and studies suggest that men in violent homes tend to be violent towards their partners. Additionally, early childhood exposure to violence increases lifelong vulnerabilities and propensity to be exposed to violence and abuse as an adult. The economy-wide effects of IPV persist due to intergenerational transmission of violence, which perpetuates violent behaviours in future generations.

Poverty and violence co-exist frequently. While violence itself has mental health and cognitive impacts, poverty exacerbates the effects. Like financial scarcity, a mother enduring intimate partner violence for the sake of her child would be cognitively loaded. Under this cognitive load and the tunnelled focus on coping with the IPV to provide the best they can for the child, her other preferences, like risk, end up falling out of the focus tunnel and are more emotion and system-1-guided. As a result, she is expected to become more risk-averse with hostilities at home (IPV increase).

In this paper, I focus on the effects of Intimate partner violence (IPV) on risk preferences and if the cognitive channel moderates it. These results are part of a bigger project in the Dominican Republic that looked at the effects of IPV on parenting styles, intra-household bargaining and preferences. With a total experimental sample of 174 women, we primed half of the sample with violence treatment and measured the cognitive load it enforces. Finally, we introduced the risk task to assess if violence treatment led to differential levels of risk parameters in our sample.

My findings can be summarised in four points. First, there is mixed evidence on the effects of Intimate partner violence on cognitive components. Second, being employed increased inhibitory control and attention. Third, there is evidence of previous experience of abuses increasing risk aversion. Past experiences of violence also had an impact on working memory. More importantly, the priming

treatment from our experiment has a notable effect on cognitive scores for those who had faced some kind of violence in their life. Finally, while higher inhibitory control and attention increase risk-seeking, the results do not hold when interacted with the treatment variable. Overall, the results give some insights into the decision-making of a mother facing intimate partner violence and an interesting starting point to look at the differences in parenting styles and risk preferences working through the cognitive mechanism in the next stage of the work.

The rest of the paper is organised in the following sections. I begin with a brief overview of where the literature stands on violence against women, cognitive effects, risk preferences and where they meet. Next, I discuss the experimental design to operationalise the theoretical hypotheses. Following the methods section, I present the findings from my experiment for each element and analyse the extent of effects of intimate partner violence on risk preferences.

4.1 Literature Review

The WHO (2013) survey conveys a damning status of intimate partner violence (IPV) levels worldwide. Approximately 30 per cent of women worldwide reported incidents of physical or sexual violence at the hands of a partner. That is, on average, during their lifetimes, 1 in 3 women faced intimate partner violence (Garcia-Moreno et al., 2006). An estimated 29.8 per cent of women in Latin America and the Caribbean were victims of IPV. Within the region, the situation is particularly dire in the Dominican Republic (DR). The nation reported the highest (1.6 per 100,000) rate for deaths of women at the hands of current or former partners in Latin America (Figure 32). It was one of the only three countries with a rate equal to or greater than 1 - Uruguay (1.1) and Honduras (1). The gender-based violence in the pre-covid era alone was alarming. Around 77,837 complaints related to gender and domestic violence were made in 2019 (US Agency for International Development, 2020). In the experimental survey about the status of women conducted by the National Office of Statistics in the DR - *Encuesta Experimental sobre la Situación de las Mujeres* (ENESIM, 2019), 77 and 67 per cent of the women reported having faced violent episodes ever and in the past 12 months, respectively. During the CoVid lockdown, there was a documented increase in women and children seeking shelter (from March – June 2020). This is in line with previous findings of increase in IPV under circumstances of economic uncertainties that reinforces patriarchal masculinities, made worse by legal mandates to stay at home, increased dependencies on the partner and massive disruption of preventative help measures (OECD, 2020; US Agency for International Development, 2020).

Overall, this remains a serious public health and human rights issue. While often misunderstood as physical violence only, the field has begun acknowledging the importance of the non-physical nature

of abuse as well. The Centers for Disease Control and Prevention (CDC) defines IPV as "physical violence, sexual violence, stalking and psychological aggression by a current or former intimate partner" (CDC, 2016).

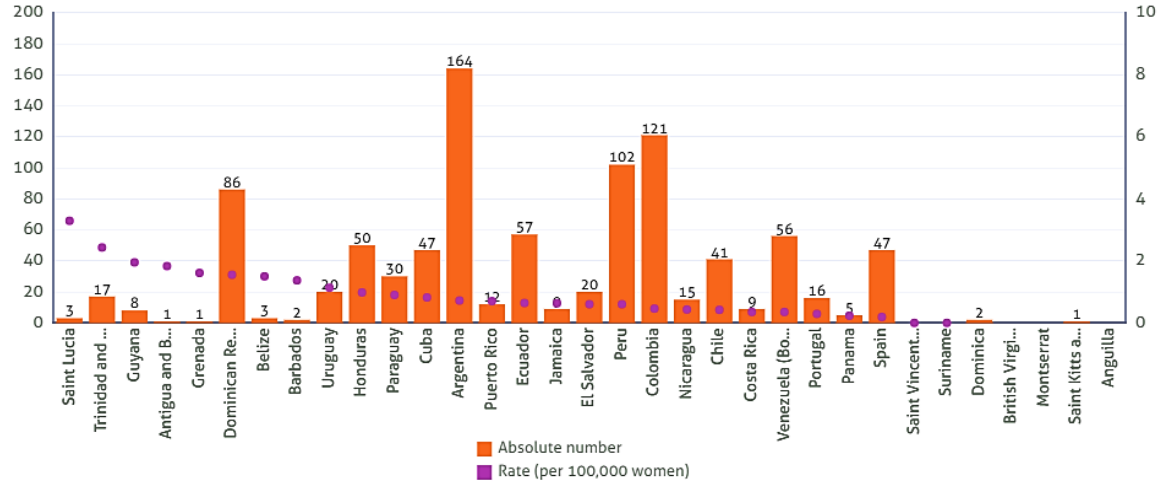


Figure 32 Women's deaths at the hands of their intimate partner or former partner, 2021
Note: (Absolute numbers and rates) in Latin America, the Caribbean, and the Iberian Peninsula (33 countries).
Source: ECLAC, Gender Equality Observatory for Latin America and the Caribbean

Miller (1996) categorised non-physical violence into emotional, psychological, social and economic abuse. According to her, emotional abuse may involve targeted behaviours that seek to undermine the victim's self-worth by name-calling and insults. Psychological abuse may entail behaviour intended to make her question her own logic and reasoning. If the abuse is social, it may involve the perpetrator isolating the victim from friends, or family by threat, force or persuading her to do so. Economic abuse revolves around creating an economic dependency by withholding finances and controlling decision-making. While all four are complex and severely debilitating, economic abuse is particularly pertinent and under-reported in developing countries like the Dominican Republic, where there may be insufficient safety nets or low trust in the system[12] (Garnelo et al., 2019).

The level of economic bargaining power between the couple for individual and joint decisions has been the focus of studies examining IPV's direct effects. Within economics, studies have focussed on Lowered power for pooled decision-making within the household is often considered the first marker to study the impact of Intimate Partner Violence. Zegenhagen et al. (2019) find a lower incidence of IPV when decision-making within the household is more collaborative. While they do not find an association between women's self-reporting on decision-making and IPV experience, they do report predictive evidence of men's decision-making and IPV risk. Similarly, using the Demographic and

[12] The Guardian suggests that intimate partner violence in Dominican Republic is underreported due to "women's lack of trust in the system, or knowledge about the availability of resources to get help" (23 Nov. 2012)

Health Survey (Institut National de la Statistique - INSTAT et al., 2019) from Mali, Mobayode et al. (2021) report nuanced findings of the intersection of external conflict, IPV and intrahousehold decision-making. First, they find wars significantly increased instances of within-household violence against women. Second, conflict increased women's autonomy in the household for some domains. Simultaneously, however, it reduced her ability to decide where earnings are used. Therefore, while non-economic autonomy in decision-making increased, it did not lead to more economic power within the home. The authors highlight the importance of not looking at IPV from a uniform lens and to develop an understanding of local norms when attempting to mitigate adverse effects of violence on women better.

A common public policy tool used to correct the economic imbalance in the household is cash transfers (Haushofer et al., 2019). The policy is based on two key assumptions. First, it would increase the bargaining position of the woman in the household. Second, the transfer could relieve some of the financial stress of the household and thus may decrease IPV. The one-size-fits-all approach combined with an incomplete accounting of regional gender norms may be why policies to reduce instances of IPV ended up doing the reverse, or in most cases, had no effect.

As well-intentioned as they may be, the transfer and women empowerment policies frequently led to an increased backlash against women. Studies on the program in Mexico (Bobonis et al., 2013) found a higher likelihood of receiving violent threats, extracting rents even when physical violence went down. This finding of increased women empowerment leading to higher violence is also echoed in India (Weitzman, 2014). Similarly, experimental evidence from Vietnam reported an increased frequency of abuse for the treatment group attending gender and entrepreneurship training sessions (Bulte and Lensink, 2019).

In comparing strategies, the results are starker when cash and in-kind transfers are compared (Ramos, 2016). Through an endogenously determined weighted utility household model to analyse the effect of transfers on IPV, he found that while cash transfers reduced violence prevalence from 17 to 10 per cent, in-kind transfers led to an additional drop of 3 percentage points. Similarly, Roy et al. (2019) reported a significant drop in physical violence when transfers were combined with behavioural change communication intervention. Thus, again reiterating the need to understand and change more fundamental behavioural background factors rather than merely designing surface-level interventions.

So, how do women cope in such circumstances? Akhter et al. (2022) identified that even economically empowered women in Bangladesh faced significant pressure to remain in the marriage or partnership.

Apart from the societal stigma of divorce, guardianship of children was one of the prominent reasons for their choice to bear with it. Cross-country analysis of 24,097 women aged 15-49 between 2000 and 2003 found drastic physical and mental health costs of IPV. They report statistically significant odds ratios of more than 1 for emotional distress, memory loss, difficulty with daily activities, depression, and suicidal thoughts, among other physical ailments like pain and dizziness.

Therefore, her coping is central to the relationships between IPV, maternal well-being, and parenting. The health effects lead to massive productivity losses (Ramos, 2016) and vicious intergenerational loops. Sousa et al. (2021) support the spillover theory in their systematic review. They find evidence of IPV in parenting style and highlight multiple ways in which the mothers struggle. Interaction with her coping interferes with bonding and attachment (Letourneau et al., 2007; Levendosky and Graham-Bermann, 2001). There is a profound influence on parenting practices, often through its effects on maternal well-being (both mothers' mental health and their sense of efficacy and identity). Multiple studies also show that mothers reconfigure material and psychological circumstances even if they do not directly stand up to violence. For instance, Lapierre (2008) found that mothers ignored their own needs and utilised their scarce resources to protect and care for their children, ensuring tasks like getting children to school were accomplished despite maternal physical injuries.

Maternal mental health suffers not only because of IPV itself but also by the crisis of parenting within violence, which incites constant worry and anxiety, distress, guilt (Wendt et al., 2015), exhaustion from somatic responses to the strain, increased stress and worry about caretaking (Buchanan, 2017). In such a scenario, the parenting response is often mediated through cognitive load and maternal depression (Cox et al., 2003). However, the effect of IPV-inflicted poor mental health on parenting is unclear. Yoo and Huang's (2013) longitudinal study using path models found no indirect effects on maternal mental health within the relationship of IPV to parenting behaviour. A few studies drew out how women explicitly focus on internal, emotionally based coping so that their children will not suffer additional stress (Busch and Lieberman, 2010). When dealing with the considerable trauma and stress of IPV, women might also turn inward to mitigate the effects of violence on themselves and their children. One such strategy is modifying their own emotional reactions to the circumstances. In this case, mothers attempt to nurture their feelings of hope and deny their pain to adopt a positive outlook (Buchbinder, 2004).

To sum up, while the evidence on parenting style is mixed, what is known from these qualitative studies on IPV is the significance of mental load, continuous stress, and emotional exhaustion, with the primary concern of ensuring safety for the child. The situation is doubly intensified because IPV and poverty may frequently be co-existing and causal (Bassuk et al., 2006; Cunradi et al., 2000;

Goodman et al., 2009). The continuous juggling of dealing with IPV and responsibilities as a mother in an environment additionally complicated by financial scarcity will have a bearing on all other preferences. In countries with low levels of social support (or "slack" (Mullainathan and Shafir, 2013a) to help ride through the crisis) like the Dominican Republic, the level of cognitive tax due to the double whammy of IPV and poverty will be higher. Ridley et al. (2020) show the vicious causal loop of poverty, violence and economic preferences being moderated by cognitive functioning and tax on mental bandwidth, with the burden falling disproportionately on women. The mental load may affect preferences such as the extent to which people tolerate risk, and social preferences. The debilitating effect may change savings and investment choices, consumer behaviour, default on loans and take up of preventative social welfare programs, making the situation worse and forming a trap. Recent lab-in-field experiments have begun to find an association between spousal violence and skipped repayment of loans in Bangladesh (Shahriar, 2016).

Looking at the process from the scarcity framework, a mother in an environment of financial poverty, facing IPV would be under additional involuntary cognitive load because of the exposure to violence. Under these circumstances, theoretically, given her primary focus on parenting the child, the rest of her preferences would change. Functioning in IPV-triggered cognitive load, trying to manage the urgent scarce need at that moment, with a tunnel focus on her child, the bulk of her deliberative System 2 functioning would be realigned towards coping and parenting. Therefore, the rest of the preferences would fall outside the tunnel and are more likely to be guided by System 1 preferences. As discussed in detail in the previous chapter, that would mean a lower willingness to take risks or an increase in risk aversion for gains.

The effect of exposure to violence inside and outside the home and risk preferences has recently begun receiving some academic interest from economics. However, studies on the potential behavioural pathway remain far and few. Moya (2018), in a study on the preferences of victims of violence in Colombia, found evidence of the behavioural channel on higher levels of risk aversion. Additionally, he establishes the role of level and duration of exposure as affecting risk preferences. More importantly, he confirms the cognitive, anxiety mechanics of the behavioural channel. One of the more famous researches linking violence and risk preferences is by Callen et al. (2014) in Afghanistan. The authors find a greater preference for certainty as levels of violence and fear priming increased. Their findings point to the critical operative role of active and passive threats of violence. The more intense, more recent, and more real the exposure is, the more likely it is to impact risk preferences. Their conclusions are in line with those from Mexico and Kenya. In a natural field experiment in post-election conflict-inflicted Kenya, participants exhibited a sharp increase in risk

aversion (by more than 80 per cent), affecting trust, beliefs about the economy and social capital (Jakiela and Ozier, 2019). Similarly, in drug-war-ridden Mexico, there is a uniform increase in risk aversion across the population in a more violent locality (Brown et al., 2019).

What is worth noting here is that while the nature of violence inside and outside the home may vary, few characteristics carry and may accentuate the effects of what happens inside. Studies have shown significant correlations between conflict and IPV instances at home (Kelly et al., 2018). The multi-level analysis confirmed the effects of cumulative years of conflict and increased instances of IPV during the civil war in Liberia from 1999 to 2003. Similarly, armed conflict and war have increased IPV in Mali (Ekhator-Mobayode et al., 2021). However, this does not imply that all the effects on preferences due to the conflict would hold for a field setting where there is no conflict but intimate partner violence only. Nevertheless, given the effect IPV causes on the mental health of the mother, her priorities on protecting the child and available evidence of conflict on risk preferences, we cannot reject the hypothesis that IPV would have an impact on risk preferences.

This paper attempts to analyse the lived experience of mothers facing IPV by focusing on their economic preferences and the possible mechanism behind them (Figure 33). I seek to answer the following research question –

Does Intimate Partner Violence (IPV) on the mother affect her risk preferences?

First, this paper focuses on maternal risk preferences as a starting point to examine spousal violence's effect (Hypothesis 1) on risk preferences. Second, I examine whether the risk-taking level is moderated through IPV-triggered-cognitive load (Hypothesis 2). Conceptually, I hypothesise that in an environment of violence, the cognitively-loaded mother who is focussing all her deliberative system-2 attention on the child will exhibit greater risk aversion (Hypothesis 3) as those choices are guided predominantly by higher, emotional, system-1 functioning (Campos-Vazquez and Cuilty, 2014).

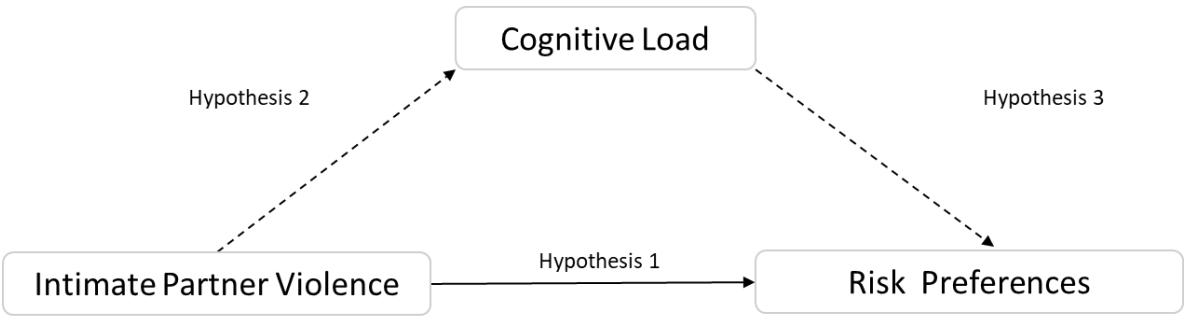


Figure 33 Research Question and hypotheses

To answer the research question, in the next section, I detail the study design that seeks to answer the primary research question and the emerging hypotheses working through the mechanics of cognitive load, and attentional processes. Following this, I describe summary results and analysis to lead into the concluding discussion.

4.2 Study Design and Implementation

This paper focuses on the effects of intimate partner violence (IPV) on women's risk preferences. Given the multiple pathways that could happen, I experimentally investigated if the cognitive load due to IPV could be an explanation for the effect. I break down the research question into the following elements – (i) the effect – Impact of IPV on Risk preferences, and (ii) the mechanism –cognitive load moderating the effect of IPV on risk preferences. This section gives an overview of the design and the study setting. I follow it up with a discussion of the experimental elements. Finally, I explain the outcomes from each, the procedural field implementation and layout the primary and secondary hypotheses emerging from the design.

This work is part of the larger project implemented in the Dominican Republic (DR) that looked at the effect of domestic violence exposure on parental involvement, children's learning performance and the extent to which cognitive load and social norms explain outcomes like intrahousehold bargaining and risk preferences. To give an overview of the complete design, months before the session, we conducted the demographic and violence against women surveys for 1032 households to assess the level of exposure to violence. The work was carried out jointly with Instituto Technologico de Santo Domingo (INTEC) and its Centre for Gender Studies as well as the Economics Department (data collection assistance). The data collection team comprised research assistants (economics and psychology at the end of their programs) and professional enumerators. The latter were hired locally from INTEC through a partnership with the National Statistics Office of the DR. Subsequently, randomly selected women, their partners and one of their children, ages 7-9, were invited to participate in the experiment. The women from the previously run survey were invited to participate in the sessions in a local school in their community. Participation was voluntary and was clearly stated in the invitation letter. Children and husbands/partners of the participating women also took part in experiments but were only accompanied by their parents.

During the experimental session, no questionnaire on violence exposure was asked of women. The only reference to violence was the treatment manipulation to which randomly chosen half of the women in the experiment, many of whom would not have faced intimate partner violence. The violence priming treatment consisted of a movie excerpt which shows a couple's interaction. The

complete experimental session progressed in the order shown in Figure 34. Discussing the complete design and effects of different treatment arms is beyond the scope of this paper. Here, I exclusively focus on mapping the effects of IPV on risk preferences through the cognitive load. The parts of the experiment relevant to this paper are shown by blue arrows in Figure 34.

Reading through Figure 34, we began the experiment by collecting the baseline cognitive scores through the Flanker Inhibitory control- Attention test and the List sorting Working memory test. The priming treatment followed the tests ($Priming_1$) for intimate partner violence. To capture the effect of the treatment on cognitive components, we administered the test for Inhibitory Control and attention ($Test_1$). Following which, the couples played the public goods bargaining game between themselves. A refresh of the priming treatment followed this intrahousehold bargaining game ($Priming_2$) and repeat the two questions of the cognitive load test ($Test_2$). After the refresh and repeat, the experiment moves to the mother playing the puzzle game with her child and completing the risk preference task, respectively.

In the following subsections, I go through the details of each element. I begin with the field setting and designs for each task chronologically, beginning with the cognitive measures and the multiple price list (MPL) for risk preferences. I end with putting all of it together in the experimental design and an illustration of how lottery choices in the MPL may look.

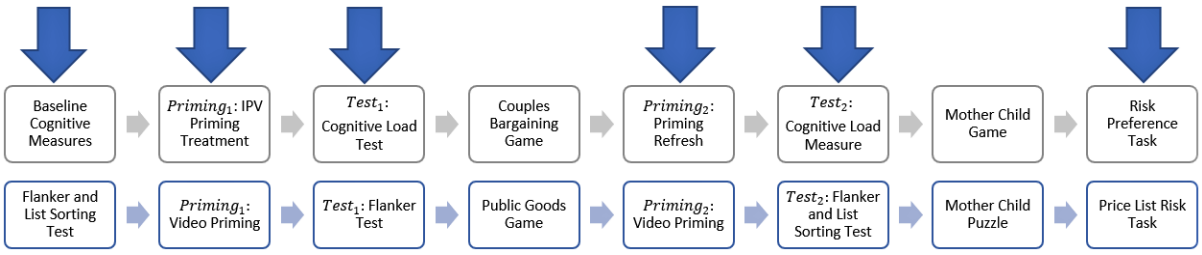


Figure 34 Experimental Session at a Glance.

4.2.1 Study Setting and Implementation on the Field

IPV is an urgent public policy challenge made more complicated by the taboo, trauma, and effects beyond one generation. The continued stress can enforce a considerable cognitive load on working memory. It could lead to a cycle of violence and women's reluctance to report it made worse by friction costs. While almost 29.8 per cent of women in Latin America and the Caribbean report abuse at a more disaggregated level, IPV in the Dominican Republic is alarming. Statistics from the health ministry (Ministerio de Salud Publica) reported that 35 per cent of women in the country faced violence from their partners. The Centro de Estudios de Genero (CEG-INTEC), a Center for gender studies at the Instituto Tecnologico de Santo Domingo in 2016, ran a study on the situation of IPV in

the country and found that femicide rates decreased in all countries in Latin America except the Dominican Republic (Giron, 2017). In fact, the nationwide Demographic and Health Survey of 2007 (Centro de Estudios Sociales et al., 2007) found that almost half of the Dominican women surveyed had faced physical, emotional or sexual abuse from their domestic partners. The country presents an interesting paradox. It is one of the fastest-growing countries in the region with the highest levels of abuse, thus forming an interesting backdrop to study the effects of economic expansion publicly on the changing gender parity (Caridad Bueno and Henderson, 2017). That is if economic development reduced women's propensity to IPV or were they more likely to face the "perverse effects" from the male backlash (Panda and Agarwal, 2005).

At this stage, it is worthwhile to point out that these figures are pre-covid, and given the increase in difficulties during the pandemic, I expect the situation to have worsened during the post-2019 years. With such endemic levels, the importance of background context in preferences cannot be ignored. It is already expected that living under such conditions would alter the cognitive processes (Garnelo et al., 2019) and hence should affect the decisions themselves. I place my work with the theoretical knowledge of cognitive load, preferences and IPV's impact on stress to understand the complete mechanism of it's effect on risk preferences.

Figure 35 Geographical Map of the Dominican Republic

(Source: By Kmusser - Own work, all data from Vector Map., CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=14857874)

I combine experimental elicitation methods with previous versions of the household violence surveys used by the Ministry of Women and the United Nations Economic Commission for Europe (UNECE). Months before the planned experimental session, the team defined a sample design for the study with support from the National Statistical Office (NSO). First, we randomly select primary sampling units and follow them up with quota sampling to select respondents based on traits like age. Households with children aged 7 – 9 qualified for the second stage quota sampling. The NSO 2018 survey (Encuesta

Experimental Sobre la Situación de las Mujeres - ENESIM, 2018) is based on standard domestic violence exposure questions. It is similar to the Violence Against Women (VAW) module implemented by the UNECE. With the help of trained enumerators from NSO, we adapted their survey and used questions relevant to our scope of work. In all, we selected 1032 households to take part.

The survey contained modules on parenting experiences, perceptions, and other demographic details. It began with the participating mother's preliminary questions about the household status and living conditions and progressed to occupational, educational, financial levels, characteristics of childcare arrangements, and help with schoolwork. Within the household, the mother first filled out the survey, and if permitted, the child answered specific questions. As these questions are answered only by the mothers, we can measure their experience using the survey's motherhood module. These 11 questions were scored on a 7-point Likert scale about her child's mood in general around her and vice versa. To measure her mental state exclusively, we have similarly scaled 15 questions on maternal health. The questions range from "I often have the feeling that I cannot handle things very well" to "I don't enjoy things as I used to" and "If there is a crisis, I have others I can talk to". It is also crucial to get an overview of the couple's interactions when discussing IPV. To this end, we have questions about the nature of the current relationship and the couple's life in general. These are sensitive topics as they involve the frequency and effects of behaviours like threatening, yelling, ignoring, controls on daily life and acts of physical violence on her physical and emotional health. At the end of the survey, the family was invited to participate in the experiments a month later.

On the day, the women were randomly allocated to either the treatment or control groups. The women were ushered to separate rooms, where we began with first getting their baseline cognitive measures using tests from the National Institute of Health (NIH) cognition battery tests (CLT). The 2 tasks are standardised measures of executive function and working memory that the participating women do thrice in the experiment at different intervals – in the beginning, after the priming and again after the priming is refreshed.

Violence priming ($Priming_1$, Figure 34). follows the baseline measures. The women, in isolation, are shown video clips of a couple arguing and are asked to recall an argument with their partner. The research assistant made a note of the discussion on his/her device. Our survey sample may or may not have participants in an environment of IPV. We set up the session to provide them with the highest protection and security, in case they were.

After the priming, one of the two-question test (CLT) questions was repeated to assess the direct cognitive impact ($Test_1$, Figure 34). The couple then did the standard household bargaining task – the Public Goods game. Individuals allocated money between their partners and themselves and made

consumption decisions. The bargaining task proceeded in two steps. In the first step, they made individual decisions; in the second, they made joint decisions.

While the parents did the bargaining task, we administered the Parent perception inventory (PPI) (Hazzard et al., 1983) questionnaire to the kids. Following the guidelines in the literature, maternal consent is sought at all stages. Assent from the children was obtained independently, and they were free to determine whether they wanted to answer the question or wished to stop altogether. The enumerators were allowed to skip the strongest negative PPI questions if they perceived any child distress or risk. To ensure maximum safety, we conducted the PPI for the children during the main session when the family's adults were engaged in the experimental tasks.

The standard instrument measures the frequency of interactions and assesses parental warmth, involvement, discipline, and guidance. The scale contained nine positive and nine negative behaviours classes. Each category included positive reinforcement, comfort, talk time, involvement in decision-making, time together, positive evaluation, allowing independence, assistance, non-verbal affection and privilege removal, criticism, command, physical punishment, yelling, threatening, time-out, nagging, and ignoring, respectively.

The translated sets were administered by reading out the scenarios of each behaviour, such as "How often does your mother take away things when you misbehave?" for the child and "How often does your mother take away things when you misbehave?". They responded by indicating on a 5-point frequency scale from 0 = never to 4 = a lot. Scores from the nine items were summed up to positive and negative scores for each, ranging from 0 to 36. The total net score was derived by subtracting the negative from the positive score. Higher scores indicated more positive parenting perceptions from both sides. The questions were alternated between negative and positive, and validity studies have shown that the instrument score significantly discriminates between children from distressed and non-distressed homes for different racial groups. The scoring has also been used for understanding perception differences in parenting between siblings, children with conduct problems, Hispanic and Anglo families (Russell, 1996; Trunzo, 2006).

Next, we repeated the violence priming for the mothers and their partners ($Priming_2$, Figure 34) and again followed it up with the 2-question cognitive load test ($Test_2$, Figure 34). Following the priming refresh, the mother and child were called upon to complete a game together where the mother had to explain a puzzle to her kid. The payoff for the mom was dependent on the child's performance. During the later analysis, their interaction was video recorded to be coded for categorisation into parenting type. In the meantime, the male partners were given the social norms game.

Finally, the risk task was introduced where the research assistant explained the 9- choice Holt and Laury Multiple Price lists (MPL) (Andersen et al., 2008; Holt and Laury, 2002). The risk preference elicitation task led to the payoff resolution endpoint of the session, where one of the decisions is picked to be paid. Before beginning the actual tasks, the participants do 9 trial rounds that mimic the actual tasks and payoffs that follow.

The experiment was conducted in local council schools, and all the data, apart from cognitive measures, were collected anonymously on Android™-supported tablets using Open Data Kit (ODK). The software is an open-source survey program that is simple and intuitive to use for research assistants. For cognitive load tests, the NIH cognition toolbox comes as an app and works only on Apple™ iPads. After configuring the app on the iPads issued by the University of East Anglia (UEA) Centre for Behavioural and Experimental Social Science (CBESS) lab, we conducted 2-day training workshops using the toolbox with the research assistants from INTEC.

The workshop began with introducing the graduate research assistants to the theoretical background of the tests and the training videos made available by NIH. Finally, we went through each of the tests. The instructions, the trial rounds and when to stop the test were explained to the team in detail, and a training brochure was handed to them at the end of the session to read about the administration in detail.

Before beginning the pre-set battery of tests, the researchers recorded the participant's self-identifying demographics on the day of the session. The team recorded their anonymised identifier, gender, age, race, ethnicity, dominant hand, highest education level and information on their mother's education level. These background variables have been shown to affect cognitive scores (Weintraub et al., 2013).

In the following sections, I detail the three elements of the entire experiment focussed on in this paper. I begin with the violence priming, follow it up with a discussion of the cognitive load test and then end with the risk task.

4.2.2 The Treatment: Intimate Partner Violence (IPV) Priming

After obtaining the baseline cognitive measures, we prime violence in mothers by showing a short video clip from a popular daily soap in the DR ($Priming_1$ and $Priming_2$, Figure 34). Women saw a movie excerpt in which a couple interacted and then recreated a situation/episode she experienced in the past. They are asked to recall an argument with their husband/partner. This is a standard method in experiments studying preference effects of trauma, violence, and war (Callen et al., 2014). We conducted this treatment in an isolated room with headphones to ensure her safety. After

showing the video on the tablet device, a short discussion is undertaken to discuss her experience with violence.

In addition to the pure video priming, we also have a video plus benefits and just benefits treatment group, where the same video is shown along with a short, scripted information blurb at the end on the benefits of parental involvement on children – " Research studies show that parent involvement activities result in substantial benefits to children, developing children' cognitive and non-cognitive skills. Some of the benefits are: Children 1. Tend to achieve more regardless of ethnic or racial background, socioeconomic status, or parents' education level 2. Generally, achieve better grades, test scores, and attendance 3. Consistently complete their homework 4. Have better self-esteem, are more self-disciplined, and show higher aspirations and motivation toward school 5. Their positive attitude about school often results in improved behaviour in school and less suspension for disciplinary reasons." As before, the treatment is followed by a small 5-minute private discussion.

Finally, the pure benefit and the control group are shown music videos without mentioning violence. The treatment is carried out with the same operating procedure. Therefore, in the original design, we have four treatment groups that I collapse into two for this paper – treatment (video and video plus benefits) and control (benefits and control) groups. Immediately after the priming treatment, all individuals repeat the cognitive load test which is detailed in the next section.

4.2.3 Cognitive Load Test

The National Institute of Health (NIH) cognitive battery toolbox (NIH-CB) is a 7-question assessment of different cognitive system functions (Table 34). [13] The set contains tests to measure executive function (EF), attention, inhibitory control, working memory, episodic memory, language, and processing speed. Developed initially as a web-based version in 2012, the toolbox was released as an iPad app available on request. The toolbox is recommended for use from ages 7 – 85 and has an early childhood version for infants as well. The app is standalone, portable and does not require custom hardware, internet access or special equipment for administration.

The test comprises 4 tests of fluid abilities (Flanker Inhibitory control test to measure attention, Inhibitory control and Executive Function, Dimensional Change Card Sort Test for Set shifting component of Executive Function, Picture sequence memory test for Episodic Memory, List sorting test for Working memory and Pattern comparison test for processing speed) and 2 for crystallised

[13] The NIH Toolbox spans four domains or broad areas of health and function: Cognition, Emotion, Motor and Sensation. Each domain includes multiple instruments that can be selected individually or used as part of a pre-set battery.

abilities (Picture Vocabulary for Episodic memory and Oral Reading Recognition test for language capabilities) (Weintraub et al., 2013). While the entire toolbox measures various cognitive components, to balance practical concerns of time and aim of the paper, I concentrate on the two most relevant– attention, inhibitory control and working memory.

Table 34 Tests included in the NIH cognition toolbox with administration time

Name	Measures	Estimated time
Flanker Inhibitory Control and Attention Test	Attention and Inhibitory Control (EF)	3 min
Picture Sequence Memory Test	Episodic Memory	7 min
List Sorting Working Memory Test	Working Memory	7 min
Picture Vocabulary Test	Language	4 min
Dimensional Change Card Sort Test	Set shifting (EF)	4 min
Pattern Comparison Processing Speed Test	Processing Speed	3 min
Reading Recognition Test	Language	3 min
Total		31 min

4.2.3.1 NIH Toolbox Flanker Inhibitory Control and Attention Test

The test measures goal-directed behaviour, inhibitory control, and attention. Here, the participant must focus on the target stimulus while blocking attention to the stimuli flanking it. In twenty rounds, 3–7-year-olds see three fishes, and ages 8 and above see three arrows pointing either in congruent or incongruent directions. For the former, they point in the same direction, while in the latter, the flanking stimuli point in the opposite direction of the middle figure. The responder needs to indicate the direction in which the middle fish or arrow points, thus inhibiting attention to task-irrelevant information.

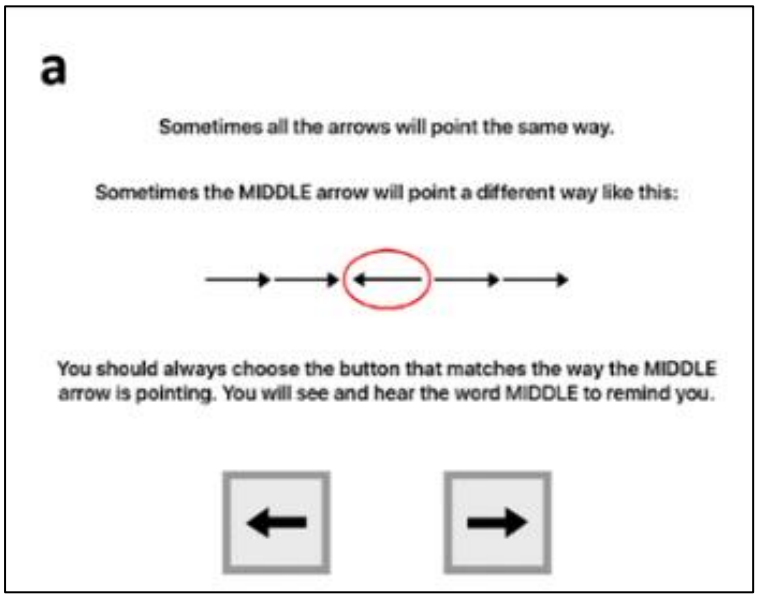


Figure 36 The Flanker test Instruction screen, as seen on the test iPad

The game begins once the participant gets at least 3 out of 4 practice trials right. If they are unable to do so, they are offered two additional practice rounds with the same cut-off to progress. Depending on age, the test has 40 stimulus sets of fish and arrows. Before starting the game, all participants are requested to keep their dominant hands' index fingers at "home base" – a standardised position equidistant from the test iPad.

The test is scored on accuracy and reaction time and generated by the app as a standardised output (Weintraub et al., 2013). Each " vector" can take a value between 0 and 5. For any individual, first accuracy is considered. If they score less than 80 per cent, the final computed score is the accuracy vector score. For each correct response, the respondent gets a 0.125 value (maximum score of 5 divided by 40), and the total Flanker accuracy vector = 0.125*number of correct responses. If he/she scores above 80 per cent, then the total computed score is calculated after including the reaction time vector. Based on a validation study of the NIH battery, the range of reaction time is set to 500 ms to 3,000 ms. The log values of reaction time are then rescaled from log (500) – log(3000), with smaller values receiving higher scores. After the reaction time scores are calculated, they are added to the accuracy score for those who scored higher than 80 per cent.

4.2.3.2 NIH Toolbox List Sorting Working Memory Test

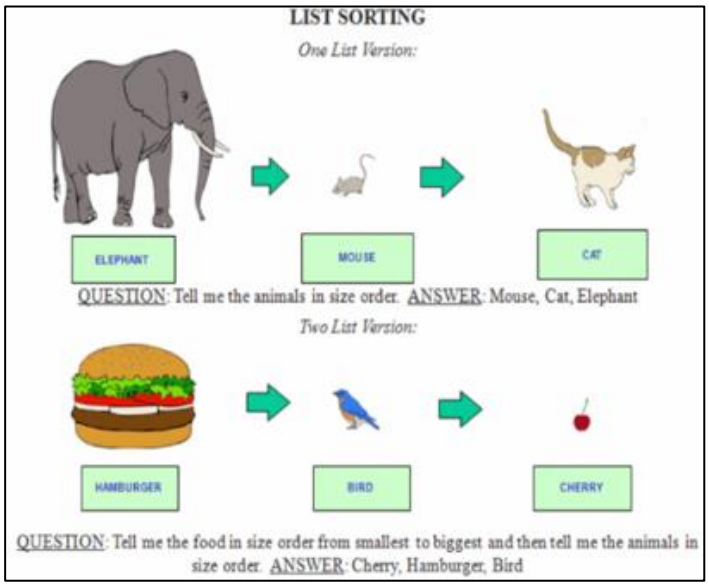


Figure 37 Screenshot of One-List and Two-List List sorting task.
Note: 1-List sorting requires participant to sequence items according to a single category, while 2 list sorting alters between two different categories.

List sorting is a working memory test requiring the participant to repeat the sequence of images presented visually an orally from smallest to largest order. The test has two versions – first, 1 list and then 2 list. In 1 list, all the pictures come from one category, like animals. In the second, two categories (animals and food) are mixed up, and the participant must order both in the same ascending order of

size. Therefore, the test first requires the participant to store information (short-term working memory), process and then manipulate it (working memory) to arrange the stored information in ascending order.

The test is scored on total accuracy by summing up the total number of items recalled and sequenced. The total score on the two lists can range from 0 to 26. As she lists the ordering, the researcher uses a Bluetooth keyboard and simultaneously enters a 1 if the response is correct or a 0 if not. With each successive trial, the total number of pictures increases, and the test is stopped as soon as two consecutive trials of the same length fail.

It is worth noting that although the original toolbox was developed in English, the official translated versions of the app are available for non-English speakers too. Parallel instructions and test versions are available for Spanish. Therefore, we can administer the toolbox in the native language of the region with minimal scope of subjectivity due to the field experimenter.

The developers used a seven-step translation method to translate the English version to Spanish for the measures of capabilities. The first two steps involved forward and back translations by Spanish and English native speakers, followed by comparing the two to identify discrepancies. Next, the draft was reviewed by a bilingual speaker, followed by finalisation by the Spanish coordinator. Finally, the version and the audio file were harmonised, formatted, typeset, and proofread. The procedure began with forward translations by native Spanish speaker and reviews by bilingual experts. After the language coordinator's feedback, each word and picture was modified to match. The audio recordings were also redone using voices for the target language.

In the experiment, the two tests are first done to get baseline measures, and then the attentional and inhibitory control effects of priming are measured using the Flanker test ($Test_1$, Figure 34). After the women and their partners do the bargaining game among themselves, we repeated the priming treatment and followed it with the two tests again before continuing to the risk task ($Test_2$, Figure 34).

4.2.4 Risk Preferences

To measure risk preferences, I built on Holt and Laury (2002), Andersen et al. (2008) and Penczynski & Santana's (2021) price list task implemented for student and non-student populations in the USA, Denmark and the Philippines. Participants were required to choose between lottery A and B in 9 choices. The switching point from A to B gave the participant's risk-seeking level. Theoretically, it is expected that if the decision-makers are highly risk averse, their switching point would be lower in the 9-step ladder.

Each binary choice is between a lower (150 pesos) and a higher risk lottery (300 pesos). The chance of winning the higher prize varies from 0.1 to 0.9 for the 9 steps. Therefore, the nine probabilities of winning the lottery are $p_w \in \{0.1, 0.2, \ldots, 0.9\}$. After the mother-child game, the mothers chose between 150 and 300 pesos with the probability p_w. Winning the lottery pays 300 pesos; losing it reduces the payment to 0. In this binary choice game, the mothers are asked (in Spanish) on the tablet "*Usted prefiere tener 150 Pesos seguros o prefiere 300 Pesos si saca una bola naranja y 0 Pesos si saca una bola blanca?* (Do you prefer to have 150 Pesos for certain or 300 Pesos if you draw an orange ball and 0 Pesos if you draw a white ball?)." Figure 38 shows one of the nine sample decision-making tasks where if she chooses lottery B, the probability of winning 300 pesos (orange ball) is 0.1, and that of making 0 pesos (white ball) is 0.9.

Now, to infer risk preferences from the price list, I take each binary choice made by the subject and estimate the parameters of the latent utility function, then construct the expected utility of the two gambles for values of the parameters. Finally, use the linking function to infer the likelihood of the observed choice, as in Andersen et al. (2008).

Figure 38 Screenshot of the Price List task.

Assuming an expected utility (EU) framework, I use a stochastic specification that translates the binary choice probabilities into the likelihood function. This is in line with the theoretical procedure used by Andersen et al. (2008) and Penczynski & Santana (2021) that implemented a Constant Relative Risk Aversion (CRRA) function for choices from the price list task. The EU from the risk task for a choice between A and B with probabilities p_w and assuming Constant Relative Risk Aversion (CRRA) can be written as –

$$EU_i = \sum_{j=A,B}(p\,(M_j) \times U(\omega + M_j)) \quad (1)$$

With the underlying utility function given by-

$$U(M) = \frac{(\omega + M)^{(\alpha)}}{(\alpha)} \tag{2}$$

Where α is the CRRA coefficient and the curvature parameter of the utility function, it is the risk parameter and the outcome of interest. In terms of risk preferences, if $\alpha > 1$, it implies risk-seeking, $\alpha = 1$ and $\alpha < 1$ indicate risk-neutral and risk aversion, respectively. ω, is the background consumption. It indicates lifetime, and previous wealth, which is an exogenous constant. It can also be taken to be 0, assuming that the background wealth has no role in integrating earnings from the risk task. For my sample, I approximate the background consumption by taking the average daily consumption for the women collected during the pre-experiment survey.

The binary choice data from each decision step is normalised and analysed with a stochastic specification like the one used by Holt and Laury (2002) for the index ∇U ("nabla" U)

$$\nabla U = \frac{U_B}{U_{150} + U_0} \tag{3}$$

The index in Equation (3) translates the choices and the utility into probabilities, thus giving us a probability distribution to estimate aggregate decisions for every participant using the maximum likelihood model. The Log-likelihood function to estimate 9 decisions for each individual (i) (Equation 4) and the full sample (Equation 5) can be written as –

$$\ln\mathcal{L}_i^U = \sum_{k=1}^{9} ln\ \nabla U_{ik} \tag{4}$$

$$\mathcal{L}^U = \sum_i \ln\mathcal{L}_i^U = \sum_i \sum_{k=1}^{9} ln\ \nabla U_{ik} \tag{5}$$

I estimated the risk preference parameter α using the maximum likelihood method for two specifications. First, assuming no background consumption (ω = 0) and second, assessing the additional impact of background consumption equal to the daily average for each mother.

Finally, I describe the hypothesis of interest from the literature on violence, IPV, risk preferences and the moderating mechanism in terms of the outcomes from the methods. After the brief discussion, in the next section, I report basic descriptive results of the sample, the treatment-control groups, their cognitive load test scores, a summary of the structural estimations and the regression results.

4.3 Results and Analysis

In this section, I present my main results. I begin with the summary statistics of the sample and continue into the balancing tests of the group that received the violence priming (treatment) and the ones that didn't (control). Next, I compare the cognitive load scores to assess if the treatment impacted the measures. Following this, I describe the risk parameter from the maximum likelihood estimations. Finally, after controlling for the correlates, I present the multivariate analysis investigating the effects of Intimate Partner Violence (IPV) on the risk parameter.

The sample of 174 mothers of 7 -9-year-olds in a heterosexual relationship were randomly allocated to receive the video priming for the violence treatment or the control group. The assistants allotted the treatment or control in alternate order of arrival. In all, 89 women were shown the short video of a couple arguing and asked to recall an argument with their partner, while 84 women were shown the control video. Table 35 presents the summary of the total experimental sample.

Table 35 Treatment groups

Group	N	Percentage (%)
Control	85	48.85
Treatment	89	51.15
Total	174	100

Table 36 contains the averages and balance tests for differences between the two groups for the relevant variables. The sample is balanced in terms of age, literacy levels, self-reported willingness to take risks and household size. During the survey, I collected information about the household's background consumption level, the decision to save, current marital relationship status, and employment status. I find no statistical difference between the groups except for the latter two. The employment status is a binary variable in the survey indicating if the respondent had any paid work in the 7 days before the survey. While the variables would influence risk preferences, the significance between the groups seems more accidental than a randomisation issue. The research assistants had no access to the survey data while allotting the groups. Additionally, the joint test after regression of treatment assignment on the null of all variables jointly being zero cannot be rejected (F = 1.38, the probability of obtaining the estimated F-statistics or greater, i.e., the p-value = 0.175).

To get at the background vulnerability factors that may affect the response and coping in an environment of violence, I created variables that captured the self-reported mental health of the mother, the level of economic control the husband/ partner exerts in her life, the frequency of violent episodes and her social interaction levels. The maternal mental health score is an average combination of variables that tapped into things like "feeling that cannot handle things well", "find yourself giving

more of your child's needs than yours", "feel lonely and friendless", "there are people to talk to when feeling lonely, or if there is a crisis" and "don't enjoy things the way I used to". The mother had to report how much she agreed with the statement on a Likert scale from 1 to 7. The stronger they agree with the statement, the higher the score. Similarly, to check for predisposition for spousal violence due to childhood experiences, I combined 4 variables that asked, "Did the adults you live with until age 15 hit each other or you, insult each other or you?" The respondents could rank from occasionally, very often to never.

Finally, to understand the exposure to IPV in their daily lives, I constructed three combined variables (Level of economic violence, Instances of IPV and total physical violence levels) that looked at the frequency of physical and sexual abuse in her current relationship. The IPV variable included a range of possible intimidation conducts. Participants had to pick the frequency with which they faced the following behaviours - if there was a threat to kill, have been pushed, kicked, dragged, smothered on purpose, slapped, or forced into non-consensual sexual acts. Each question had four responses – many times, a few times, once and never. The higher the score, the lower the average physical violence experienced.

Table 36 Balance tests between control and treatment groups

Factor	Control (84)	Treatment (89)	Difference (p-value)
Age	33.14	33.89	-0.756 (0.42)
Literacy Level	0.976	0.977	-0.001 (0.95)
Marital Status	4.66	4.29	0.37 (0.03**)
Household size	4.63	4.65	-0.025 (0.88)
Background consumption of the household	4230.88	9157.07	-4926.19 (0.11)
Employment Status	0.53	0.40	0.125 (0.09*)
Mental health Score	3.33	3.40	-0.06 (0.74)
Savings	0.17	0.19	-0.014 (0.80)
Economic violence	14.96	15.66	-0.698 (0.00***)
Total Violence	3.97	3.97	-0.001 (0.963)
Instances of IPV	47.42	47.65	-0.228 (0.14)
Meet friends, neighbours, or relatives often	3.44	3.49	-0.047 (0.84)
Abusive family while growing up	2.61	2.60	0.007 (0.92)
Willingness to take risk	2.57	2.42	0.149 (0.62)
Baseline Score Flanker Test	6.76	6.69	0.068 (0.75)
Baseline Score List Sorting Test	13.87	13.48	0.384 (0.55)

Note: Balance test difference tested by using t-test. 78 and 84 women in the control and treatment groups did the baseline Flanker test, respectively. On the other hand, 78 and 80 did the List Sorting test before beginning the experiment. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Economic violence score was calculated as the frequency sum of the following questions “Has he made decisions about the economic situation of the household without taking your opinion?”, “Has he

refused or stopped giving you money for household expenses and your children?", "Has he taken or attempted to take your money, property or things?" and "have you been forbidden to work or study?" Finally, the total violence score is included as a catchall score to capture the complete spectrum of possible violence incidence. If the participant gave a non-zero frequency response to any violence score, it is coded as 1 and 0 if not. In addition to including instances of economic, sexual, and physical violence, the variable also cases when the mothers felt they were ignored, humiliated, spied on, restricted socially, and blamed for being unfaithful by their partners. As can be seen in Table 36, apart from economic violence levels, the groups are balanced for the other two variables in my sample.

Before the participants began the experiment, I administered the NIH Flanker Inhibitory Control and Attention Test and the NIH List Sorting Working Memory test to get the baseline cognitive scores. Comparing the cognitive scores shows that the two groups are not statistically different at the experiment's outset. A higher score on both tests implies better attention and working memory levels.

Having described the experimental setup, the sample breakup, baseline characteristics and the balancing tests, I now address the research question. I will begin with first presenting the risk parameter from the maximum likelihood estimation. Then I link the risk parameter to the primary research objective of whether the IPV treatment influences it in my experiment. Then, I delve deeper into the mechanics of the process. I analyse the effects of the IPV treatment on the cognitive load test scores and complete the cycle from IPV to risk parameter through the cognitive mechanism. Finally, I conclude with some heterogenous analysis to investigate aspects of real-life IPV instances that may impact a mother's cognitive load and its consequences.

4.3.1 Intimate Partner Violence and the Risk Parameter

I first present the maximum likelihood estimation of risk parameters for individuals (Table 37). The median value for the MPL estimate is 0.273 and 0.559 (including the background consumption). In line with the method, the higher the parameter, the lower the risk aversion. Understandably, including background consumption increases the estimates of the CRRA parameter (Andersen et al., 2008), as previous wealth is also included as part of the decision-making rather than having 0 as the starting budget point.

Table 37 Maximum Likelihood Estimates of Individual Risk Parameter (α and α_{back})

	Median	N
Risk parameter, α	.273	164
Risk parameter, α_{back}, with background consumption	.559	164

Note: Background consumption level is the daily average individual consumption. The average for the entire sample is 152.62 pesos.

Table 38 Estimation Results of IPV results on the risk preference parameter

Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)
Risk Parameter	α	α	α	α_{back}	α_{back}	α_{back}
Treatment (Primed with IPV)	-2.514	-0.763	-0.0264	2.324	0.611	-0.144
	(-0.56)	(-0.17)	(-0.01)	(0.52)	(0.13)	(-0.03)
Economic violence		8.691	10.65*		-8.501	-10.47*
		(1.64)	(1.95)		(-1.62)	(-1.94)
Current Relationship Status			2.950			-2.964
			(1.45)			(-1.47)
Employment Status			-2.329			2.492
			(-0.51)			(0.55)
Constant	24.32***	21.24***	8.627	-22.10***	-19.09***	-6.465
	(7.52)	(5.70)	(0.78)	(-6.91)	(-5.18)	(-0.59)
N	164	164	162	164	164	162

Note: Risk preference parameter assuming no background consumption (α) and background consumption (α_{back}). *t* statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Looking at Table 38, the primary hypothesis (Hypothesis 1) on the effect of IPV priming on the risk parameter cannot be rejected. The results from linear regression for the risk parameter without (α) and with background consumption (α_{back}) are not significant for the priming treatment in any of the models. In the three regressions for each parameter, I progressively include the unbalanced covariates and find no statistically significant effect of violence priming. What needs to be noted is that estimates from Columns 1,2, and 3 in Table 38 are an artefactual reality and hypothetical case of an individual that does not account for her current consumption level when making decisions. Nevertheless, in line with our predictions, the level of risk parameter falls (coefficients of both α and α_{back} are negative) reducing the risk-seeking in response to the IPV priming as more control variables are added from Columns 1 to 3 and 4 to 6. Therefore, for the binary MPL decisions, violence priming decreases the tendency to take risks for both cases. Although, statistical significance alludes us.

Of all the control variables included, there is a statistically significant relationship between the level of lived intimate partner economic abuse reported by the mother in the pre-experiment survey and her risk preferences. This hints to the existence of some relationship between spousal violence and risk preferences. Nevertheless, the inconclusive evidence from my experimental treatment needs to be explained. Given the random allocation, there is a chance that the group that got the IPV treatment also included those who have not faced any real-life violence. For those mothers, it is possible that the treatment did not work enough to trigger any follow-up effect. The significance of reported violence and the non-significance of the IPV treatment can also be read in light of similar findings from Afghanistan (Callen et al., 2014). The authors found evidence of previous violence exposure as the key factor that triggered effects on preferences in fear-based-priming controlled field experiments.

In the next section, I explore these heterogeneous effects further along with hypotheses 2 and 3. I first discuss if the Intimate partner violence treatment in my experiment had adverse cognitive load

effects (Hypothesis 2). I follow it up with a heterogenous analysis of the impact on test scores because of distinct kinds of violence. Then, I link the three factors together to analyse whether the theoretical framework is borne out from my data – if the effects of IPV on risk preferences are moderated through the cognitive mechanism.

4.3.2 Effect of IPV on Cognitive Load Test Scores

I now summarise the scores from the cognitive load tests at different stages to assess the effect of violence treatment. Table 39 and Table 40 present the summary scores and the statistical tests between them. As can be seen in Table 39, women in the treatment group score higher in the Flanker Inhibitory Control test both after priming ($Test_1$) and priming refresh ($Test_2$). Their raw scores after each round and the corresponding difference from baseline (Δ_1, Δ_2) are higher than the control group at all stages. This is a surprising result, not in line with our hypothesis 2, as we expect priming to have a more significant cognitive impact on the treated group. The pattern is confirmed by the t-test in columns (1) and (2) of Table 40. Since higher scores on the test indicate better performance, the negative sign shows that treatment groups do better (not statistically) than the control group.

Table 39 Summary of Cognitive Load Test Scores

	Control					Treatment				
Test	Baseline	$Test_1$	Δ_1	$Test_2$	Δ_2	Baseline	$Test_1$	Δ_1	$Test_2$	Δ_2
Flanker	6.76	6.93	0.197	7.20	0.463	6.69	6.98	0.315	7.22	0.541
List Sorting	13.87			14.95	0.96	13.48			14.50	1.25

Note: 73 and 77 women in the control and treatment groups did the Flanker test post-Priming treatment, respectively. On the other hand, 67 and 74 women repeated the test after priming refresh. Additionally, 65 and 73 women in the control and treatment groups did the List Sorting test after the priming was refreshed. Difference from baseline (Δ) calculated as the New Score (Post Priming or Priming refresh) – Baseline scores. Δ_1 is the change in scores after $Priming_1$ and Δ_2 is the change in scores after $Priming_2$.

Table 40 Statistical t-Tests for Between-group Differences in Cognitive Load test scores

Test	Difference between Control and Treatment groups (standard error)			
	In Raw Scores		Changes from Baseline	
	(1)	(2)	(3)	(4)
	$Test_1$	$Test_2$	$Test_1$	$Test_2$
Flanker	-0.055 (0.240)	-0.031 (0.241)	-0.117 (0.139)	-0.077 (0.177)
List Sorting		0.446 (0.665)		-0.280 (0.506)

Note: Differences in Raw scores are calculated as the change in scores from control to treatment for each test round. Column 1 = Difference in Scores from the cognitive test ($Test_1$) done right after first priming, or $Priming_1$. Column 2 = Difference in Scores from the cognitive test ($Test_2$) done right after priming refresh, or $Priming_2$. Differences in changes from baseline are calculated as the first difference (difference in difference) in scores between the control and treatment group, i.e., [changes from baseline scores for control - changes from baseline scores for the treatment group] or $\Delta_1 - \Delta_2$ for the two rounds of tests. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

However, the same cannot be said for the List Sorting Working Memory test. The test was only done at baseline and after the priming was refreshed. We see that the raw scores for the treatment group are lower than the control group at both stages, hinting at some effect on working memory. There is

an increase compared to the baseline scores, hinting at some learning effects being captured in the scores as well.

To account for the learning and difference from baseline, I calculate and statistically test the difference in the difference between control and treatment groups for both the tests (Columns 3 and 4 in Table 40). The level of difference is not significant for any of the tests; therefore, we cannot reject the hypothesis of no effect of priming on cognitive load.

It is important to point here that for our analysis, I have recoded the original 4 groups – video, video & benefits, only benefits and control into 2. I categorised video and video plus benefits into the treatment group, and the benefits only and control as the control group. Given this reclassification, the scores from the respective group would include the effects of both. Exploring this possibility statistically, I tested the difference in scores for only the control and only the video treatment group. While other tests were not significant, the difference in scores from the List sorting test was statistically significant at 10% level (Table 41). Therefore, there is some evidence of violence priming on working memory.

Table 41 Between-subject differences in List sorting Raw scores for pure treatment and control group

Group	N	Mean (Std. error)
Control (Baseline Scores)	34	15.529 (0.653)
Treatment (Scores from $Test_2$)	30	14.133 (0.737)
Difference		1.396* (0.981)

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.3.3 Heterogeneous Analysis of Effects of IPV on Cognitive Load Test Scores

In this section, I dive into the effects of IPV priming on individual cognitive load test scores (Hypothesis 2) and present the heterogenous analysis of various aspects of self-reported violence on the post-priming performance after including covariates of interest. I begin with the analysis of IPV on the raw scores from the measure of inhibitory control & attention – the Flanker test and working memory – the List Sorting test. Next, I look at the effect on the differences in the performances of these tests from the baseline levels. Besides looking at the impact of the experimental Intimate Partner violence priming (IPV), the regressions also include the presence of other kinds of violence, especially economic violence, and the catchall total violence score to look into the joint effects on the performance in the cognitive tests.

Table 42 summarises the results from regressions looking at the effect of IPV priming on raw performance scores from the Flanker inhibitory control and attention test. To recall, the test was done at the three stages in the experiment- the baseline, post-priming ($Priming_1$) and after the priming was

refreshed ($Priming_2$). The stage at which the test was done is coded correspondingly as $Test_1$ (when done post-priming) and $Test_2$ (when done after priming refresh).

Table 42 Regression Estimates for the effect of IPV on the measure of Inhibitory Control and Attention (Flanker Test)

Dependent Variable: Raw Score on Flanker Test	(1) $Test_1$	(2) $Test_2$	(3) $Test_1$	(4) $Test_2$	(5) $Test_1$	(6) $Test_2$	(7) $Test_1$	(8) $Test_2$
Treatment (Primed with IPV)	0.0591	-0.029	0.174	-0.038	0.122	-0.046	0.141	-0.041
	(0.25)	(-0.12)	(0.69)	(-0.16)	(0.42)	(-0.16)	(0.41)	(-0.12)
Economic Violence			0.265	-0.103	0.181	-0.116		
			(0.91)	(-0.36)	(0.49)	(-0.31)		
Employment status			0.528**	0.345	0.513**	0.344	0.530**	0.339
			(2.18)	(1.43)	(2.07)	(1.40)	(2.14)	(1.39)
Relationship status			-0.019	-0.024	-0.023	-0.024	-0.037	-0.011
			(-0.18)	(-0.23)	(-0.22)	(-0.23)	(-0.34)	(-0.11)
Treatment x Eco. Violence					0.225	0.030		
					(0.37)	(0.05)		
Total Violence							-0.027	0.0632
							(-0.08)	(0.18)
Treatment x Total Violence							-0.068	0.068
							(-0.14)	(0.14)
Constant	6.930***	7.205***	6.635***	7.178***	6.691***	7.185***	6.824***	7.051***
	(40.61)	(41.75)	(11.32)	(12.44)	(11.02)	(12.03)	(10.97)	(11.49)
N	151	143	149	142	149	142	149	142

t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Each successive column from 1 to 9 in Table 42 adds control variables and looks at the effect on the raw scores from each test. As can be seen, apart from the mom's employment status, there is no statistically significant effect on the scores from the Flanker Inhibitory test. In line with our expectations, an employed, earning mother does better at the test. Contrastingly, neither IPV priming treatment from our experiment nor the self-reported violence measures have any statistically significant effect on the raw scores.

Similarly, Table 43 contains results from regressions looking at the effect of IPV priming on raw performance scores from the List Sorting Test for Working memory. Apart from the baseline, the test was done only after the priming was refreshed ($Test_2$). Like before, I add control variables in each successive column from 1 to 4 and do not find a statistically significant effect of the experimental IPV treatment on working memory. However, something interesting can be seen. When interacted with previously lived exposure to violence in general and economic violence in particular, the IPV treatment leads to a positively significant effect on the working memory test score. While this is not entirely in line with what I expected, I can explain this as a by-product of how working memory functions. The experiences are stored in her working memory when the mother has lived through violence. In such a scenario, working memory is inordinately activated when the IPV treatment taps into past experiences. This may be why those who have lived through some form of spousal violence performed better.

Table 43 Regression Estimates for the effect of IPV on the measure of Working Memory (List Sorting Test)

Dependent Variable: Raw Score on List Sorting Test	(1) $Test_2$	(2) $Test_2$	(3) $Test_2$	(4) $Test_2$
Treatment (Primed with IPV)	-0.0434	0.379	-1.115	-1.777
	(-0.05)	(0.44)	(-1.15)	(-1.52)
Economic Violence		0.865	-1.596	
		(0.86)	(-1.28)	
Employment status		1.725**	1.305	1.367
		(2.07)	(1.59)	(1.64)
Relationship status		0.288	0.168	0.210
		(0.78)	(0.47)	(0.58)
Treatment x Eco. Violence			6.257***	
			(3.12)	
Total Violence				-1.689
				(-1.41)
Treatment x Total Violence				4.077**
				(2.46)
Constant	15.03***	12.47***	14.10***	14.22***
	(25.11)	(6.23)	(7.02)	(6.82)
N	141	140	140	140

t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 44 presents regression results looking at the effect of IPV priming and violence on Flanker test scores after accounting for baseline performances. Controlling for baseline measures is important in filtering out the actual effect of violence on cognitive components as it helps control for noise in the results due to individual differences in capabilities and learning effects. Continuing the same terminology Δ is the difference in a mother's score on the respective test compared to her baseline performance on the same test. The measure is calculated as the difference between the raw scores for the baseline from the new scores. Therefore, Δ_1 is the change in score on the Flanker Test after $Priming_1$ and Δ_2 is the corresponding change after the priming is refreshed ($Priming_2$). Again, though our IPV Priming treatment did not have a statistically significant effect, lived experience of violence did. Though the effect is unstable, it is in line with what we would expect, there is a hint of economic violence and total violence dampening effect on the change in Flanker test scores, and therefore Inhibitory control and attention.

Like Table 44, Table 45 contains the regression results analysing the effect of IPV priming and violence on List Sorting Working memory test scores after accounting for baseline performances. As the List Sorting test is only done at baseline and after the priming is refreshed, we only have one measure of changes in working memory, Δ_2. As can be seen, none of the variables, background, IPV treatment or violence statistically affect the working memory test performance.

In conclusion, a few points and some mixed results can be drawn from the heterogenous analysis of IPV and cognitive components. First, the mother's employment status seems to guide her inhibitory control and attention, though the effect is unstable. Second, previous experience with violence seems to better the working memory performance. Thirdly, though not very robust, lived violence has a

dampening effect on inhibitory control and attention. Finally, the IPV treatment from the experiment did not statistically affect either Inhibitory control, attention or working memory.

Table 44 Regression Estimates for the effect of IPV on changes in Flanker Test Scores from Baseline

Dependent Variable: Difference from baseline in Flanker Test Score	(1) Δ_1	(2) Δ_2	(3) Δ_1	(4) Δ_2	(5) Δ_1	(6) Δ_2	(7) Δ_1	(8) Δ_2
Treatment (Primed with IPV)	0.118	0.077	0.063	-0.007	0.073	0.063	0.084	0.064
	(0.84)	(0.44)	(0.42)	(-0.04)	(0.51)	(0.35)	(0.48)	(0.30)
Economic Violence			-0.205	-0.442**			-0.175	-0.321
			(-1.19)	(-2.07)			(-0.80)	(-1.16)
Employment status			0.082	0.006	0.099	0.023	0.087	0.0212
			(0.57)	(0.03)	(0.70)	(0.13)	(0.60)	(0.12)
Relationship status			-0.015	0.016	-0.024	0.034	-0.013	0.020
			(-0.24)	(0.21)	(-0.39)	(0.43)	(-0.22)	(0.25)
Total Violence					-0.342**	-0.182		
					(-2.41)	(-0.99)		
Treatment x Eco. Violence							-0.082	-0.295
							(-0.22)	(-0.68)
Constant	0.198*	0.464***	0.311	0.548	0.451	0.402	0.291	0.480
	(1.97)	(3.61)	(0.90)	(1.27)	(1.32)	(0.92)	(0.81)	(1.09)
N	150	141	148	140	148	140	148	140

t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 45 Regression Estimates for effect of IPV on changes in List Sorting Test Scores from Baseline

Dependent Variable: Score Difference from baseline in List Sorting Test	(1) Δ_2	(2) Δ_2	(3) Δ_2	(4) Δ_2
Treatment (Primed with IPV)	0.281	0.294	0.134	0.0620
	(0.55)	(0.55)	(0.22)	(0.08)
Economic Violence		-0.380	-0.640	
		(-0.61)	(-0.81)	
Employment status		0.578	0.536	0.535
		(1.12)	(1.02)	(1.02)
Relationship status		-0.0751	-0.0861	-0.0544
		(-0.33)	(-0.38)	(-0.24)
Treatment x Eco. Violence			0.690	
			(0.53)	
Total Violence				-0.269
				(-0.36)
Treatment x Eco. Violence				0.667
				(0.64)
Constant	0.969***	1.081	1.248	1.020
	(2.64)	(0.88)	(0.98)	(0.78)
N	137	136	136	136

t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.3.4 Linking IPV, Cognitive load and Risk Parameter

Finally, I discuss the third hypothesis that connects IPV to the risk parameter through cognitive measures. Table 46 reports the regression estimates with the risk parameter without (α) and with background consumption (α_{back}) as the dependent variable. Columns 1 , and 2 have the results for the risk parameter assuming no background consumption and 3, and 4 contain regression estimates assuming background consumption equal to the daily average individual consumption in the Dominican Republic (152.62 Pesos). The higher the risk parameter, the more risk-seeking the decision-

maker is. In order to look into the combined effect of IPV treatment, the cognitive test scores from both Flanker and List Sorting tests are interacted. In addition, I also include the change from baseline scores from these two tests to look at individual effects on risk preferences. Apart from the presence of economic violence and Inhibitory control- Attention, no other variable seems to have a statistically significant effect on the risk parameter. The effects for these two factors are in line with what we would expect. In column 3, other things being constant, economic violence reduces the risk parameter (α_{back}), thus increasing risk averseness. Similarly, a higher measure of performance on the inhibitory control and attention tests, increases the risk parameter (α_{back}), thereby increasing the tendency to take risks.

Therefore, in line with evidence from other previous studies, we see some connection between previous exposure to violence to risk preferences. Additionally, higher Inhibitory control and attention have a role in guiding the risk parameter towards more risk-seeking behaviour. However, the statistical evidence establishing it as the moderating variable from IPV to the risk parameter remains elusive on account of non-significant interaction effects.

Table 46 Regression Estimates for effect on risk parameter including cognitive load test scores

Dependent Variable: Risk Parameter without and with background consumption	(1) α	(2) α	(3) α_{back}	(4) α_{back}
Control x Flanker $Test_2$ score x List Sorting $Test_2$ score	0.0237	0.483	-0.0540	-0.566
	(0.09)	(0.94)	(-0.21)	(-1.12)
Treatment x Flanker $Test_2$ score x List Sorting $Test_2$ score	0.00160	0.441	-0.0323	-0.525
	(0.01)	(0.87)	(-0.12)	(-1.04)
Economic Violence	10.38*	6.855	-10.33*	-6.928
	(1.69)	(1.14)	(-1.70)	(-1.16)
Employment status	2.753	2.506	-2.738	-2.495
	(1.23)	(1.15)	(-1.24)	(-1.16)
Relationship status	-2.398	-1.449	2.409	1.375
	(-0.46)	(-0.28)	(0.47)	(0.27)
List Sorting $Test_2$ score after $Priming_2$	0.410	-3.742	-0.238	4.346
	(0.25)	(-0.95)	(-0.14)	(1.12)
Flanker $Test_2$ score after $Priming_2$	-0.473	-2.842	1.087	4.199
	(-0.10)	(-0.40)	(0.24)	(0.60)
Δ_2, Difference from baseline in List Sorting test		0.682		-0.710
		(0.71)		(-0.74)
Δ_2, Difference from baseline in Flanker test		-8.565***		8.208***
		(-3.21)		(3.11)
Constant	6.008	40.91	-7.603	-48.16
	(0.20)	(0.77)	(-0.26)	(-0.91)
N	133	129	133	129

t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.4 Conclusion

With this paper, I move beyond looking at financial scarcity's direct effect on probability weighting and risk preferences through cognitive mechanisms to analysing risk parameters through another

source of cognitive load – Intimate Partner Violence on mothers. While poverty and financial scarcity by themselves are pervasive issues in the developing world, the situation is worse for women in such circumstances as some form of violence often co-exist. Violence within the household is severely debilitating for mothers with young kids in countries with low social protection, strong gender norms about mothering, taboo about the subject, and no recuse. Literature has shown its overarching impact on her economic preferences, decisions to work and well-being.

I place my work at the intersection of Intimate partner violence on mothers with young children (7-9), the cognitive load they face due to it, their coping with a focus on the kid, and risk preferences. Theoretically, a mother facing Intimate partner violence would be cognitively loaded from it. Even in those circumstances, she would focus on coping with it for the kid. As a result, all her other preferences would change. As she is tunnelling on the child, her risk preferences would be guided more by System-1, and she is more likely to be risk-averse than those who do not face spousal violence.

Overall, there are some key insights from my results. First, treatment priming from the experiment does not have a statistically significant effect on the risk parameter. Second, on the whole, the treatment does not have a cognitive loading effect. However, this result must be taken with a pinch of salt. The non-significance may be a result of poor power in the experiment. As heterogeneous analysis reveals some significant (weak) effects of priming on working memory scores when tested between pure treatment and control groups. Thirdly, while the hypothesised circuit from IPV to risk parameter through Cognitive Load does not hold statistically, there is evidence of higher inhibitory control and attention, making the mother more willing to take risks. Fourth, apart from employment status, any exposure to violence, particularly economic abuse, has an impact in triggering the effect on risk preferences, working memory, inhibitory control and attention.

While these results are mixed, they give an interesting insight into the key mechanism effects. In line with previous findings for war trauma and preferences in Afghanistan (Callen et al., 2014), I find that violence priming only works when there has been a previous experience of having lived through the situation. The effects on risk preferences hold for cases with reported economic abuse.

The limitations of the experimental methods used bind the design. While the measurement of risk preference has a long history, there is no solid consensus on how it should be measured. The choice of measure depends on the intent, field setting, participants' numerical skills and logistical concerns (Dave et al., 2010). They may vary on incentives, complexity in terms of task design, the time required, fineness of measures, stability, and link to theories. Though the price list measures have been used

across countries, there is a consensus that the method is relatively complex, leading to considerable data loss due to inconsistency from multiple switching points between choices A and B (Charness et al., 2013; Crosetto and Filippin, 2016).

Conceptually, the experimental design is based on the cognitive load effects of violence on the primary caregiver and the resulting effect on risk preferences. Therefore, it would carry over to other settings and domains where the initial priors of low trust in institutions, struggling social care systems and gendered societal norms hold. In particular, I see three direct extensions. Firstly, in conflict settings, the researcher might want to study the impact of external disturbances on intra-household bargaining and risk preferences. Second, to situations where there is an interest in looking at other economic preferences, including and beyond risk preferences. For example, the same Price list (Andersen et al., 2008) can be used to obtain joint measures of risk and time preference parameters. Thirdly, using the same design, one can test the direct interaction effects of poverty (financial scarcity) and IPV. As this paper is a first attempt at understanding preferences from a cognitive lens, it is limited in its focus on risk preference in an environment of within-household violence that may be highly correlated with financial scarcity.

Of course, how a mother copes with the violence in terms of parenting strategies and negotiating bargaining power with the spouse or partner may have further heterogeneous effects on the risk preferences. Her behaviour with the child or the mothering style she engages in affects the child's outcomes. How and what happens in that scenario remains an open question and has been parked as an extension of this paper. Further work is being carried forward from the results of this experiment to look at the complete effects on a mother's risk preferences and her intrahousehold bargaining power, coping, and mothering in an environment of Intimate Partner Violence.

5 Conclusion

In their review of the state of the scarcity literature, de Bruijn and Antonides (2021) noted the need for empirical evidence that explains the theoretical link from financial scarcity to economic preferences through its two core psychological mechanisms – cognitive load and tunnelling. In particular, no single work connects poverty to the risk preference theory through the scarcity cycle. Available studies either look at the stress due to poverty increasing risk aversion (Haushofer and Fehr, 2014), or provide evidence for one part of the mechanism – poverty impeding cognitive function (Mani et al., 2013), scarcity of money and change in the information that is focussed on (Zhao and Tomm, 2018). Even studies that have tried to study the complete mechanism have done so with non-monetary scarcities (A. K. Shah et al., 2018) or looked at focus and tunnelling effects for non-monetary outcomes (Fehr et al., 2020; Lichand and Mani, 2020). I began my work as an attempt to contribute to this glaring empirical gap on the hypothesised split in preferences due to scarcity.

The thesis comprised three papers from two lab-in-field experiments in Uganda and the Dominican Republic. The first two papers linked financial scarcity to cognitive components and the resulting tunnelling effect on probability weighting function and risky choices. The third paper brought in another co-existing source of cognitive load – Intimate Partner Violence. It looked at the tunnelling impact on risk preferences for the mother coping with spousal abuse and focussing on the child.

The experiment in Uganda exclusively focused on the tunnelling impact of financial scarcity on aspects of risk preferences through the cognitive load. I break down the overarching research question into core elements – (i) the cause - the role of scarcity, (ii) the mechanism - cognitive instruments, and (iii) the effect – a decision-attribute- dependent measure of the probability weighting function and risky choice. I implement a lab-in-field between-within-subject experiment and combine it with natural instruments to determine scarcity's differential impacts. A decision-maker may face three financial shortfalls through the year –cyclical, seasonal periods of plenty and shortfall, unexpected shock, or a combination of the two. To identify all three, I cross the distinct lean and plenty periods of the annual harvest cycle of the region with priming for unexpected scarcity for randomly assigned groups in both phases. The four levels cover the permutations of the scarcity possible and give us a 2*2 between-subject design at the treatment stage. Next, given my interest in understanding the psychological mechanism triggered by causal scarcity, I introduce the cognitive load test for all subjects. The two-question test follows right after the first treatment. It is intended to measure the tax on attention, inhibitory control and working memory due to the four levels of scarcity. Finally, I independently measured probability weighting and risk preferences for gains and losses to identify the outcome

effect by implementing common consequence ladders and the Eckel Grossman task twice for the same participant. The only feature setting the two apart is the relevance to scarcity. Given the decision-attribute and controlling for all individual-level noise, any simultaneous difference in probability weighting and risky choice would indicate a split in preferences or tunnelling. Therefore, I have a 2*2*2*2 between-within-subject design for expected, unexpected scarcity by the domain of choices for scarcity relevant and irrelevant attributes.

The second experiment in the Dominican Republic looked at the effect of domestic violence exposure on parental involvement, children's learning performance and the extent to which cognitive load and social norms explain outcomes like intrahousehold bargaining and risk preferences. For the paper in this thesis, I focus on the impact on risk preferences. During the experimental session, randomly chosen half of the women were given the violence priming treatment manipulation. To capture the treatment's effect on cognitive components, I administered the test for Inhibitory Control and attention and working memory. Then, the experiment moves to the Holt-Laury style risk preference task.

For the effects of financial scarcity, I find that decision-makers struggling with finances are concerned about money even when they are not prompted to. I show that scarcity imposed significant cognitive load, and the effect on the cognitive components differed by the nature of the shortfall. While expected scarcity by itself loaded inhibitory control and attention, shock scarcity influenced working memory. Moreover, when a decision-maker faced expected and shock scarcity, both inhibitory control and working memory were affected. Additionally, I find evidence of the level of scarcity force and scarcity relevance in guiding the Expected Utility Theory consistent probability weighting function. I also find evidence that unless the top-down scarcity goals and scarcity-triggered cognitive load are not strong enough, the differentiating effect due to bottom-up attention mechanics of scarcity relevance do not hold. For probability weighting, I track the odds of Expected Utility Theory consistent choices for each decision attribute separately. In line with the theory, I can see that the two scarcity forces together are significantly more likely to result in the scarcity-relevant probability weighting function moving closer to Expected Utility Theory predictions. The effect is more substantial for losses. This is notable as the loss domain itself is known to be effortful. Finally, I show cognitive load being the working channel for this. In case of non-probabilistic risk preferences, I present evidence that when the top-down scarcity and the bottom-up force of the choices are strong - which is the case for losses, the difference due to relevance-irrelevance or tunnelling is the greatest.

I show that the decision attributes begin to matter only after the top-down force of scarcity reaches a critical value. Anything less than that only expected, or shock scarcity is not strong enough to kickstart

the decision-attribute-based attentional reallocation effects of tunnelling. The mechanism of Bottom-up attention grab of scarcity relevance, followed by its congruence with Top-down scarcity goals and the eventual redistribution of System 2 heavy (Expected Utility Theory consistent) and System 1 guided (non- Expected Utility Theory) comes into play only when there is enough felt force of scarcity, to begin with. Decision attributes begin to matter only after the top-down force of scarcity reaches a critical value. Anything less than that only expected or shock scarcity, is not strong enough to kickstart the decision-attribute-based attentional reallocation effects of tunnelling. The mechanism of Bottom-up attention grab of scarcity relevance, followed by its congruence with Top-down scarcity goals and the eventual redistribution of System 2 heavy (Expected Utility Theory consistent) and System 1 guided (non- Expected Utility Theory) comes into play only when there is enough felt force of scarcity, to begin with.

What happens when there is a mismatch in the forces? In line with my conceptual framework, I show that in such a case (like risky choice for gains), because gains alone do not attract enough System-2 functioning, so the alignment with the goal of "meeting the scarcity at hand" does not happen. Therefore, it is more likely that tunnelling may not happen, and choices are outcomes of decision bracketing. Another reason for the mismatch maybe an insufficient scarcity force to begin with. In such a scenario, the decision-maker may be able to withstand the effects of expected scarcity by itself and not show any tunnelling effects. Therefore, a scarcity-triggered preference split depends on the level of scarcity, the domain, and the attributes of choices.

Looking at Intimate Partner Violence as a source of cognitive load, I find weak evidence of priming affecting working memory. There is an effect of previous experiences of violence, particularly economic abuse and employment status, on women's risk-seeking behaviour. Interestingly, and in support of similar findings in other experimental conflict studies, I find that past experiences of trauma have a moderating role in risk preferences today. I also find statistical evidence of inhibitory control and attention having a role in pushing up the risk parameter.

While these are important empirical results, they are not the end of the road for studying the mechanics of cognitive effects on preferences in general and risk preferences in particular. The experimental data from the mother-child game from the Dominican Republic is still being processed and I plan to take it forward to look at the heterogenous impact of coping mechanisms to the violence on risk preferences. The work on financial scarcity and risk preferences holds promise but can be extended to understand the effects on impatience and non- material needs. A growing body of work looks at how the dual system model and cognitive systems impact self-control (Fudenberg and Levine, 2006) and time preferences (Bartos et al., 2018). As I use non-parametric methods to track the

probability weighting and risk preferences here, in the next step, I would like to extend the use to more parametric and statistical methods to study the same problem and propose a theoretical model that looks at the interaction of the probability weighting function and the value function in a scenario of financial scarcity working through the mechanism of cognitive load and tunnelling.

The work is a step in understanding how material deprivations affect preferences. A natural question arises about the effects on higher- decision-makers and the extent of impact in these contexts. The first experiments in exploring scarcity effects (Mani et al., 2013) were done in two settings – with farmers in Tamil Nadu (State in India) and mall goers in New Jersey (USA). The authors found significant adverse cognitive effects in both cases. Similarly, Shah et al. (2018), in their seminal study on characteristics of scarcity as a force, conducted experiments with an American sample and found scarcity to be pervasive, persistent and a factor even in non-monetary decisions. In fact, some of the only available evidence on tunnelling, borrowing and formation of scarcity traps comes from laboratory experiments in the USA (A. K. Shah et al., 2018; Shah et al., 2012). This implies that while the entire conceptual framework may hold for otherwise well-to-do participants, the consequences are far more dire for those struggling with poverty. While the effects may be more muted for the non-poor decision makers with enough cushion and social protections to cover as slack, the mechanics are the same. The fact that the core framework holds across settings speaks to this thesis's fundamental nature, strength, importance and urgency of understanding contextual-cognitive factors.

Another natural question arises on decision-makers' learning and adaptation to financial scarcities. What needs to be understood here is that the wisdom to plan is a luxury not accorded to those facing scarcity. While there may be an intention and good sense to plan for future financial shocks after going through it the first time, the mechanism of scarcity and tunnelling is such that it does not leave enough cognitive space to do so. Cautious adaptation for the future falls by the wayside when the current need is all that is being focussed on. As was highlighted in the literature review section in paper 1, scarcity tends to assume a life of its own and form a self-reinforcing cycle because of the “rationality” for scarcity-relevant needs. In order to meet the current, most pressing need, the decision-maker tends to “overborrow” from the future (Shah et al., 2012). The repercussions of the neglected, scarcity irrelevant, “biased” decisions will be carried over into the next period. This implies that a trap-like situation will likely form where those with already constrained finances struggle to meet the costs of focusing on scarcity-relevant needs in the previous periods. Therefore, cycle after cycle, they lag behind, playing catch up, stuck in a psychological scarcity trap.

Within this framework, poverty has affective consequences that form a feedback loop, thus exacerbating poverty. Haushofer (2019) derived a condition for when that could happen. If the

product of elasticities of psychological well-being with respect to income and income with respect to psychological well-being is larger than one, there is a propensity of the psychological poverty trap being formed. He analysed the psychological effects of cyclical income disruptions and concluded significant triggers for the effects to become self-sustaining. Similarly, Molotsky and Handa (2021) use evaluation data from cycles of cash transfer programme in Malawi and find a significant reduction in stress and improvement in positive affective feelings and economic decisions. Thereby also supporting Mullainathan and Shafir's (2013) theoretical explanation that the scarcity process is made worse when there is not enough slack to moderate the impacts of scarcity in the next cycle. In such a scenario, decision-makers with insufficient slack to absorb the financial scarcity in the first period, in the following period, would already be at a considerable disadvantage. Therefore, the cognitive effort that could otherwise be spent planning and adapting is counteracted by managing the previous period's decisions. Therefore, the lower ability to adjust and plan could be a result of two processes working together – tunnelling and juggling of the current scarcity period leaving no cognitive space to undertake planning along with the decisions from the previous periods of scarcity, forming a loop of subsequent disadvantages in the follow-up periods.

Formation and workings of the hypothesised scarcity trap is an exciting research avenue as the effects hold beyond one period. My thesis attempts to study static effects, which can now be extended to dynamic, more than one period.With this understanding of the mechanics of uni-period bifurcation in preferences, it is possible to increase the efficiency of future policies cost-effectively. The work may contribute to improved policy, mitigation against scarcity traps, and known behavioural effects of poverty (Arunachalam and Shenoy, 2017; Bertrand et al., 2004; Cook and Sadeghein, 2018; Dalton et al., 2016; Shah et al., 2012) by designing better defaults, assistance (to reduce Scarcity led cognitive load at-source), reducing uncertainties (changing nature of Scarcity), or information prompts (understanding the involuntary dynamic tunnelling-split involved). Moreover, it is essential to magnify the causality chain beyond cognitive abilities (Brañas-Garza and Smith, 2016; Dohmen et al., 2018, 2010) to study effects on preferences, especially when they may be multigenerational, form a feedback trap, cross-cultural, far-reaching and can affect anyone (Dean et al., 2017; Rydval, 2012).

6 References

Abdellaoui, M., 2000. Parameter-free elicitation of utility and probability weighting functions. Management science 46, 1497–1512.

Abdellaoui, M., Bleichrodt, H., l'Haridon, O., 2008. A tractable method to measure utility and loss aversion under prospect theory. Journal of Risk and uncertainty 36, 245.

Abdellaoui, M., Driouchi, A., L'Haridon, O., 2011. Risk aversion elicitation: reconciling tractability and bias minimization. Theory Decis 71, 63–80.

Adamkovič, M., Martončik, M., 2017. A review of consequences of poverty on economic decision-making: A hypothesized model of a cognitive mechanism. Frontiers in psychology 8, 1784.

Akhter, R., Wilson, J.K., Haque, S.E., Ahamed, N., 2022. Like a Caged Bird: The Coping Strategies of Economically Empowered Women Who Are Victims of Intimate Partner Violence in Bangladesh. J Interpers Violence 37, NP9040–NP9065.

Alesina, A., Passarelli, F., 2019. Loss aversion in politics. American Journal of Political Science 63, 936–947.

Allais, M., 1953. Le comportement de l'homme rationnel devant le risque: critique des postulats et axiomes de l'école américaine. Econometrica: Journal of the econometric society 503–546.

Anand, P., Lea, S., 2011. The psychology and behavioural economics of poverty. Journal of Economic Psychology 32, 284–293.

Andersen, S., Harrison, G.W., Lau, M.I., Rutström, E.E., 2008. Eliciting risk and time preferences. Econometrica 76, 583–618.

Anderson, M.L., 2008. Multiple inference and gender differences in the effects of early intervention: A reevaluation of the Abecedarian, Perry Preschool, and Early Training Projects. Journal of the American statistical Association 103, 1481–1495.

Andersson, O., Holm, H.J., Tyran, J.-R., Wengström, E., 2016. Risk aversion relates to cognitive ability: preferences or noise? Journal of the European Economic Association 14, 1129–1154.

Andrikogiannopoulou, A., Papakonstantinou, F., 2020. History-Dependent Risk Preferences: Evidence from Individual Choices and Implications for the Disposition Effect. The Review of Financial Studies 33, 3674–3718.

Arunachalam, R., Shenoy, A., 2017. Poverty traps, convergence, and the dynamics of household income. Journal of Development Economics 126, 215–230.

Ashraf, N., Camerer, C.F., Loewenstein, G., 2005. Adam Smith, behavioral economist. Journal of Economic Perspectives 19, 131–145.

Assembly, G., 2015. Sustainable development goals. SDGs Transform Our World 2030, 6–28.

Attema, A.E., Brouwer, W.B., l'Haridon, O., 2013. Prospect theory in the health domain: A quantitative assessment. Journal of health economics 32, 1057–1065.

Azariadis, C., Stachurski, J., 2005. Poverty traps. Handbook of economic growth 1, 295–384.

Balboni, C., Bandiera, O., Burgess, R., Ghatak, M., Heil, A., 2020. Why do people stay poor?

Banerjee, A.V., Duflo, E., 2007. The Economic Lives of the Poor. Journal of Economic Perspectives 21, 141–167.

Banerjee, A.V., Mullainathan, S., 2008. Limited attention and income distribution. American Economic Review 98, 489–493.

Banerji, A., Gupta, N., 2014. Detection, identification, and estimation of loss aversion: Evidence from an auction experiment. American Economic Journal: Microeconomics 6, 91–133.

Bank, W., 2014. World development report 2015: Mind, society, and behavior. The World Bank.

Bank, W., 2000. World Development Report 2000-2001: Attacking Poverty. World Bank Group.

Baranov, V., Bhalotra, S., Biroli, P., Maselko, J., 2020. Maternal depression, women's empowerment, and parental investment: evidence from a randomized controlled trial. American economic review 110, 824–859.

Barberis, N., Xiong, W., 2009. What drives the disposition effect? An analysis of a long-standing preference-based explanation. the Journal of Finance 64, 751–784.

Barberis, N.C., 2013. Thirty years of prospect theory in economics: A review and assessment. Journal of Economic Perspectives 27, 173–196.

Barrett, C.B., Garg, T., McBride, L., 2016. Well-Being Dynamics and Poverty Traps. Annual Review of Resource Economics.

Bartos, V., Bauer, M., Chytilová, J., Levely, I., 2018. Effects of Poverty on Impatience: Preferences or Inattention? CERGE-EI Working Paper Series.

Bassuk, E., Dawson, R., Huntington, N., 2006. Intimate partner violence in extremely poor women: Longitudinal patterns and risk markers. Journal of Family Violence 21, 387–399.

Baucells, M., Villasís, A., 2010. Stability of risk preferences and the reflection effect of prospect theory. Theory and Decision 68, 193–211.

Bechara, A., Damasio, A.R., Damasio, H., Anderson, S.W., 1994. Insensitivity to future consequences following damage to human prefrontal cortex. Cognition 50, 7–15.

Bedi, G., Goddard, C., 2007. Intimate partner violence: What are the impacts on children? Australian Psychologist 42, 66–77.

Bellon, E., Fias, W., De Smedt, B., 2016. Are individual differences in arithmetic fact retrieval in children related to inhibition? Frontiers in Psychology 7, 825.

Benartzi, S., Thaler, R.H., 1995. Myopic loss aversion and the equity premium puzzle. The quarterly journal of Economics 110, 73–92.

Bernoulli, D., 1954. Exposition of a New Theory on the Measurement of Risk. Econometrica 22, 23–36.

Bertrand, M., Mullainathan, S., Shafir, E., 2004. A behavioral-economics view of poverty. American Economic Review 94, 419–423.

Blais, A.-R., Weber, E.U., 2006. A domain-specific risk-taking (DOSPERT) scale for adult populations. Judgment and Decision making 1.

Bleichrodt, H., Pinto, J.L., 2000. A parameter-free elicitation of the probability weighting function in medical decision analysis. Management science 46, 1485–1496.

Bobonis, G.J., González-Brenes, M., Castro, R., 2013. Public transfers and domestic violence: The roles of private information and spousal control. American Economic Journal: Economic Policy 5, 179–205.

Bordalo, P., Gennaioli, N., Shleifer, A., 2022. Salience. Annual Review of Economics.

Bordalo, P., Gennaioli, N., Shleifer, A., 2020. Memory, attention, and choice. Quarterly Journal of Economics 135.

Bordalo, P., Gennaioli, N., Shleifer, A., 2012a. Salience theory of choice under risk. The Quarterly journal of economics 127, 1243–1285.

Bordalo, P., Gennaioli, N., Shleifer, A., 2012b. Salience in experimental tests of the endowment effect. American Economic Review 102, 47–52.

Bowles, S., Durlauf, S.N., Hoff, K., 2006. Poverty Traps (Russell Sage Foundation, New York, NY.).

Braeutigam, S., 2005. Neuroeconomics—From neural systems to economic behaviour. Brain research bulletin 67, 355–360.

Brañas-Garza, P., Smith, J., 2016. Cognitive abilities and economic behavior. Journal of Behavioral and Experimental Economics 64, 1–4.

Brandstätter, E., Kühberger, A., Schneider, F., 2002. A cognitive-emotional account of the shape of the probability weighting function. Journal of Behavioral Decision Making 15, 79–100.

Brown, R., Montalva, V., Thomas, D., Velásquez, A., 2019. Impact of violent crime on risk aversion: Evidence from the Mexican drug war. Review of Economics and Statistics 101, 892–904.

Buchbinder, E., 2004. Motherhood of battered women: The struggle for repairing the past. Clinical Social Work Journal 32, 307–326.

Budescu, D.V., Por, H.-H., Broomell, S.B., Smithson, M., 2014. The interpretation of IPCC probabilistic statements around the world. Nature Clim Change 4, 508–512.

Burks, S.V., Carpenter, J.P., Goette, L., Rustichini, A., 2008. Cognitive Skills Explain Economic Preferences, Strategic Behavior, and Job Attachment, SSRN.

Busch, A.L., Lieberman, A.F., 2010. Mothers' Adult Attachment Interview ratings predict preschool children's IQ following domestic violence exposure. Attachment & Human Development 12, 505–527.

Callen, M., Isaqzadeh, M., Long, J.D., Sprenger, C., 2014. Violence and risk preference: Experimental evidence from Afghanistan. American Economic Review 104, 123–148.

Camerer, C., Babcock, L., Loewenstein, G., Thaler, R., 1997. Labor Supply of New York City Cabdrivers: One Day at a Time*. The Quarterly Journal of Economics 112, 407–441.

Camerer, C., Loewenstein, G., Prelec, D., 2005. Neuroeconomics: How neuroscience can inform economics. Journal of economic Literature 43, 9–64.

Campos-Vazquez, R.M., Cuilty, E., 2014. The role of emotions on risk aversion: A Prospect Theory experiment. Journal of Behavioral and Experimental Economics 50, 1–9.

Caridad Bueno, C., Henderson, E.A., 2017. Bargaining or Backlash? Evidence on Intimate Partner Violence from the Dominican Republic. Feminist Economics 23, 90–116.

Carter, M.R., Barrett, C.B., 2006. The economics of poverty traps and persistent poverty: An asset-based approach. The Journal of Development Studies 42, 178–199.

Carvalho, L.S., Meier, S., Wang, S.W., 2016. Poverty and economic decision-making: Evidence from changes in financial resources at payday. American Economic Review 106, 260–284.

CDC, 2016. Intimate partner violence: Definitions.

Centro de Estudios Sociales, Demográficos (Dominican Republic), Macro International, 2007. Encuesta demográfica y de salud República Dominicana, 2007. Centro de Estudios Sociales y Demográficos.

Charness, G., Gneezy, U., Imas, A., 2013. Experimental methods: Eliciting risk preferences. Journal of Economic Behavior & Organization 87, 43–51.

Charupat, N., Deaves, R., Derouin, T., Klotzle, M., Miu, P., 2013. Emotional balance and probability weighting. Theory and decision 75, 17–41.

Chivers, D., 2017. Success, survive or escape? Aspirations and poverty traps. Journal of Economic Behavior & Organization 143, 116–132.

Choi, S., Kim, J., Lee, E., Lee, J., 2022. Probability Weighting and Cognitive Ability. Management Science 68, 5201–5215.

Clark, J.M., 1918. Economics and modern psychology: II. Journal of Political Economy 26, 136–166.

Clist, P., D'Exelle, B., Verschoor, A., 2021. An endowment effect for risk levels: Evidence from a Ugandan lab. Journal of Economic Behavior & Organization 182, 297–310.

Cohen, J., Dupas, P., 2010. Free Distribution or Cost-Sharing? Evidence from a Randomized Malaria Prevention Experiment*. The Quarterly Journal of Economics 125, 1–45.

Cohen, S., Kamarck, T., Mermelstein, R., 1983. A Global Measure of Perceived Stress. Journal of Health and Social Behavior 24, 385–396.

Cook, L.A., Sadeghein, R., 2018. Effects of perceived scarcity on financial decision making. Journal of Public Policy and Marketing 37.

Corbetta, M., Shulman, G.L., 2002. Control of goal-directed and stimulus-driven attention in the brain. Nature reviews neuroscience 3, 201–215.

Cowan, N., 2008. What are the differences between long-term, short-term, and working memory? Prog Brain Res 169, 323–338.

Cristofori, I., Cohen-Zimerman, S., Grafman, J., 2019. Executive functions, in: Handbook of Clinical Neurology.

Crosetto, P., Filippin, A., 2016. A theoretical and experimental appraisal of four risk elicitation methods. Experimental Economics 19, 613–641.

Crosetto, P., Filippin, A., 2013. The "bomb" risk elicitation task. Journal of Risk and Uncertainty 47, 31–65.

Cunradi, C.B., Caetano, R., Clark, C., Schafer, J., 2000. Neighborhood poverty as a predictor of intimate partner violence among White, Black, and Hispanic couples in the United States: A multilevel analysis. Annals of epidemiology 10, 297–308.

Dalton, P.S., Ghosal, S., Mani, A., 2016. Poverty and Aspirations Failure. Economic Journal 126.

Dalton, P.S., Nhung, N., Rüschenpöhler, J., 2020. Worries of the poor: The impact of financial burden on the risk attitudes of micro-entrepreneurs. Journal of Economic Psychology 79, 102198.

Dasgupta, U., Mani, S., Sharma, S., Singhal, S., 2016. Eliciting risk preferences: Firefighting in the field.

Dave, C., Eckel, C.C., Johnson, C.A., Rojas, C., 2010. Eliciting risk preferences: When is simple better? Journal of Risk and Uncertainty 41, 219–243.

de Bruijn, E.-J., Antonides, G., 2021. Poverty and economic decision making: a review of scarcity theory. Theory and Decision 1–33.

De Martino, B., Camerer, C.F., Adolphs, R., 2010. Amygdala damage eliminates monetary loss aversion. Proc. Natl. Acad. Sci. U.S.A. 107, 3788–3792.

De Martino, B., Kumaran, D., Seymour, B., Dolan, R.J., 2006. Frames, Biases, and Rational Decision-Making in the Human Brain. Science 313, 684 LP – 687.

Dean, E.B., Schilbach, F., Schofield, H., 2017. Poverty and Cognitive Function, in: The Economics of Poverty Traps. University of Chicago Press.

Deck, C., Jahedi, S., 2015. The effect of cognitive load on economic decision making: A survey and new experiments. European Economic Review 78, 97–119.

Diamond, A., 2013. Executive functions. Annual review of psychology 64, 135–168.

Diederich, A., Trueblood, J.S., 2018. A dynamic dual process model of risky decision making. Psychological review 125, 270.

Dimmock, S.G., Kouwenberg, R., Mitchell, O.S., Peijnenburg, K., 2021. Household portfolio underdiversification and probability weighting: Evidence from the field. The Review of Financial Studies 34, 4524–4563.

Dohmen, T., Falk, A., Huffman, D., Sunde, U., 2018. On the Relationship between Cognitive Ability and Risk Preference. Journal of Economic Perspectives.

Dohmen, T., Falk, A., Huffman, D., Sunde, U., 2010. Are risk aversion and impatience related to cognitive ability? American Economic Review 100, 1238–1260.

Dohmen, T., Falk, A., Huffman, D., Sunde, U., Schupp, J., Wagner, G.G., 2011. Individual risk attitudes: Measurement, determinants, and behavioral consequences. Journal of the European Economic Association 9, 522–550.

Duffy, S., Naddeo, J.J., Owens, D., Smith, J., 2016. Cognitive load and mixed strategies: On brains and minimax.

Duflo, E., 2006. Poor but rational. Understanding poverty 367–378.

Eckel, C.C., 2019. Measuring individual risk preferences. IZA World of Labor.

Eckel, C.C., Grossman, P.J., 2008. Men, women and risk aversion: Experimental evidence. Handbook of experimental economics results 1, 1061–1073.

Eckel, C.C., Grossman, P.J., 2002. Sex differences and statistical stereotyping in attitudes toward financial risk. Evolution and human behavior 23, 281–295.

Edwards, K.D., 1996. Prospect theory: A literature review. International review of financial analysis 5, 19–38.

Einhorn, H.J., Hogarth, R.M., 1985. Ambiguity and uncertainty in probabilistic inference. Psychological review 92, 433.

Ekhator-Mobayode, U.E., Kelly, J., Rubin, A., Arango, D.J., 2021. Intimate Partner Violence and Household Decision Making Autonomy.

Elliott, R., Newman, J.L., Longe, O.A., Deakin, J.F.W., 2003. Differential response patterns in the striatum and orbitofrontal cortex to financial reward in humans: a parametric functional magnetic resonance imaging study. Journal of Neuroscience 23, 303–307.

Ellis, A., Masatlioglu, Y., 2022. Choice with endogenous categorization. The Review of Economic Studies 89, 240–278.

ENESIM, 2019. Informe de resultados de la Encuesta Experimental sobre la Situación de las Mujeres.

Engelmann, J., Hirmas, A., van der Weele, J.J., 2021. Top Down or Bottom Up? Disentangling the Channels of Attention in Risky Choice.

Engle, R.W., 2002. Working Memory Capacity as Executive Attention. Current Directions in Psychological Science 11, 19–23.

Etchart-Vincent, N., 2009. Probability weighting and the 'level'and 'spacing'of outcomes: An experimental study over losses. Journal of Risk and Uncertainty 39, 45–63.

Etchart-Vincent, N., 2004. Is probability weighting sensitive to the magnitude of consequences? An experimental investigation on losses. Journal of Risk and uncertainty 28, 217–235.

Evans, J.S.B.T., 2008. Dual-processing accounts of reasoning, judgment, and social cognition. Annu. Rev. Psychol. 59, 255–278.

Evans, J.S.B.T., Stanovich, K.E., 2013. Dual-process theories of higher cognition: Advancing the debate. Perspectives on psychological science 8, 223–241.

Fehr, D., Fink, G., Jack, B.K., 2020. Poor and rational: Decision-making under scarcity.

Fehr, D., Fink, G., Jack, K., 2019. Poverty, seasonal scarcity and exchange asymmetries. National Bureau of Economic Research.

Fehr-Duda, H., Bruhin, A., Epper, T., Schubert, R., 2010. Rationality on the rise: Why relative risk aversion increases with stake size. Journal of Risk and Uncertainty 40, 147–180.

Fehr-Duda, H., Epper, T., 2012. Probability and Risk: Foundations and Economic Implications of Probability-Dependent Risk Preferences, SSRN.

Fehr-Duda, H., Epper, T., Bruhin, A., Schubert, R., 2011. Risk and rationality: The effects of mood and decision rules on probability weighting. Journal of Economic Behavior & Organization 78, 14–24.

Fox, C.R., Erner, C., Walters, D.J., 2015. Decision under risk: From the field to the laboratory and back. The Wiley Blackwell handbook of judgment and decision making 43–88.

Fraenkel, L., Cunningham, M., Peters, E., 2015. Subjective numeracy and preference to stay with the status quo. Med Decis Making 35, 6–11.

Fudenberg, D., Levine, D.K., 2006. A Dual-Self Model of Impulse Control. American Economic Review 96, 1449–1476.

Gabaix, X., 2014. A sparsity-based model of bounded rationality. Quarterly Journal of Economics.

Garcia-Moreno, C., Jansen, H.A.F.M., Ellsberg, M., Heise, L., Watts, C.H., 2006. Prevalence of intimate partner violence: findings from the WHO multi-country study on women's health and domestic violence. The lancet 368, 1260–1269.

Garnelo, M., Bustin, C., Duryea, S., Morrison, A., 2019. Applying behavioral insights to intimate partner violence: Improving services for survivors in Latin America and the Caribbean. Inter-American Development Bank.

Gerhardt, H., Biele, G.P., Heekeren, H.R., Uhlig, H., 2016. Cognitive load increases risk aversion. SFB 649 Discussion Paper.

Ghatak, M., 2015. Theories of poverty traps and anti-poverty policies. World Bank Economic Review 29.

Giesselmann, M., Bohmann, S., Goebel, J., Krause, P., Liebau, E., Richter, D., Schacht, D., Schröder, C., Schupp, J., Liebig, S., 2019. The Individual in Context(s): Research Potentials of the Socio-Economic Panel Study (SOEP) in Sociology. European Sociological Review 35, 738–755.

Gintis, H., 2014. The Bounds of Reason: Game Theory and the Unification of the Behavioral Sciences-Revised Edition. Princeton University Press.

Giron, C., 2017. Violence Against Women on the Rise in the Dominican Republic. NotiCen: Central American & Caribbean Affairs 21, 2–2.

Glimcher, P.W., Fehr, E., 2013. Neuroeconomics: Decision making and the brain. Academic Press.

Glimcher, P.W., Rustichini, A., 2004. Neuroeconomics: The Consilience of Brain and Decision. Science 306, 447 LP – 452.

Gneezy, U., Potters, J., 1997. An experiment on risk taking and evaluation periods. The Quarterly Journal of Economics 112, 631–645.

Gold, J.I., Shadlen, M.N., 2007. The neural basis of decision making. Annual review of neuroscience 30.

Golden, C.J., 1975. A group version of the Stroop Color and Word Test. Journal of personality assessment 39, 386–388.

Gonzalez, R., Wu, G., 1999. On the shape of the probability weighting function. Cognitive psychology 38, 129–166.

Goodman, L.A., Smyth, K.F., Borges, A.M., Singer, R., 2009. When crises collide: How intimate partner violence and poverty intersect to shape women's mental health and coping? Trauma, Violence, & Abuse 10, 306–329.

Green, L., Myerson, J., 2004. A discounting framework for choice with delayed and probabilistic rewards. Psychological bulletin 130, 769.

Grevenbrock, N., Groneck, M., Ludwig, A., Zimper, A., 2021. Cognition, optimism, and the formation of age-dependent survival beliefs. International Economic Review 62, 887–918.

Gul, F., 1991. A theory of disappointment aversion. Econometrica: Journal of the Econometric Society 667–686.

Guo, L., Trueblood, J.S., Diederich, A., 2017. Thinking Fast Increases Framing Effects in Risky Decision Making. Psychol Sci 28, 530–543.

Harbaugh, W.T., Krause, K., Vesterlund, L., 2009. The fourfold pattern of risk attitudes in choice and pricing tasks. The Economic Journal 120, 595–611.

Harrison, G.W., Humphrey, S.J., Verschoor, A., 2010. Choice under uncertainty: evidence from Ethiopia, India and Uganda. The Economic Journal 120, 80–104.

Haushofer, J., 2019. Is there a Psychological Poverty Trap? Working Paper.

Haushofer, J., Fehr, E., 2014. On the psychology of poverty. Science 344, 862–867.

Hazzard, A., Christensen, A., Margolin, G., 1983. Children's perceptions of parental behaviors. Journal of Abnormal Child Psychology 11, 49–59.

Herrmann, T., Hübler, O., Menkhoff, L., Schmidt, U., 2017. Allais for the poor: Relations to ability, information processing, and risk attitudes. J Risk Uncertain 54, 129–156.

Hey, J.D., Pace, N., 2014. The explanatory and predictive power of non two-stage-probability theories of decision making under ambiguity. Journal of Risk and Uncertainty 49, 1–29.

Hogarth, R.M., Einhorn, H.J., 1990. Venture theory: A model of decision weights. Management science 36, 780–803.

Holt, C.A., Laury, S.K., 2002. Risk Aversion and Incentive Effects. American Economic Review 92, 1644–1655.

Huijsmans, I., Ma, I., Micheli, L., Civai, C., Stallen, M., Sanfey, A.G., 2019. A scarcity mindset alters neural processing underlying consumer decision making. Proceedings of the National Academy of Sciences of the United States of America 116.

Humphrey, S.J., Verschoor, A., 2004. The probability weighting function: Experimental evidence from Uganda, India and Ethiopia. Economics Letters.

Institut National de la Statistique - INSTAT, Cellule de Planification et de Statistique Secteur Sante-Developpement, ICF, 2019. Mali Demographic and Health Survey 2018. INSTAT/CPS/SS-DS-PF and ICF, Bamako, Mali.

Jakiela, P., Ozier, O., 2019. The impact of violence on individual risk preferences: Evidence from a natural experiment. Review of Economics and Statistics 101, 547–559.

Jasper, J.D., Bhattacharya, C., Levin, I.P., Jones, L., Bossard, E., 2013. Numeracy as a predictor of adaptive risky decision making. Journal of Behavioral Decision Making 26, 164–173.

Johnson, J.G., Busemeyer, J.R., 2016. A computational model of the attention process in risky choice. Decision 3, 254.

Jumare, H., Visser, M., Brick, K., 2018. Risk preferences and the poverty trap, in: Agricultural Adaptation to Climate Change in Africa. ROUTLEDGE in association with GSE Research, pp. 169–198.

Kahneman, D., 2003a. A perspective on judgment and choice: mapping bounded rationality. American psychologist 58, 697.

Kahneman, D., 2003b. Maps of bounded rationality: Psychology for behavioral economics. American Economic Review.

Kahneman, D., Egan, P., 2011. Thinking, fast and slow. Farrar, Straus and Giroux New York.

Kahneman, D., Frederick, S., 2002. Representativeness revisited: Attribute substitution in intuitive judgment. Heuristics and biases: The psychology of intuitive judgment 49, 81.

Kahneman, D., Tversky, A., 1979. An analysis of decision under risk, in: Econometrica. World Scientific, pp. 263–292.

Kaur, S., Mullainathan, S., Oh, S., Schilbach, F., 2021. Do Financial Concerns Make Workers Less Productive?

Kelly, J.T.D., Colantuoni, E., Robinson, C., Decker, M.R., 2018. From the battlefield to the bedroom: a multilevel analysis of the links between political conflict and intimate partner violence in Liberia. BMJ Global Health 3, e000668.

Kenning, P., Plassmann, H., 2005. NeuroEconomics: An overview from an economic perspective. Brain research bulletin 67, 343–354.

Keys, A., Brožek, J., Henschel, A., Mickelsen, O., Taylor, H.L., 1950. The biology of human starvation.(2 vols).

Kirchler, M., Andersson, D., Bonn, C., Johannesson, M., Sørensen, E., Stefan, M., Tinghög, G., Västfjäll, D., 2017. The effect of fast and slow decisions on risk taking. Journal of Risk and Uncertainty.

Kluwe-Schiavon, B., Viola, T.W., Sanvicente-Vieira, B., Malloy-Diniz, L.F., Grassi-Oliveira, R., 2017. Balancing automatic-controlled behaviors and emotional-salience states: A dynamic executive functioning hypothesis. Frontiers in psychology 7, 2067.

Koch, A.K., Nafziger, J., 2019. Correlates of narrow bracketing. The Scandinavian Journal of Economics 121, 1441–1472.

Kocher, M.G., Schindler, D., Trautmann, S.T., Xu, Y., 2019. Risk, time pressure, and selection effects. Experimental Economics 22, 216–246.

Kőszegi, B., Rabin, M., 2006. A Model of Reference-Dependent Preferences. The Quarterly Journal of Economics 121, 1133–1165.

Kraay, A., McKenzie, D., 2014. Do Poverty Traps Exist? Assessing the Evidence. Journal of Economic Perspectives 28.

Kremer, M., Rao, G., Schilbach, F., 2019. Behavioral development economics. Handbook of Behavioral Economics 2.

Krosch, A.R., Amodio, D.M., 2014. Economic scarcity alters the perception of race. Proceedings of the National Academy of Sciences 111, 9079–9084.

Kunreuther, H., Novemsky, N., Kahneman, D., 2001. Making low probabilities useful. Journal of risk and uncertainty 23, 103–120.

Lapierre, S., 2008. Mothering in the context of domestic violence: The pervasiveness of a deficit model of mothering. Child & Family Social Work 13, 454–463.

Letourneau, N.L., Fedick, C.B., Willms, J.D., 2007. Mothering and domestic violence: A longitudinal analysis. Journal of Family Violence 22, 649–659.

Levendosky, A.A., Graham-Bermann, S.A., 2001. Parenting in battered women: The effects of domestic violence on women and their children. Journal of family violence 16, 171–192.

Levin, I.P., Schneider, S.L., Gaeth, G.J., 1998. All frames are not created equal: A typology and critical analysis of framing effects. Organizational behavior and human decision processes 76, 149–188.

Lichand, G., Mani, A., 2020. Cognitive droughts. Working Paper.

Lilleholt, L., 2019. Cognitive ability and risk aversion: A systematic review and meta analysis. Judgment and Decision Making 14, 234–279.

Loewenstein, G., O'Donoghue, T., Bhatia, S., 2015. Modeling the interplay between affect and deliberation. Decision 2, 55.

Loewenstein, G.F., Hsee, C.K., Weber, E.U., Welch, N., 2001. Risk as Feelings. Psychological Bulletin.

Lusk, J.L., Hudson, M.D., 2010. Bargaining over losses. Int. Game Theory Rev. 12, 83–91.

Maćkowiak, B., Matějka, F., Wiederholt, M., 2023. Rational inattention: A review. Journal of Economic Literature 61, 226–273.

MacLeod, C.M., 1991. Half a century of research on the Stroop effect: an integrative review. Psychological bulletin 109, 163.

MacLeod, C.M., Dodd, M.D., Sheard, E.D., Wilson, D.E., Bibi, U., 2003. In opposition to inhibition, in: The Psychology of Learning and Motivation: Advances in Research and Theory, Vol. 43. Elsevier Science, New York, NY, US, pp. 163–214.

Malul, M., Rosenboim, M., Shavit, T., 2013. So when are you loss averse? Testing the S-shaped function in pricing and allocation tasks. Journal of economic psychology 39, 101–112.

Mani, A., Mullainathan, S., Shafir, E., Zhao, J., 2020. Scarcity and cognitive function around payday: A conceptual and empirical analysis. Journal of the Association for Consumer Research 5, 365–376.

Mani, A., Mullainathan, S., Shafir, E., Zhao, J., 2013. Poverty Impedes Cognitive Function. Science 341, 976 LP – 980.

Marzilli Ericson, K.M., Fuster, A., 2014. The Endowment Effect. Annu. Rev. Econ. 6, 555–579.

Massar, S.A.A., Pu, Z., Chen, C., Chee, M.W.L., 2020. Losses Motivate Cognitive Effort More Than Gains in Effort-Based Decision Making and Performance. Frontiers in human neuroscience 14, 287.

Mata, R., Frey, R., Richter, D., Schupp, J., Hertwig, R., 2018. Risk preference: A view from psychology. Journal of Economic Perspectives 32, 155–172.

McClure, S.M., Laibson, D.I., Loewenstein, G., Cohen, J.D., 2004. Separate neural systems value immediate and delayed monetary rewards. Science 306, 503–507.

Miguel, E., Kremer, M., 2004. Worms: Identifying Impacts on Education and Health in the Presence of Treatment Externalities. Econometrica 72, 159–217.

Miller, E.K., Buschman, T.J., 2015. Working memory capacity: Limits on the bandwidth of cognition. Daedalus 144, 112–122.

Miller, M.S., 1996. No visible wounds: Identifying non-physical abuse of women by their men. Ballantine Books.

Millroth, P., Juslin, P., 2015. Prospect evaluation as a function of numeracy and probability denominator. Cognition 138, 1–9.

Morvan, C., Jenkins, B., 2017. Judgment under uncertainty: Heuristics and biases, Judgment Under Uncertainty: Heuristics and Biases.

Moya, A., 2018. Violence, psychological trauma, and risk attitudes: Evidence from victims of violence in Colombia. Journal of Development Economics 131, 15–27.

Mukherjee, K., 2011. Thinking styles and risky decision-making: Further exploration of the affect–probability weighting link. Journal of Behavioral Decision Making 24, 443–455.

Mukherjee, K., 2010. A dual system model of preferences under risk. Psychological review 117, 243.

Mullainathan, S., Shafir, E., 2013a. Scarcity: Why having too little means so much. Macmillan.

Mullainathan, S., Shafir, E., 2013b. Decision making and policy in contexts of poverty. Behavioral foundations of public policy 281–300.

Myagkov, M., Plott, C.R., 1997. Exchange economies and loss exposure: Experiments exploring prospect theory and competitive equilibria in market environments. The American Economic Review 801–828.

Novemsky, N., Kahneman, D., 2005. The boundaries of loss aversion. Journal of Marketing research 42, 119–128.

Odean, T., 1998. Are Investors Reluctant to Realize Their Losses? The Journal of Finance 53, 1775–1798.

OECD, 2020. SIGI 2020 Regional Report for Latin America and the Caribbean, Social Institutions and Gender Index.

Ong, Q., Theseira, W., Ng, I.Y.H., 2019. Reducing debt improves psychological functioning and changes decision-making in the poor. Proceedings of the National Academy of Sciences 116, 7244–7249.

Organization, W.H., 2013. Global and regional estimates of violence against women: prevalence and health effects of intimate partner violence and non-partner sexual violence. World Health Organization.

Orquin, J.L., Lagerkvist, C.J., 2015. Effects of salience are both short-and long-lived. Acta psychologica 160, 69–76.

Orquin, J.L., Loose, S.M., 2013. Attention and choice: A review on eye movements in decision making. Acta psychologica 144, 190–206.

Pachur, T., Schulte-Mecklenbeck, M., Murphy, R.O., Hertwig, R., 2018. Prospect theory reflects selective allocation of attention. Journal of Experimental Psychology: General 147, 147.

Panda, P., Agarwal, B., 2005. Marital violence, human development and women's property status in India. World development 33, 823–850.

Patalano, A.L., Saltiel, J.R., Machlin, L., Barth, H., 2015. The role of numeracy and approximate number system acuity in predicting value and probability distortion. Psychonomic Bulletin & Review 22, 1820–1829.

Penczynski, S.P., Santana, M.I., 2021. Measuring trust in institutions and its causal effects. Working paper. http://www. penczynski. de/attach/Trust. pdf (accessed 23 ….

Petrova, D.G., Van der Pligt, J., Garcia-Retamero, R., 2014. Feeling the numbers: On the interplay between risk, affect, and numeracy. Journal of Behavioral Decision Making 27, 191–199.

Piech, R.M., Pastorino, M.T., Zald, D.H., 2010. All I saw was the cake. Hunger effects on attentional capture by visual food cues. Appetite 54, 579–582.

Pocheptsova, A., Amir, O., Dhar, R., Baumeister, R.F., 2009. Deciding without resources: Resource depletion and choice in context. Journal of Marketing Research 46, 344–355.

Prelec, D., 1998. The probability weighting function. ECONOMETRICA-EVANSTON ILL- 66, 497–528.

Rabin, M., Weizsäcker, G., 2009. Narrow bracketing and dominated choices. American Economic Review.

Radel, R., Clément-Guillotin, C., 2012. Evidence of motivational influences in early visual perception: Hunger modulates conscious access. Psychological science 23, 232–234.

Radloff, L.S., 1977. The CES-D scale: A self-report depression scale for research in the general population. Applied psychological measurement 1, 385–401.

Ramos, A., 2016. Household decision making with violence: Implications for conditional cash transfer programs. Universitat Autonoma de Barcelona.

Reynaud, A., Couture, S., 2012. Stability of risk preference measures: Results from a field experiment on French farmers. Theory and Decision 73, 203–221.

Ridley, M., Rao, G., Schilbach, F., Patel, V., 2020. Poverty, depression, and anxiety: Causal evidence and mechanisms. Science 370.

Riege, A.H., Teigen, K.H., 2013. Additivity neglect in probability estimates: Effects of numeracy and response format. Organizational Behavior and Human Decision Processes 121, 41–52.

Rieger, M.O., Wang, M., Hens, T., 2015. Risk preferences around the world. Management Science 61, 637–648.

Rojas, M., 2011. Poverty and psychological distress in Latin America. Journal of Economic Psychology 32, 206–217.

Rottenstreich, Y., Hsee, C.K., 2001. Money, kisses, and electric shocks: On the Affective Psychology of Risk. Psychological Science.

Roy, S., Hidrobo, M., Hoddinott, J., Ahmed, A., 2019. Transfers, Behavior Change Communication, and Intimate Partner Violence: Postprogram Evidence from Rural Bangladesh. The Review of Economics and Statistics 101, 865–877.

Russell, A., 1996. Positive parenting and boys' and girls' misbehaviour during a home observation. International Journal of Behavioral Development 19, 291–308.

Rustichini, A., 2009. Neuroeconomics: what have we found, and what should we search for. Current opinion in neurobiology 19, 672–677.

Rydval, O., 2012. The causal effect of cognitive abilities on economic behavior: evidence from a forecasting task with varying cognitive load. CERGE-EI Working Paper Series.

Samuelson, W., Zeckhauser, R., 1988. Status quo bias in decision making. J Risk Uncertainty 1, 7–59.

Scarpina, F., Tagini, S., 2017. The stroop color and word test. Frontiers in psychology 8, 557.

Schilbach, F., Schofield, H., Mullainathan, S., 2016. The psychological lives of the poor, in: American Economic Review.

Schulz, J.F., Fischbacher, U., Thöni, C., Utikal, V., 2014. Affect and fairness: Dictator games under cognitive load. Journal of Economic Psychology 41, 77–87.

Shafir, E., 2017. Decisions in poverty contexts. Current Opinion in Psychology 18, 131–136.

Shah, A., Zhao, J., Mullainathan, S., Shafir, E., 2018. Money in the Mental Lives of the Poor. Social Cognition 36.

Shah, A.K., Mullainathan, S., Shafir, E., 2018. An exercise in self-replication: Replicating Shah, Mullainathan, and Shafir (2012). Journal of Economic Psychology.

Shah, A.K., Mullainathan, S., Shafir, E., 2012. Some consequences of having too little. Science 338, 682–685.

Shah, A.K., Shafir, E., Mullainathan, S., 2015. Scarcity frames value. Psychological Science 26, 402–412.

Shahriar, A.Z.M., 2016. Exposure to intimate partner violence and repayment of microcredit: Evidence from field experiments in Bangladesh. Journal of Banking & Finance 72, 1–14.

Shapiro, G.K., Burchell, B.J., 2012. Measuring financial anxiety. Journal of Neuroscience, Psychology, and Economics 5, 92.

Sheehy-Skeffington, J., Haushofer, J., 2014. The behavioural economics of poverty. Barriers to and opportunities for poverty reduction 96.

Shefrin, H., Statman, M., 1985. The Disposition to Sell Winners Too Early and Ride Losers Too Long: Theory and Evidence. The Journal of Finance 40, 777–790.

Sims, C.A., 2010. Rational inattention and monetary economics, in: Handbook of Monetary Economics. Elsevier, pp. 155–181.

Smith, K., Dickhaut, J., McCabe, K., Pardo, J.V., 2002. Neuronal Substrates for Choice under Ambiguity, Risk, Gains, and Losses. Management Science 48, 711–718.

Sokol-Hessner, P., Hsu, M., Curley, N.G., Delgado, M.R., Camerer, C.F., Phelps, E.A., 2009. Thinking like a trader selectively reduces individuals' loss aversion. Proceedings of the National Academy of Sciences 106, 5035–5040.

Spears, D., 2011. Economic decision-making in poverty depletes behavioral control. The BE Journal of Economic Analysis & Policy 11.

Stanovich, K.E., West, R.F., 2000. Individual differences in reasoning: Implications for the rationality debate? Behavioral and brain sciences 23, 645–665.

Stott, H.P., 2006. Cumulative prospect theory's functional menagerie. Journal of Risk and Uncertainty.

Strauss, E., Sherman, E., Spreen, O., 2006. A compendium of neuropsychological tests. New York: Oxford University Press.

Stroop, J.R., 1935. Studies of interference in serial verbal reactions. Journal of experimental psychology 18, 643.

Tanaka, T., Camerer, C.F., Nguyen, Q., 2010. Risk and time preferences: Linking experimental and household survey data from Vietnam. American Economic Review 100, 557–571.

Tenorio, R., Cason, T.N., 2002. To spin or not to spin? Natural and laboratory experiments from The Price is Right. The Economic Journal 112, 170–195.

Thaler, R., 1985. Mental Accounting and Consumer Choice. Marketing Science 4, 199–214.

Thaler, R., 1980. Toward a positive theory of consumer choice. Journal of Economic Behavior & Organization 1, 39–60.

Thompson, V.A., Evans, J., Frankish, K., 2009. Dual process theories: A metacognitive perspective. Ariel 137, 43–51.

Tom, S.M., Fox, C.R., Trepel, C., Poldrack, R.A., 2007. The neural basis of loss aversion in decision-making under risk. Science 315, 515–518.

Tomm, B., Zhao, J., 2018. Scarcity biases attention to motivationally relevant distractors. Journal of Vision 18, 482.

Tomm, B.M., Zhao, J., 2016. Scarcity captures attention and induces neglect: Eyetracking and behavioral evidence., in: CogSci.

Toubia, O., Johnson, E., Evgeniou, T., Delquié, P., 2013. Dynamic Experiments for Estimating Preferences: An Adaptive Method of Eliciting Time and Risk Parameters. Management Science 59, 613–640.

Traczyk, J., Fulawka, K., 2016. Numeracy moderates the influence of task-irrelevant affect on probability weighting. Cognition 151, 37–41.

Trepel, C., Fox, C.R., Poldrack, R.A., 2005. Prospect theory on the brain? Toward a cognitive neuroscience of decision under risk. Cognitive brain research 23, 34–50.

Trunzo, A.C., 2006. Engagement, parenting skills, and parent-child relations as mediators of the relationship between parental self-efficacy and treatment outcomes for children with conduct problems.

Tversky, A., Kahneman, D., 1992. Advances in prospect theory: Cumulative representation of uncertainty. Journal of Risk and uncertainty 5, 297–323.

Tversky, A., Kahneman, D., 1991. Loss Aversion in Riskless Choice: A Reference-Dependent Model*. The Quarterly Journal of Economics 106, 1039–1061.

US Agency for International Development, 2020. USAID/Dominican Republic COVID- Specific Gender Analysis Report - Preventing and Responding to COVID-19 in the Dominican Republic Activity.

van de Kuilen, G., Wakker, P.P., 2011. The Midweight Method to Measure Attitudes Toward Risk and Ambiguity. Management Science 57, 582–598.

Van der Sluis, S., De Jong, P.F., Van der Leij, A., 2004. Inhibition and shifting in children with learning deficits in arithmetic and reading. Journal of experimental child psychology 87, 239–266.

Verschoor, A., D'Exelle, B., 2020. Probability weighting for losses and for gains among smallholder farmers in Uganda. Theory and Decision.

Verschoor, A., D'Exelle, B., Perez-Viana, B., 2016. Lab and life: Does risky choice behaviour observed in experiments reflect that in the real world? Journal of Economic Behavior and Organization 128.

Vohs, K.D., 2013. The poor's poor mental power. Science 341, 969–970.

Von Neumann, J., Morgenstern, O., 1947. Theory of games and economic behavior, 2nd rev. ed, Theory of games and economic behavior, 2nd rev. ed. Princeton University Press, Princeton, NJ, US.

Wagner, G., Frick, J., Schupp, J., 2007. The German Socio-Economic Panel Study (SOEP) – Scope, Evolution and Enhancements. Schmollers Jahrbuch : Journal of Applied Social Science Studies / Zeitschrift für Wirtschafts- und Sozialwissenschaften 127, 139–169.

Wakker, P.P., 2010. Prospect theory: For risk and ambiguity. Cambridge university press.

Wang, S.W., Filiba, M., Camerer, C.F., 2010. Dynamically optimized sequential experimentation (DOSE) for estimating economic preference parameters. Manuscript submitted for publication.

Weber, B., Aholt, A., Neuhaus, C., Trautner, P., Elger, C.E., Teichert, T., 2007. Neural evidence for Reference-dependence in real-market-transactions. Neuroimage 35, 441–447.

Weber, E.U., Bottom, W.P., 1989. Axiomatic measures of perceived risk: Some tests and extensions. Journal of Behavioral Decision Making 2, 113–131.

Weintraub, S., Dikmen, S.S., Heaton, R.K., Tulsky, D.S., Zelazo, P.D., Bauer, P.J., Carlozzi, N.E., Slotkin, J., Blitz, D., Wallner-Allen, K., 2013. Cognition assessment using the NIH Toolbox. Neurology 80, S54–S64.

Westbrook, A., Braver, T.S., 2015. Cognitive effort: A neuroeconomic approach. Cognitive, Affective, & Behavioral Neuroscience 15, 395–415.

Wiederholt, M., 2010. Rational inattention. The New Palgrave Dictionary of Economics (Online Edition ed.) 1–8.

Wolach, A.H., McHale, M.A., Tarlea, A., 2004. Numerical stroop effect. Perceptual and motor skills 98, 67–77.

Wolfe, D.A., Crooks, C.V., Lee, V., McIntyre-Smith, A., Jaffe, P.G., 2003. The effects of children's exposure to domestic violence: A meta-analysis and critique. Clinical child and family psychology review 6, 171–187.

Wu, G., Gonzalez, R., 1998. Common consequence conditions in decision making under risk. Journal of Risk and uncertainty 16, 115–139.

Wu, G., Gonzalez, R., 1996. Curvature of the probability weighting function. Management science 42, 1676–1690.

Yechiam, E., Ashby, N.J., Hochman, G., 2019. Are we attracted by losses? Boundary conditions for the approach and avoidance effects of losses. Journal of Experimental Psychology: Learning, Memory, and Cognition 45, 591.

Yechiam, E., Retzer, M., Telpaz, A., Hochman, G., 2015. Losses as ecological guides: Minor losses lead to maximization and not to avoidance. Cognition 139, 10–17.

Yesuf, M., Bluffstone, R.A., 2009. Poverty, risk aversion, and path dependence in low-income countries: Experimental evidence from Ethiopia. American Journal of Agricultural Economics 91, 1022–1037.

Yoo, J.A., Huang, C.-C., 2013. Long-term relationships among domestic violence, maternal mental health and parenting, and preschool children's behavior problems. Families in Society 94, 268–276.

Zeckhauser, R.J., Viscusi, W.K., 1990. Risk within reason. Science 248, 559–564.

Zegenhagen, S., Ranganathan, M., Buller, A.M., 2019. Household decision-making and its association with intimate partner violence: Examining differences in men's and women's perceptions in Uganda. SSM - Population Health 8, 100442.

Zeisberger, S., Vrecko, D., Langer, T., 2012. Measuring the time stability of Prospect Theory preferences. Theory and Decision 72, 359–386.

Zhao, J., Tomm, B.M., 2018. Psychological responses to scarcity, in: Oxford Research Encyclopedia of Psychology.

Zwane, A.P., 2012. Implications of scarcity. Science 338, 617–618.

7 Appendix

7.1 Experimental Scripts

7.1.1 Primed Group, Gains Domain

WELCOME

Welcome. Thank you for taking the time to come today. [*Introduce Experimenters and Assistants*]. You can ask any of us questions during today's programme.

We have invited you here, today, because we want to learn about how people in this area take decisions. You are going to be asked to take decisions about money. The money that results from your decisions will be yours to keep.

Did you all remember to bring your vouchers? [*Pause*]. Excellent. This voucher, as you can see written on it, is worth 4,000 shillings. Depending on the decisions that you will take today, money may be added to or money may be taken away from those 4,000 shillings. We will also reimburse you for transport at the end of today's programme.

Before we begin, let us make a few things clear.

- To begin with, participation is voluntary. You may choose not to participate in the exercise, and should feel free to leave at any point.
- We also must make clear that this is research about your decisions. Therefore, you cannot talk with others. This is very important. I'm afraid that if we find you talking with others, we will have to send you home, and you will not be able to earn any money here today. Of course, if you have questions, you can ask one of us. We also ask you to switch off your mobile phones.
- Make sure that you listen carefully to us. You will be able to make a good amount of money here today, and it is important that you follow our instructions.
- Please feel free to ask any of us questions during today's programme.
- You will be asked to make decisions that are not a matter of getting it right or wrong; they are about what you prefer. However, it is important to think seriously about your choices because it will affect how much money you can take home.
- During today's programme, you will be asked to make one or more choices, which will be explained to you very clearly. Only one of your choices will be selected to determine the money you will be paid. At the end of today's programme, we will randomly select one of your decisions to be paid out. Any money you earn will be paid out to you privately after all parts of the exercise are complete.
- As you will find out, there are also a few questions and exercises that do not affect how much money you will take home today. We will always make this clear when this is the case.

PART 1

We will now begin with part 1 of today's programme. Here I will ask you three questions and write down your responses. These questions have no influence on the workshop earnings you will take home today.

P1. Can you remember the last time that this area that you live in was badly affected by something spoiling the crops, maybe armyworm or locust attacks or flooding or landslides, one of these things that happens here often enough? I don't need to tell you that crop yields are then much lower than normal and some people experience loss of property, such as livestock or even their land. Thinking about the last time that this happened, how would you rate the difficulties you had in meeting your daily expenses? You can give a rating from 1 to 5, with 1 being no difficulty at all and 5 meaning it was an extremely tough time for me.

P2a,b,c. Imagine you have been feeling sick lately. The doctor diagnoses a completely treatable ailment. He explains the treatment and prescriptions. What would be on your mind as you hear the news and think about what to do? Think about the top three things on your mind and summarise each of these concerns in one or two words.

P3a. I will ask you now about an upcoming expenditure that you wil face. This can be any major expenditure in the coming months. What is the most significant expenditure coming up?

P3b. On a scale of 1-5, how worried are you that you'll meet this expenditure, with 1 being the least worried and 5 being the most worried?

PART 2

Now it is time for part 2 of today's programme. Here I will ask you to do a few exercises. Whether you do them correctly or not has no influence on the workshop earnings you will take home today. However, we would still like you to do them as best you can.

CL1a,b. I would like you to first count triangles. Have a look at this row of triangles:

D	**DDDD**	**DDDDD**	**DD**	**DDD**

Beginning from left to right, the number of triangles are 1, 4, 5, 2, 3.

[Point to the corresponding cell as you read out the numbers.]

Do you understand how this counting exercise works? [*Answer any questions*]

[*Show Sheet 1*] When you are ready, I would like you to start counting all the triangles on this sheet. Please first do the top row [*move your finger along that row*] and then the next row [*move your finger along that one*] and so on until you have finished your sheet.

Are you ready? Please name the **number of triangles as quickly as you can**.

[*Start stopwatch and record number of seconds taken and number of mistakes made.*]

CL2a,b. I would like you to next count digits. Have a look at this row of digits:

444	**5**	**33**	**11111**	**2222**

Beginning from left to right, the correct number of digits are 3, 1, 2, 5, 4.

[Point to the corresponding cell as you read out the numbers.]

Do you understand how this counting exercise works? [*Answer any questions*]

[*Show Sheet 2*] When you are ready, I would like you to start counting all the digits on this sheet. Please first do the top row [*move your finger along that row*] and then the next row [*move your finger along that one*] and so on until you have finished your sheet.

Are you ready? Please name the **number of digits as quickly as you can**.

[*Start stopwatch and record number of seconds taken and number of mistakes made.*]
CL3a,b. In the final exercise, I would like you to say some numbers after me. For example ***[****Enumerator taps foot to read the digits at even speed of about one per second and doesn't repeat the digits]*, if I say 7-1-9, what would you say?" [C*onfirm that the respondent is correct or help them understand.*]
Now listen carefully as I say some numbers, and repeat them after me. [*Tap your foot as before; record number of mistakes, 0-5*]

4 3
7 9 2
5 9 4 1
9 3 8 7 2
1 5 2 6 4 9

Now I am going to again say some numbers, but this time I want you to say them backwards to me. For example, if I say 7-1-9, what would you say? [*The correct answer is 9-1-7. Confirm the correct answer or help the respondent understand*.]
Please listen carefully as I say some numbers, and repeat them backwards after me. [*Tap your foot as before; record number of mistakes, 0-10*]

	Correct answer:
2 4	*4 2*
7 5	*5 7*
6 2 9	*9 2 6*
5 4 1	*1 4 5*
3 2 7 9	*9 7 2 3*
4 9 6 8	*8 6 9 4*
9 3 8 7 2	*2 7 8 3 9*
6 1 2 4 3	*3 4 2 1 6*
1 5 2 6 4 9	*9 4 6 2 5 1*
2 1 8 4 5 9	*9 5 4 8 1 2*

PART 3

Finally, it is time for part 3 of today's programme; this is the part during which your decisions will affect the amount of money you will take home today. As I mentioned before, only one decision will be selected for payment at the end of today's workshop. However, you don't know which one that is, so think carefully about each decision you take: it could be the one that is selected for real!
You see these two bags? One is purple, and the other is blue. You also see this large pile of counters, right? Some are red, others are green, and yet others are white.
Each of these counters represents money. The red counters are worth 4,000 shillings; the green ones 5,000 shillings; and the white ones 6,500 shillings.
Let me explain what decision you need to make; this one is just an example, for teaching. I'm going to fill each of these two bags with counters. Watch carefully.
In the purple bag, I put 7 red counters. How much was each red counter worth again [*let people respond spontaneously*]. 4,000 shillings, that's right; very good! Now I'm going to add 7 green counters. Does anybody remember how much the green counter was worth? [*Let people respond spontaneously*]. Excellent, you're right: 5,000 shillings. And now, finally, I'm going to add 6 white counters to the bag. I don't suppose anybody remembers how much these are worth? [*Let people respond spontaneously*]. Ah, you did! 6,500 shillings. Well done for remembering.
In the blue bag, I'm going to put 20 green counters. I'm sure you remember how much that one was worth, right? [*Let people respond spontaneously*]. Exactly, 5,000 shillings.
What I'm going to do next is, without looking, I will take a counter out of one bag: only one bag. And I'm going to ask YOU to let me know which bag I should take a counter out of. Let's suppose you asked me to take a counter out of the purple bag. Now, let me take a counter out of that. [*Do so without looking*]. Ah, the counter is [*colour*]. So if you had decided the purple bag, you would go home with [*mention the corresponding amount*].
Now let's suppose you'd asked me to take a counter out of the blue bag. Who can tell me which counter I would have selected? [*Let people respond spontaneously.*] So there's no need for me to draw a counter? Why not? [*Let people respond spontaneously*]. That's right! All the counters in the bag are green. So if you'd decided to let me take a counter out of the blue bag, I would definitely have drawn a green counter, which means you would have gone home with how much? Exactly, 5,000 shillings.
OK, are there any questions. [*Respond to any questions*.]
Now, let me ask you a question, in private, to see if you have understood the experiments.
[*Administer control question to each subject in turn*.]
CONTROL QUESTION. Which of the two bags gives you a higher chance of going home with exactly 6,500 shillings. The purple one or the blue one?
Excellent, thank you. There is one more thing I should explain. Remember we gave you a voucher for 4,000 shillings? The red counter stands for that voucher: we give you exactly the voucher money. But if the green marble is drawn, you get more than that: we add 1,000 shillings, so that you receive 5,000 shillings. And if the white marble is drawn, we add 2,500 shillings, so that you receive 6,500.
I think we know enough now to begin the exercise. Remember, the decisions you are about to take will influence how much money you will go home with today, so listen carefully.
[*This table is meant to assist the instructions you are about to deliver. You can refer to it if you find that helpful.*]

	Purple bag	Blue bag
First	20 green	4 red, 9 green, 7 white
Next	4 red, 16 green	8 red, 5 green, 7 white

Next	6 red, 14 green	10 red, 3 green, 7 white
Next	9 red, 11 green	13 red, 7 white
Finally	2 red, 18 green	6 red, 7 green, 7 white

First, I'm going to put 20 green counters (worth 5,000 shillings) in the purple bag [*do so*]. Then, I'm going to put 4 red counters (worth 4,000 shillings), 9 green counters (worth 5,000 shillings) and 7 white counters (worth 6,500 shillings) in the blue bag [*do so*].

CL DECISION 1: Which bag would you like me to draw a counter from? [*Subjects respond in private*.]

Now here is something that I didn't tell you yet. We're going to come back in 5 months' time, in April. The next decision is about being paid, not today but in 5 months' time.

CL DECISION 2: Which bag would you like me to draw a counter from, knowing that payment will be in 5 months from now? [*Subjects respond in private*.]

Next, I'm going to put 4 red counters (worth 4,000 shillings) and 16 green counters (worth 5,000 shillings) in the purple bag [*do so*]. Then, I'm going to put 8 red counters (worth 4,000 shillings), 5 green counters (worth 5,000 shillings) and 7 white counters (worth 6,500 shillings) in the blue bag [*do so*].

CL DECISION 3: Which bag would you like me to draw a counter from for payment today? [*Subjects respond in private*.]

CL DECISION 4: Which bag would you like me to draw a counter from, knowing that payment will be in 5 months from now? [*Subjects respond in private*.]

Next, I'm going to put 6 red counters (worth 4,000 shillings) and 14 green counters (worth 5,000 shillings) in the purple bag [*do so*]. Then, I'm going to put 10 red counters (worth 4,000 shillings), 3 green counters (worth 5,000 shillings) and 7 white counters (worth 6,500 shillings) in the blue bag [*do so*].

CL DECISION 5: Which bag would you like me to draw a counter from for payment today? [*Subjects respond in private*.]

CL DECISION 6: Which bag would you like me to draw a counter from, knowing that payment will be in 5 months from now? [*Subjects respond in private*.]

Next, I'm going to put 9 red counters (worth 4,000 shillings) and 11 green counters (worth 5,000 shillings) in the purple bag [*do so*]. Then, I'm going to put 13 red counters (worth 4,000 shillings) and 7 white counters (worth 6,500 shillings) in the blue bag [*do so*].

CL DECISION 7: Which bag would you like me to draw a counter from for payment today? [*Subjects respond in private*.]

CL DECISION 8: Which bag would you like me to draw a counter from, knowing that payment will be in 5 months from now? [*Subjects respond in private*.]

And finally, I'm going to put 2 red counters (worth 4,000 shillings) and 18 green counters (worth 5,000 shillings) in the purple bag [*do so*]. Then, I'm going to put 6 red counters (worth 4,000 shillings), 7 green counters (worth 5,000 shillings) and 7 white counters (worth 6,500 shillings) in the blue bag [*do so*].

CL DECISION 9: Which bag would you like me to draw a counter from for payment today? [*Subjects respond in private*.]

CL DECISION 10: Which bag would you like me to draw a counter from, knowing that payment will be in 5 months from now? [*Subjects respond in private*.]

Wonderful, there are two more decisions I'd like you to take and then we're done.

You see this large sheet in front of you? [*Display large sheet with the following contents.*]

	A	B

1	5600	5600
2	4800	7200
3	4000	8800
4	3200	10400
5	2400	12000
6	400	14000

You have to tell me which row you prefer and then I'll toss this coin, which has A on one side, B on the other. If you choose row 1, and A comes up, you'll be paid 5600 shillings. If B comes up, you'll be paid 5600 shillings as well.
If you choose row 4, and A comes up, you'll be paid 3200 shillings. If B comes up, you'll be paid 10400 shillings. Do you see how the game works? [*Answer any questions*].
EG DECISION 1. Which row do you prefer, 1, 2, 3, 4, 5 or 6, for payment today? [*Subjects respond in private*.]
EG DECISION 2. And which row do you prefer if payment takes place in 5 months' time, when we come back? [*Subjects respond in private.*]

RESOLUTION
Thank you so much for taking part today; we really appreciate it. Here is 4,000 shillings for transport. Now let's see how much you've earned today. We're first going to select a decision that you took [*select without looking a folded piece of paper from a bag; the bag contains the numbers 1,3,5,7,9. If number 1 is selected, reconstruct the purple and blue bags corresponding with CL DECISION 1, draw a counter out of each bag and pay participants in accordance with the decision they took. Ditto for any of the other numbers that may be selected.*]
[*Pay respondents the amount that corresponds with the counters selected for their decisions. Don't pay them separately for their vouchers; that's now been taken care of. Thank them again and ask them to wait for the 5-minute post-experiment survey.*]

7.1.2 Primed Group, Loss Domain

WELCOME
Welcome. Thank you for taking the time to come today. [*Introduce Experimenters and Assistants*]. You can ask any of us questions during today's programme.
We have invited you here, today, because we want to learn about how people in this area take decisions. You are going to be asked to take decisions about money. The money that results from your decisions will be yours to keep.
Did you all remember to bring your vouchers? [*Pause*]. Excellent. This voucher, as you can see written on it, is worth 4,000 shillings. Depending on the decisions that you will take today, money may be added to or money may be taken away from those 4,000 shillings. We will also reimburse you for transport at the end of today's programme.
Before we begin, let us make a few things clear.

- To begin with, participation is voluntary. You may choose not to participate in the exercise, and should feel free to leave at any point.

- We also must make clear that this is research about your decisions. Therefore, you cannot talk with others. This is very important. I'm afraid that if we find you talking with others, we will have to send you home, and you will not be able to earn any money here today. Of course, if you have questions, you can ask one of us. We also ask you to switch off your mobile phones.
- Make sure that you listen carefully to us. You will be able to make a good amount of money here today, and it is important that you follow our instructions.
- Please feel free to ask any of us questions during today's programme.
- You will be asked to make decisions that are not a matter of getting it right or wrong; they are about what you prefer. However, it is important to think seriously about your choices because it will affect how much money you can take home.
- During today's programme, you will be asked to make one or more choices, which will be explained to you very clearly. Only one of your choices will be selected to determine the money you will be paid. At the end of today's programme, we will randomly select one of your decisions to be paid out. Any money you earn will be paid out to you privately after all parts of the exercise are complete.
- As you will find out, there are also a few questions and exercises that do not affect how much money you will take home today. We will always make this clear when this is the case.

PART 1

We will now begin with part 1 of today's programme. Here I will ask you three questions and write down your responses. These questions have no influence on the workshop earnings you will take home today.

P1. Can you remember the last time that this area that you live in was badly affected by something spoiling the crops, maybe armyworm or locust attacks or flooding or landslides, one of these things that happens here often enough? I don't need to tell you that crop yields are then much lower than normal and some people experience loss of property, such as livestock or even their land. Thinking about the last time that this happened, how would you rate the difficulties you had in meeting your daily expenses? You can give a rating from 1 to 5, with 1 being no difficulty at all and 5 meaning it was an extremely tough time for me.

P2a,b,c. Imagine you have been feeling sick lately. The doctor diagnoses a completely treatable ailment. He explains the treatment and prescriptions. What would be on your mind as you hear the news and think about what to do? Think about the top three things on your mind and summarise each of these concerns in one or two words.
P3a. I will ask you now about an upcoming expenditure that you wil face. This can be any major expenditure in the coming months. What is the most significant expenditure coming up?

P3b. On a scale of 1-5, how worried are you that you'll meet this expenditure, with 1 being the least worried and 5 being the most worried?

PART 2

Now it is time for part 2 of today's programme. Here I will ask you to do a few exercises. Whether you do them correctly or not has no influence on the workshop earnings you will take home today. However, we would still like you to do them as best you can.

CL1a,b. I would like you to first count triangles. Have a look at this row of triangles:

D	**DDDD**	**DDDDD**	**DD**	**DDD**

Beginning from left to right, the number of triangles are 1, 4, 5, 2, 3.

[Point to the corresponding cell as you read out the numbers.]

Do you understand how this counting exercise works? [*Answer any questions*]

[*Show Sheet 1*] When you are ready, I would like you to start counting all the triangles on this sheet. Please first do the top row [*move your finger along that row*] and then the next row [*move your finger along that one*] and so on until you have finished your sheet.

Are you ready? Please name the **number of triangles as quickly as you can**.

[*Start stopwatch and record number of seconds taken and number of mistakes made.*]

CL2a,b. I would like you to next count digits. Have a look at this row of digits:

444	**5**	**33**	**11111**	**2222**

Beginning from left to right, the correct number of digits are 3, 1, 2, 5, 4.

[Point to the corresponding cell as you read out the numbers.]

Do you understand how this counting exercise works? [*Answer any questions*]

[*Show Sheet 2*] When you are ready, I would like you to start counting all the digits on this sheet. Please first do the top row [*move your finger along that row*] and then the next row [*move your finger along that one*] and so on until you have finished your sheet.

Are you ready? Please name the **number of digits as quickly as you can**.

[*Start stopwatch and record number of seconds taken and number of mistakes made.*]
CL3a,b. In the final exercise, I would like you to say some numbers after me. For example ***[****Enumerator taps foot to read the digits at even speed of about one per second and doesn't repeat the digits]*, if I say 7-1-9, what would you say?" [C*onfirm that the respondent is correct or help them understand.*]
Now listen carefully as I say some numbers, and repeat them after me. [*Tap your foot as before; record number of mistakes, 0-5*]

4 3
7 9 2
5 9 4 1
9 3 8 7 2

1 5 2 6 4 9

Now I am going to again say some numbers, but this time I want you to say them backwards to me. For example, if I say 7-1-9, what would you say? [*The correct answer is 9-1-7. Confirm the correct answer or help the respondent understand*.]
Please listen carefully as I say some numbers, and repeat them backwards after me. [*Tap your foot as before; record number of mistakes, 0-10*]

	Correct answer:
2 4	*4 2*
7 5	*5 7*
6 2 9	*9 2 6*
5 4 1	*1 4 5*
3 2 7 9	*9 7 2 3*
4 9 6 8	*8 6 9 4*
9 3 8 7 2	*2 7 8 3 9*
6 1 2 4 3	*3 4 2 1 6*
1 5 2 6 4 9	*9 4 6 2 5 1*
2 1 8 4 5 9	*9 5 4 8 1 2*

PART 3
Finally, it is time for part 3 of today's programme; this is the part during which your decisions will affect the amount of money you will take home today. As I mentioned before, only one decision will be selected for payment at the end of today's workshop. However, you don't know which one that is, so think carefully about each decision you take: it could be the one that is selected for real!
You see these two bags? One is purple, and the other is blue. You also see this large pile of counters, right? Some are red, others are green, and yet others are white.
Each of these counters represents money. The red counters are worth 1,000 shillings; the green ones 2,000 shillings; and the white ones 4,000 shillings.
Let me explain what decision you need to make; this one is just an example, for teaching. I'm going to fill each of these two bags with counters. Watch carefully.
In the purple bag, I put 7 red counters. How much was each red counter worth again [*let people respond spontaneously*]. 1,000 shillings, that's right; very good! Now I'm going to add 7 green counters. Does anybody remember how much the green counter was worth? [*Let people respond spontaneously*]. Excellent, you're right: 2,000 shillings. And now, finally, I'm going to add 6 white counters to the bag. I don't suppose anybody remembers how much these are worth? [*Let people respond spontaneously*]. Ah, you did! 4,000 shillings. Well done for remembering.
In the blue bag, I'm going to put 20 green counters. I'm sure you remember how much that one was worth, right? [*Let people respond spontaneously*]. Exactly, 2,000 shillings.
What I'm going to do next is, without looking, I will take a counter out of one bag: only one bag. And I'm going to ask YOU to let me know which bag I should take a counter out of. Let's suppose you asked me to take a counter out of the purple bag. Now, let me take a counter out of that. [*Do so without looking*]. Ah, the counter is [*colour*]. So if you had decided the purple bag, you would go home with [*mention the corresponding amount*].
Now let's suppose you'd asked me to take a counter out of the blue bag. Who can tell me which counter I would have selected? [*Let people respond spontaneously.*] So there's no need for me to

draw a counter? Why not? [*Let people respond spontaneously*]. That's right! All the counters in the bag are green. So if you'd decided to let me take a counter out of the blue bag, I would definitely have drawn a green counter, which means you would have gone home with how much? Exactly, 2,000 shillings.

OK, are there any questions. [*Respond to any questions*.]

Now, let me ask you a question, in private, to see if you have understood the experiments. [*Administer control question to each subject in turn*.]

CONTROL QUESTION. Which of the two bags gives you a higher chance of going home with exactly 4,000 shillings. The purple one or the blue one?

Excellent, thank you. There is one more thing I should explain. Remember we gave you a voucher for 4,000 shillings? The white counter stands for that voucher: we give you exactly the voucher money. But if the green marble is drawn, you get less than that: we deduct 2,000 shillings, so that you receive 2,000 shillings. And if the red marble is drawn, we deduct 3,000 shillings, so that you receive 1,000.

I think we know enough now to begin the exercise. Remember, the decisions you are about to take will influence how much money you will go home with today, so listen carefully.

[*This table is meant to assist the instructions you are about to deliver. You can refer to it if you find that helpful.*]

	Purple bag	Blue bag
First	13 red, 7 green	15 red, 1 green, 4 white
Next	14 red, 6 green	16 red, 4 white
Next	4 red, 16 green	6 red, 10 green, 4 white
Next	1 red, 19 green	3 red, 13 white, 4 white
Finally	10 red, 10 green	12 red, 4 green, 4 white

First, I'm going to put 13 red counters (worth 1,000 shillings) and 7 green counters (worth 2,000 shillings) in the purple bag [*do so*]. Then, I'm going to put 15 red counters (worth 1,000 shillings), 1 green counter (worth 2,000 shillings) and 4 white counters (worth 4,000 shillings) in the blue bag [*do so*].

CL DECISION 1: Which bag would you like me to draw a counter from? [*Subjects respond in private*.]

Now here is something that I didn't tell you yet. We're going to come back in 5 months' time, in April. The next decision is about being paid, not today but in 5 months' time.

CL DECISION 2: Which bag would you like me to draw a counter from, knowing that payment will be in 5 months from now? [*Subjects respond in private*.]

Next, I'm going to put 14 red counters (worth 1,000 shillings) and 6 green counters (worth 2,000 shillings) in the purple bag [*do so*]. Then, I'm going to put 16 red counters (worth 1,000 shillings), and 4 white counters (worth 4,000 shillings) in the blue bag [*do so*].

CL DECISION 3: Which bag would you like me to draw a counter from for payment today? [*Subjects respond in private*.]

CL DECISION 4: Which bag would you like me to draw a counter from, knowing that payment will be in 5 months from now? [*Subjects respond in private*.]

Next, I'm going to put 4 red counters (worth 1,000 shillings) and 16 green counters (worth 2,000 shillings) in the purple bag [*do so*]. Then, I'm going to put 6 red counters (worth 1,000 shillings), 10 green counters (worth 2,000 shillings) and 4 white counters (worth 4,000 shillings) in the blue bag [*do so*].

CL DECISION 5: Which bag would you like me to draw a counter from for payment today? [*Subjects respond in private*.]
CL DECISION 6: Which bag would you like me to draw a counter from, knowing that payment will be in 5 months from now? [*Subjects respond in private*.]
Next, I'm going to put 1 red counter (worth 1,000 shillings) and 19 green counters (worth 2,000 shillings) in the purple bag [*do so*]. Then, I'm going to put 3 red counters (worth 1,000 shillings), 13 green counters (worth 2,000 shillings) and 4 white counters (worth 4,000 shillings) in the blue bag [*do so*].
CL DECISION 7: Which bag would you like me to draw a counter from for payment today? [*Subjects respond in private*.]
CL DECISION 8: Which bag would you like me to draw a counter from, knowing that payment will be in 5 months from now? [*Subjects respond in private*.]
And finally, I'm going to put 10 red counters (worth 1,000 shillings) and 10 green counters (worth 2,000 shillings) in the purple bag [*do so*]. Then, I'm going to put 12 red counters (worth 1,000 shillings), 4 green counters (worth 2,000 shillings) and 4 white counters (worth 4,000 shillings) in the blue bag [*do so*].
CL DECISION 9: Which bag would you like me to draw a counter from for payment today? [*Subjects respond in private*.]
CL DECISION 10: Which bag would you like me to draw a counter from, knowing that payment will be in 5 months from now? [*Subjects respond in private*.]
Wonderful, there are two more decisions I'd like you to take and then we're done.
You see this large sheet in front of you? [*Display large sheet with the following contents.*]

	A	B
1	1600	1600
2	800	3200
3	0	4800
4	-800	6400
5	-1600	8000
6	-3600	10000

You have to tell me which row you prefer and then I'll toss this coin, which has A on one side, B on the other. If you choose row 1, and A comes up, you'll be paid 1600 shillings. If B comes up, you'll be paid 1600 shillings as well. This is on top of the voucher of 4000 shillings that you have received, so you'll go home with 5,600 shillings.
If you choose row 4, and A comes up, you'll lose 800 shillings, which we will take away from the voucher of 4000 shillings that you have received, so you'll go home with 3,200 shillings. If B comes up, you'll be paid 6400 shillings on top of the voucher of 4000 shillings that you have received, so you'll go home with 10,400 shillings. Do you see how the game works? [*Answer any questions*].
EG DECISION 1. Which row do you prefer, 1, 2, 3, 4, 5 or 6, for payment today? [*Subjects respond in private*.]
EG DECISION 2. And which row do you prefer if payment takes place in 5 months' time, when we come back? [*Subjects respond in private.*]

RESOLUTION

Thank you so much for taking part today; we really appreciate it. Here is 4,000 shillings for transport. Now let's see how much you've earned today. We're first going to select a decision that you took [*select without looking a folded piece of paper from a bag; the bag contains the numbers 1,3,5,7,9. If number 1 is selected, reconstruct the purple and blue bags corresponding with CL DECISION 1, draw a counter out of each bag and pay participants in accordance with the decision they took. Ditto for any of the other numbers that may be selected.*]
[*Pay respondents the amount that corresponds with the counters selected for their decisions. Don't pay them separately for their vouchers; that's now been taken care of. Thank them again and ask them to wait for the 5-minute post-experiment survey.*]

7.1.3 Control Group, Gains Domain

WELCOME
Welcome. Thank you for taking the time to come today. [*Introduce Experimenters and Assistants*]. You can ask any of us questions during today's programme.

We have invited you here, today, because we want to learn about how people in this area take decisions. You are going to be asked to take decisions about money. The money that results from your decisions will be yours to keep.

Did you all remember to bring your vouchers? [*Pause*]. Excellent. This voucher, as you can see written on it, is worth 4,000 shillings. Depending on the decisions that you will take today, money may be added to or money may be taken away from those 4,000 shillings. We will also reimburse you for transport at the end of today's programme.

Before we begin, let us make a few things clear.

- To begin with, participation is voluntary. You may choose not to participate in the exercise, and should feel free to leave at any point.
- We also must make clear that this is research about your decisions. Therefore, you cannot talk with others. This is very important. I'm afraid that if we find you talking with others, we will have to send you home, and you will not be able to earn any money here today. Of course, if you have questions, you can ask one of us. We also ask you to switch off your mobile phones.
- Make sure that you listen carefully to us. You will be able to make a good amount of money here today, and it is important that you follow our instructions.
- Please feel free to ask any of us questions during today's programme.
- You will be asked to make decisions that are not a matter of getting it right or wrong; they are about what you prefer. However, it is important to think seriously about your choices because it will affect how much money you can take home.
- During today's programme, you will be asked to make one or more choices, which will be explained to you very clearly. Only one of your choices will be selected to determine the money you will be paid. At the end of today's programme, we will randomly select one of your decisions to be paid out. Any money you earn will be paid out to you privately after all parts of the exercise are complete.

- As you will find out, there are also a few questions and exercises that do not affect how much money you will take home today. We will always make this clear when this is the case.

PART 1

We will now begin with part 1 of today's programme. We now begin with the first part. Here I will ask you three questions and write down your responses. These questions have no influence on the workshop earnings you will take home today.

P1. Can you remember the last time you attended a big feast, such as a wedding or a big celebration in the village? During such a period, there must have been lots of people present, sometimes coming from afar. Can you recall such a feast that you attended? Please rate from 1 to 5 how much you enjoyed it, with 1 meaning 'no fun at all' and 5 'it was a lot of fun'.

P2a,b,c. Imagine you have won four free grocery vouchers from the shop in your area. [*Check with respondent that they know what a grocery voucher is and explain if necessary.*] You can keep one and give one each to three of your family, friends or acquaintances. The vouchers can be used anytime in the coming months. Which of the three people immediately come to your mind to give the voucher to? You can tell me their names or their relations to you.
P3a. I would like you to think about the last time you spent a Sunday afternoon socialising and relaxing with your family or friends? How long ago was that, would you say?

P3b. On a scale of 1- 5, how much fun did you have at that get-together, with 1 being the least fun and 5 being the most fun?

PART 2

Now it is time for part 2 of today's programme. Here I will ask you to do a few exercises. Whether you do them correctly or not has no influence on the workshop earnings you will take home today. However, we would still like you to do them as best you can.

CL1a,b. I would like you to first count triangles. Have a look at this row of triangles:

D	**DDDD**	**DDDDD**	**DD**	**DDD**

Beginning from left to right, the number of triangles are 1, 4, 5, 2, 3.

[Point to the corresponding cell as you read out the numbers.]

Do you understand how this counting exercise works? [*Answer any questions*]

[*Show Sheet 1*] When you are ready, I would like you to start counting all the triangles on this sheet. Please first do the top row [*move your finger along that row*] and then the next row [*move your finger along that one*] and so on until you have finished your sheet.

Are you ready? Please name the **number of triangles as quickly as you can**.

[*Start stopwatch and record number of seconds taken and number of mistakes made.*]

CL2a,b. I would like you to next count digits. Have a look at this row of digits:

444	**5**	**33**	**11111**	**2222**

Beginning from left to right, the correct number of digits are 3, 1, 2, 5, 4.

[Point to the corresponding cell as you read out the numbers.]

Do you understand how this counting exercise works? [*Answer any questions*]

[*Show Sheet 2*] When you are ready, I would like you to start counting all the digits on this sheet. Please first do the top row [*move your finger along that row*] and then the next row [*move your finger along that one*] and so on until you have finished your sheet.

Are you ready? Please name the **number of digits as quickly as you can**.

[*Start stopwatch and record number of seconds taken and number of mistakes made.*]

CL3a,b. In the final exercise, I would like you to say some numbers after me. For example ***[****Enumerator taps foot to read the digits at even speed of about one per second and doesn't repeat the digits]*, if I say 7-1-9, what would you say?" [C*onfirm that the respondent is correct or help them understand.*]

Now listen carefully as I say some numbers, and repeat them after me. [*Tap your foot as before; record number of mistakes, 0-5*]

4 3
7 9 2
5 9 4 1
9 3 8 7 2
1 5 2 6 4 9

Now I am going to again say some numbers, but this time I want you to say them backwards to me. For example, if I say 7-1-9, what would you say? [*The correct answer is 9-1-7. Confirm the correct answer or help the respondent understand*.]

Please listen carefully as I say some numbers, and repeat them backwards after me. [*Tap your foot as before; record number of mistakes, 0-10*]

	Correct answer:
2 4	*4 2*
7 5	*5 7*
6 2 9	*9 2 6*
5 4 1	*1 4 5*

3 2 7 9	*9 7 2 3*
4 9 6 8	*8 6 9 4*
9 3 8 7 2	*2 7 8 3 9*
6 1 2 4 3	*3 4 2 1 6*
1 5 2 6 4 9	*9 4 6 2 5 1*
2 1 8 4 5 9	*9 5 4 8 1 2*

PART 3

Finally, it is time for part 3 of today's programme; this is the part during which your decisions will affect the amount of money you will take home today. As I mentioned before, only one decision will be selected for payment at the end of today's workshop. However, you don't know which one that is, so think carefully about each decision you take: it could be the one that is selected for real!

You see these two bags? One is purple, and the other is blue. You also see this large pile of counters, right? Some are red, others are green, and yet others are white.

Each of these counters represents money. The red counters are worth 4,000 shillings; the green ones 5,000 shillings; and the white ones 6,500 shillings.

Let me explain what decision you need to make; this one is just an example, for teaching. I'm going to fill each of these two bags with counters. Watch carefully.

In the purple bag, I put 7 red counters. How much was each red counter worth again [*let people respond spontaneously*]. 4,000 shillings, that's right; very good! Now I'm going to add 7 green counters. Does anybody remember how much the green counter was worth? [*Let people respond spontaneously*]. Excellent, you're right: 5,000 shillings. And now, finally, I'm going to add 6 white counters to the bag. I don't suppose anybody remembers how much these are worth? [*Let people respond spontaneously*]. Ah, you did! 6,500 shillings. Well done for remembering.
In the blue bag, I'm going to put 20 green counters. I'm sure you remember how much that one was worth, right? [*Let people respond spontaneously*]. Exactly, 5,000 shillings.

What I'm going to do next is, without looking, I will take a counter out of one bag: only one bag. And I'm going to ask YOU to let me know which bag I should take a counter out of. Let's suppose you asked me to take a counter out of the purple bag. Now, let me take a counter out of that. [*Do so without looking*]. Ah, the counter is [*colour*]. So if you had decided the purple bag, you would go home with [*mention the corresponding amount*].

Now let's suppose you'd asked me to take a counter out of the blue bag. Who can tell me which counter I would have selected? [*Let people respond spontaneously.*] So there's no need for me to draw a counter? Why not? [*Let people respond spontaneously*]. That's right! All the counters in the bag are green. So if you'd decided to let me take a counter out of the blue bag, I would definitely have drawn a green counter, which means you would have gone home with how much? Exactly, 5,000 shillings.

OK, are there any questions. [*Respond to any questions*.]

Now, let me ask you a question, in private, to see if you have understood the experiments. [*Administer control question to each subject in turn*.]

CONTROL QUESTION. Which of the two bags gives you a higher chance of going home with exactly 6,500 shillings. The purple one or the blue one?

Excellent, thank you. There is one more thing I should explain. Remember we gave you a voucher for 4,000 shillings? The red counter stands for that voucher: we give you exactly the voucher money. But if the green marble is drawn, you get more than that: we add 1,000 shillings, so that you receive 5,000 shillings. And if the white marble is drawn, we add 2,500 shillings, so that you receive 6,500.

I think we know enough now to begin the exercise. Remember, the decisions you are about to take will influence how much money you will go home with today, so listen carefully.

[*This table is meant to assist the instructions you are about to deliver. You can refer to it if you find that helpful.*]

	Purple bag	Blue bag
First	20 green	4 red, 9 green, 7 white
Next	4 red, 16 green	8 red, 5 green, 7 white
Next	6 red, 14 green	10 red, 3 green, 7 white
Next	9 red, 11 green	13 red, 7 white
Finally	2 red, 18 green	6 red, 7 green, 7 white

First, I'm going to put 20 green counters (worth 5,000 shillings) in the purple bag [*do so*]. Then, I'm going to put 4 red counters (worth 4,000 shillings), 9 green counters (worth 5,000 shillings) and 7 white counters (worth 6,500 shillings) in the blue bag [*do so*].

CL DECISION 1: Which bag would you like me to draw a counter from? [*Subjects respond in private*.]

Now here is something that I didn't tell you yet. We're going to come back in 5 months' time, in April. The next decision is about being paid, not today but in 5 months' time.

CL DECISION 2: Which bag would you like me to draw a counter from, knowing that payment will be in 5 months from now? [*Subjects respond in private*.]

Next, I'm going to put 4 red counters (worth 4,000 shillings) and 16 green counters (worth 5,000 shillings) in the purple bag [*do so*]. Then, I'm going to put 8 red counters (worth 4,000 shillings), 5 green counters (worth 5,000 shillings) and 7 white counters (worth 6,500 shillings) in the blue bag [*do so*].

CL DECISION 3: Which bag would you like me to draw a counter from for payment today? [*Subjects respond in private*.]

CL DECISION 4: Which bag would you like me to draw a counter from, knowing that payment will be in 5 months from now? [*Subjects respond in private*.]

Next, I'm going to put 6 red counters (worth 4,000 shillings) and 14 green counters (worth 5,000 shillings) in the purple bag [*do so*]. Then, I'm going to put 10 red counters (worth 4,000 shillings), 3 green counters (worth 5,000 shillings) and 7 white counters (worth 6,500 shillings) in the blue bag [*do so*].

CL DECISION 5: Which bag would you like me to draw a counter from for payment today? [*Subjects respond in private*.]

CL DECISION 6: Which bag would you like me to draw a counter from, knowing that payment will be in 5 months from now? [*Subjects respond in private*.]

Next, I'm going to put 9 red counters (worth 4,000 shillings) and 11 green counters (worth 5,000 shillings) in the purple bag [*do so*]. Then, I'm going to put 13 red counters (worth 4,000 shillings) and 7 white counters (worth 6,500 shillings) in the blue bag [*do so*].

CL DECISION 7: Which bag would you like me to draw a counter from for payment today? [*Subjects respond in private*.]

CL DECISION 8: Which bag would you like me to draw a counter from, knowing that payment will be in 5 months from now? [*Subjects respond in private*.]

And finally, I'm going to put 2 red counters (worth 4,000 shillings) and 18 green counters (worth 5,000 shillings) in the purple bag [*do so*]. Then, I'm going to put 6 red counters (worth 4,000 shillings), 7 green counters (worth 5,000 shillings) and 7 white counters (worth 6,500 shillings) in the blue bag [*do so*].

CL DECISION 9: Which bag would you like me to draw a counter from for payment today? [*Subjects respond in private*.]

CL DECISION 10: Which bag would you like me to draw a counter from, knowing that payment will be in 5 months from now? [*Subjects respond in private*.]

Wonderful, there are two more decisions I'd like you to take and then we're done.
You see this large sheet in front of you? [*Display large sheet with the following contents.*]

	A	B
1	5600	5600
2	4800	7200
3	4000	8800
4	3200	10400
5	2400	12000

6	400	14000

You have to tell me which row you prefer and then I'll toss this coin, which has A on one side, B on the other. If you choose row 1, and A comes up, you'll be paid 5600 shillings. If B comes up, you'll be paid 5600 shillings as well.

If you choose row 4, and A comes up, you'll be paid 3200 shillings. If B comes up, you'll be paid 10400 shillings. Do you see how the game works? [*Answer any questions*].

EG DECISION 1. Which row do you prefer, 1, 2, 3, 4, 5 or 6, for payment today? [*Subjects respond in private*.]

EG DECISION 2. And which row do you prefer if payment takes place in 5 months' time, when we come back? [*Subjects respond in private.*]

RESOLUTION
Thank you so much for taking part today; we really appreciate it. Here is 4,000 shillings for transport. Now let's see how much you've earned today. We're first going to select a decision that you took

[*select without looking a folded piece of paper from a bag; the bag contains the numbers 1,3,5,7,9. If number 1 is selected, reconstruct the purple and blue bags corresponding with CL DECISION 1, draw a counter out of each bag and pay participants in accordance with the decision they took. Ditto for any of the other numbers that may be selected.*]

[*Pay respondents the amount that corresponds with the counters selected for their decisions. Don't pay them separately for their vouchers; that's now been taken care of. Thank them again and ask them to wait for the 5-minute post-experiment survey.*]

7.1.4 Control Group, Loss Domain

WELCOME
Welcome. Thank you for taking the time to come today. [*Introduce Experimenters and Assistants*]. You can ask any of us questions during today's programme.
We have invited you here, today, because we want to learn about how people in this area take decisions. You are going to be asked to take decisions about money. The money that results from your decisions will be yours to keep.
Did you all remember to bring your vouchers? [*Pause*]. Excellent. This voucher, as you can see written on it, is worth 4,000 shillings. Depending on the decisions that you will take today, money may be added to or money may be taken away from those 4,000 shillings. We will also reimburse you for transport at the end of today's programme.
Before we begin, let us make a few things clear.

- To begin with, participation is voluntary. You may choose not to participate in the exercise, and should feel free to leave at any point.
- We also must make clear that this is research about your decisions. Therefore, you cannot talk with others. This is very important. I'm afraid that if we find you talking with others, we will have to send you home, and you will not be able to earn any money here today. Of course, if you have questions, you can ask one of us. We also ask you to switch off your mobile phones.
- Make sure that you listen carefully to us. You will be able to make a good amount of money here today, and it is important that you follow our instructions.
- Please feel free to ask any of us questions during today's programme.
- You will be asked to make decisions that are not a matter of getting it right or wrong; they are about what you prefer. However, it is important to think seriously about your choices because it will affect how much money you can take home.
- During today's programme, you will be asked to make one or more choices, which will be explained to you very clearly. Only one of your choices will be selected to determine the money you will be paid. At the end of today's programme, we will randomly select one of your decisions to be paid out. Any money you earn will be paid out to you privately after all parts of the exercise are complete.
- As you will find out, there are also a few questions and exercises that do not affect how much money you will take home today. We will always make this clear when this is the case.

PART 1

We will now begin with part 1 of today's programme. Here I will ask you three questions and write down your responses. These questions have no influence on the workshop earnings you will take home today.

P1. Can you remember the last time you attended a big feast, such as a wedding or a big celebration in the village? During such a period, there must have been lots of people present, sometimes coming from afar. Can you recall such a feast that you attended? Please rate from 1 to 5 how much you enjoyed it, with 1 meaning 'no fun at all' and 5 'it was a lot of fun'.

P2a,b,c. Imagine you have won four free grocery vouchers from the shop in your area. [*Check with respondent that they know what a grocery voucher is and explain if necessary.*] You can keep one and give one each to three of your family, friends or acquaintances. The vouchers can be used anytime in the coming months. Which of the three people immediately come to your mind to give the voucher to? You can tell me their names or their relations to you.

P3a. I would like you to think about the last time you spent a Sunday afternoon socialising and relaxing with your family or friends? How long ago was that, would you say?

P3b. On a scale of 1- 5, how much fun did you have at that get-together, with 1 being the least fun and 5 being the most fun?

PART 2

Now it is time for part 2 of today's programme. Here I will ask you to do a few exercises. Whether you do them correctly or not has no influence on the workshop earnings you will take home today. However, we would still like you to do them as best you can.

CL1a,b. I would like you to first count triangles. Have a look at this row of triangles:

D	**DDDD**	**DDDDD**	**DD**	**DDD**

Beginning from left to right, the number of triangles are 1, 4, 5, 2, 3.

[Point to the corresponding cell as you read out the numbers.]

Do you understand how this counting exercise works? [*Answer any questions*]

[*Show Sheet 1*] When you are ready, I would like you to start counting all the triangles on this sheet. Please first do the top row [*move your finger along that row*] and then the next row [*move your finger along that one*] and so on until you have finished your sheet.

Are you ready? Please name the **number of triangles as quickly as you can**.

[*Start stopwatch and record number of seconds taken and number of mistakes made.*]

CL2a,b. I would like you to next count digits. Have a look at this row of digits:

444	**5**	**33**	**11111**	**2222**

Beginning from left to right, the correct number of digits are 3, 1, 2, 5, 4.

[Point to the corresponding cell as you read out the numbers.]

Do you understand how this counting exercise works? [*Answer any questions*]

[*Show Sheet 2*] When you are ready, I would like you to start counting all the digits on this sheet. Please first do the top row [*move your finger along that row*] and then the next row [*move your finger along that one*] and so on until you have finished your sheet.

Are you ready? Please name the **number of digits as quickly as you can**.

[*Start stopwatch and record number of seconds taken and number of mistakes made.*]

CL3a,b. In the final exercise, I would like you to say some numbers after me. For example ***[****Enumerator taps foot to read the digits at even speed of about one per second and doesn't repeat the digits]*, if I say 7-1-9, what would you say?" [C*onfirm that the respondent is correct or help them understand.*]

Now listen carefully as I say some numbers, and repeat them after me. [*Tap your foot as before; record number of mistakes, 0-5*]

4 3
7 9 2
5 9 4 1
9 3 8 7 2
1 5 2 6 4 9

Now I am going to again say some numbers, but this time I want you to say them backwards to me. For example, if I say 7-1-9, what would you say? [*The correct answer is 9-1-7. Confirm the correct answer or help the respondent understand*.]

Please listen carefully as I say some numbers, and repeat them backwards after me. [*Tap your foot as before; record number of mistakes, 0-10*]

	Correct answer:
2 4	*4 2*
7 5	*5 7*
6 2 9	*9 2 6*
5 4 1	*1 4 5*
3 2 7 9	*9 7 2 3*
4 9 6 8	*8 6 9 4*
9 3 8 7 2	*2 7 8 3 9*
6 1 2 4 3	*3 4 2 1 6*
1 5 2 6 4 9	*9 4 6 2 5 1*
2 1 8 4 5 9	*9 5 4 8 1 2*

PART 3

Finally, it is time for part 3 of today's programme; this is the part during which your decisions will affect the amount of money you will take home today. As I mentioned before, only one decision will be selected for payment at the end of today's workshop. However, you don't know which one that is, so think carefully about each decision you take: it could be the one that is selected for real!

You see these two bags? One is purple, and the other is blue. You also see this large pile of counters, right? Some are red, others are green, and yet others are white.

Each of these counters represents money. The red counters are worth 1,000 shillings; the green ones 2,000 shillings; and the white ones 4,000 shillings.

Let me explain what decision you need to make; this one is just an example, for teaching. I'm going to fill each of these two bags with counters. Watch carefully.

In the purple bag, I put 7 red counters. How much was each red counter worth again [*let people respond spontaneously*]. 1,000 shillings, that's right; very good! Now I'm going to add 7 green counters. Does anybody remember how much the green counter was worth? [*Let people respond*

spontaneously]. Excellent, you're right: 2,000 shillings. And now, finally, I'm going to add 6 white counters to the bag. I don't suppose anybody remembers how much these are worth? [*Let people respond spontaneously*]. Ah, you did! 4,000 shillings. Well done for remembering.
In the blue bag, I'm going to put 20 green counters. I'm sure you remember how much that one was worth, right? [*Let people respond spontaneously*]. Exactly, 2,000 shillings.
What I'm going to do next is, without looking, I will take a counter out of one bag: only one bag. And I'm going to ask YOU to let me know which bag I should take a counter out of. Let's suppose you asked me to take a counter out of the purple bag. Now, let me take a counter out of that. [*Do so without looking*]. Ah, the counter is [*colour*]. So if you had decided the purple bag, you would go home with [*mention the corresponding amount*].
Now let's suppose you'd asked me to take a counter out of the blue bag. Who can tell me which counter I would have selected? [*Let people respond spontaneously.*] So there's no need for me to draw a counter? Why not? [*Let people respond spontaneously*]. That's right! All the counters in the bag are green. So if you'd decided to let me take a counter out of the blue bag, I would definitely have drawn a green counter, which means you would have gone home with how much? Exactly, 2,000 shillings.
OK, are there any questions. [*Respond to any questions*.]
Now, let me ask you a question, in private, to see if you have understood the experiments. [*Administer control question to each subject in turn*.]
CONTROL QUESTION. Which of the two bags gives you a higher chance of going home with exactly 4,000 shillings. The purple one or the blue one?
Excellent, thank you. There is one more thing I should explain. Remember we gave you a voucher for 4,000 shillings? The white counter stands for that voucher: we give you exactly the voucher money. But if the green marble is drawn, you get less than that: we deduct 2,000 shillings, so that you receive 2,000 shillings. And if the red marble is drawn, we deduct 3,000 shillings, so that you receive 1,000.
I think we know enough now to begin the exercise. Remember, the decisions you are about to take will influence how much money you will go home with today, so listen carefully.
[*This table is meant to assist the instructions you are about to deliver. You can refer to it if you find that helpful.*]

	Purple bag	Blue bag
First	13 red, 7 green	15 red, 1 green, 4 white
Next	14 red, 6 green	16 red, 4 white
Next	4 red, 16 green	6 red, 10 green, 4 white
Next	1 red, 19 green	3 red, 13 white, 4 white
Finally	10 red, 10 green	12 red, 4 green, 4 white

First, I'm going to put 13 red counters (worth 1,000 shillings) and 7 green counters (worth 2,000 shillings) in the purple bag [*do so*]. Then, I'm going to put 15 red counters (worth 1,000 shillings), 1 green counter (worth 2,000 shillings) and 4 white counters (worth 4,000 shillings) in the blue bag [*do so*].
CL DECISION 1: Which bag would you like me to draw a counter from? [*Subjects respond in private*.]
Now here is something that I didn't tell you yet. We're going to come back in 5 months' time, in April. The next decision is about being paid, not today but in 5 months' time.

CL DECISION 2: Which bag would you like me to draw a counter from, knowing that payment will be in 5 months from now? [*Subjects respond in private*.]
Next, I'm going to put 14 red counters (worth 1,000 shillings) and 6 green counters (worth 2,000 shillings) in the purple bag [*do so*]. Then, I'm going to put 16 red counters (worth 1,000 shillings), and 4 white counters (worth 4,000 shillings) in the blue bag [*do so*].
CL DECISION 3: Which bag would you like me to draw a counter from for payment today? [*Subjects respond in private*.]
CL DECISION 4: Which bag would you like me to draw a counter from, knowing that payment will be in 5 months from now? [*Subjects respond in private*.]
Next, I'm going to put 4 red counters (worth 1,000 shillings) and 16 green counters (worth 2,000 shillings) in the purple bag [*do so*]. Then, I'm going to put 6 red counters (worth 1,000 shillings), 10 green counters (worth 2,000 shillings) and 4 white counters (worth 4,000 shillings) in the blue bag [*do so*].
CL DECISION 5: Which bag would you like me to draw a counter from for payment today? [*Subjects respond in private*.]
CL DECISION 6: Which bag would you like me to draw a counter from, knowing that payment will be in 5 months from now? [*Subjects respond in private*.]
Next, I'm going to put 1 red counter (worth 1,000 shillings) and 19 green counters (worth 2,000 shillings) in the purple bag [*do so*]. Then, I'm going to put 3 red counters (worth 1,000 shillings), 13 green counters (worth 2,000 shillings) and 4 white counters (worth 4,000 shillings) in the blue bag [*do so*].
CL DECISION 7: Which bag would you like me to draw a counter from for payment today? [*Subjects respond in private*.]
CL DECISION 8: Which bag would you like me to draw a counter from, knowing that payment will be in 5 months from now? [*Subjects respond in private*.]
And finally, I'm going to put 10 red counters (worth 1,000 shillings) and 10 green counters (worth 2,000 shillings) in the purple bag [*do so*]. Then, I'm going to put 12 red counters (worth 1,000 shillings), 4 green counters (worth 2,000 shillings) and 4 white counters (worth 4,000 shillings) in the blue bag [*do so*].
CL DECISION 9: Which bag would you like me to draw a counter from for payment today? [*Subjects respond in private*.]
CL DECISION 10: Which bag would you like me to draw a counter from, knowing that payment will be in 5 months from now? [*Subjects respond in private*.]
Wonderful, there are two more decisions I'd like you to take and then we're done.
You see this large sheet in front of you? [*Display large sheet with the following contents.*]

	A	B
1	1600	1600
2	800	3200
3	0	4800
4	-800	6400
5	-1600	8000
6	-3600	10000

You have to tell me which row you prefer and then I'll toss this coin, which has A on one side, B on the other. If you choose row 1, and A comes up, you'll be paid 1600 shillings. If B comes up, you'll be paid 1600 shillings as well. This is on top of the voucher of 4000 shillings that you have received, so you'll go home with 5,600 shillings.
If you choose row 4, and A comes up, you'll lose 800 shillings, which we will take away from the voucher of 4000 shillings that you have received, so you'll go home with 3,200 shillings. If B comes up, you'll be paid 6400 shillings on top of the voucher of 4000 shillings that you have received, so you'll go home with 10,400 shillings. Do you see how the game works? [*Answer any questions*].
EG DECISION 1. Which row do you prefer, 1, 2, 3, 4, 5 or 6, for payment today? [*Subjects respond in private*.]
EG DECISION 2. And which row do you prefer if payment takes place in 5 months' time, when we come back? [*Subjects respond in private.*]

RESOLUTION
Thank you so much for taking part today; we really appreciate it. Here is 4,000 shillings for transport. Now let's see how much you've earned today. We're first going to select a decision that you took [*select without looking a folded piece of paper from a bag; the bag contains the numbers 1,3,5,7,9. If number 1 is selected, reconstruct the purple and blue bags corresponding with CL DECISION 1, draw a counter out of each bag and pay participants in accordance with the decision they took. Ditto for any of the other numbers that may be selected.*]
[*Pay respondents the amount that corresponds with the counters selected for their decisions. Don't pay them separately for their vouchers; that's now been taken care of. Thank them again and ask them to wait for the 5-minute post-experiment survey.*]

7.1.5 Stroop Test Sheet

SHEET 1 FOR PART 2

ΔΔΔ	Δ	ΔΔΔΔΔ	ΔΔ	ΔΔΔΔ
ΔΔΔΔΔ	ΔΔ	ΔΔΔ	ΔΔΔΔ	Δ
ΔΔ	ΔΔΔΔΔ	ΔΔΔΔ	Δ	ΔΔΔ
Δ	ΔΔΔ	ΔΔ	ΔΔΔΔ	ΔΔΔΔ
ΔΔΔΔ	ΔΔ	ΔΔΔΔΔ	ΔΔΔ	Δ
ΔΔΔ	ΔΔΔΔ	Δ	ΔΔ	ΔΔΔΔΔ
ΔΔ	ΔΔΔΔΔ	ΔΔΔΔ	ΔΔΔ	Δ
ΔΔΔΔΔ	ΔΔΔ	ΔΔ	Δ	ΔΔΔΔ
Δ	ΔΔΔΔ	ΔΔΔ	ΔΔΔΔΔ	ΔΔ
ΔΔΔ	Δ	ΔΔΔΔΔ	ΔΔ	ΔΔΔΔ
ΔΔ	ΔΔΔ	ΔΔΔΔ	Δ	ΔΔΔΔΔ
ΔΔΔΔΔ	ΔΔ	Δ	ΔΔΔΔ	ΔΔΔ
ΔΔΔΔ	Δ	ΔΔ	ΔΔΔΔΔ	ΔΔΔ
Δ	ΔΔΔΔΔ	ΔΔΔΔ	ΔΔΔ	ΔΔ
ΔΔΔ	ΔΔΔΔ	ΔΔ	ΔΔΔΔΔ	Δ

SHEET 2 FOR PART 2

2	11	444	5555	33333
111	3333	22222	4	55
44444	55	3	1111	222
5555	33333	111	44	2
33	4	22222	555	1111
222	11111	5	33333	44
11111	2	33	444	5555
3	44	11111	5	222
22222	5555	4	111	33
5	11	33333	2222	444
44	22222	555	1111	3
33333	5555	2	444	11
111	44444	33	5	2222
4	222	1111	33333	55
2222	3	555	44	11111
11	3333	44444	222	5

7.1.6 Post Experiment Survey and Data Collection Sheet

Identification of the respondent

Village/Cell	*1.1*
Village ID	*1.2*
Respondent	*1.3*
Respondent ID?	*1.4*

Respondent Response

P1 (1-5)	
P2a (Words)	
P2b(words)	
P2c(words)	
P3a (words)	
P3 (1-5)	
CL1a(seconds)	
CL1b(mistakes)	
CL2a(seconds)	
CL2b(mistakes)	
CL3a (mistakes 0-5)	
CL3b (mistakes 0-10)	
Control question (1 – right, 0 – wrong)	
CL1	
CL2	
CL3	
CL4	
CL5	
CL6	
CL7	
CL8	
CL9	
CL10	

EG1 (1-6)	
EG2(1-6)	

1. Respondent characteristics

Respondent's sex (1 = Male 2 = Female)	*3.1*
What is your age? [*Record in years*]	*3.2*
Are you married? (1 = Yes 2 = No)	*3.3*
What is the highest level of education that you have attained? (It does not have to be completed) 1 = Primary; 2 = Secondary; 3 = Tertiary; 4 = No education 5 = Other	*3.4*
What is your relationship to the household head? 1 = I am the household head 2 = Spouse of the household head 3 = Other relative 4 = Other	*3.5*
How worried are you about your current financial situation on a scale of 1-5? (1- not at all to 5 – extremely worried)	3.6
What is the total size of the land available to your household for cultivation (owned + rented + any other)? *(in number of acres)*	3.7

2. Risk (Code 888- Don't know)

Please tell me, in general, how willing or unwilling you are to take risks, using a scale from 0 to 10, where 0 means you are "completely unwilling to take risks" and 10 means you are "very willing to take risks." You can also use any number between 0 and 10 to indicate where you fall on the scale.

4.1

Completely unwilling to take risks										Very willing to take risks
0	1	2	3	4	5	6	7	8	9	10

How do you evaluate your attitude towards risk regarding the following areas? Please tick a box on the scale, where the value 0 means "risk averse" and the value 10 means "fully prepared to take risks" (risk-prone).

4.2	
Regarding financial investments?	a)
In leisure time and sport?	b)
With your health?	c)

3. Psychological Wellbeing

1. Life satisfaction and stress

Now I will ask you some questions about your feelings and opinions. You can indicate your response by telling me how often you felt or thought a certain way. The best approach is to answer quickly. That is, don't try to count up the number of times you felt a particular way but rather indicate the choice that seems like a good estimate.

Taking all things together, would you say you are ? 1 = "very happy" 2 = "quite happy" 3 ="not very happy" 4 = "not at all happy"	*5.1.1*
All things considered, how satisfied are you with your life as a whole these days on a scale of 1 to 10? (1= very dissatisfied...10= very satisfied)	*5.1.2*

Response codes for the next questions –

1 = Never, 2 = Almost never 3 = Sometimes 4 = Fairly often 5 = Very often

How often have you felt that you were unable to control the important things in your life?	*5.1.3*
How often have you felt confident about your ability to handle your personal problems?	*5.1.4*
How often have you felt that things were going your way?	*5.1.5*
How often have you felt difficulties were piling up so high that you could not overcome them?	5.1.6

2. Risk and worries

Now I would like to ask you questions about which risks you face and what your worries are.

In the last two months, did you experience this and How worried are about the following areas of your life ?

(5 = No, 0 = Yes, 1 = not at all worried, 2 = not very worried, 3 = somewhat worried, 4= very worried

777-not applicable)

Health problems, illness	*5 2.1*
Problems at home and with relatives	*5.2.2*
Not enough money for basic needs (such as food and clothing)	*5.2.3*
Not being able to educate all children	*5.2.4*
Not enough money for other living expenses	*5.2.5*
Not enough money for medicines and medical treatment	*5.2.6*
Difficulty finding work	*5.2.7*
Idleness of children or spouse	*5 2.8*
Alcohol consumption of children or spouse	*5. 2.9*
Death of a family member	*5.2.10*
Debts owed to others	*5.2.11*
Other	*5.2.12*

3. Psychological wellbeing

I will read out a list of some of the ways you may feel or behave. Please indicate how often you have felt this way during the past week. You can indicate your response by telling me how often you felt or thought a certain way.

1 = Rarely or none of the time, 2 = Some or a little of the time, 3 = Occasionally or a moderate amount of time,

4= All of the time

I was bothered by things that usually don't bother me	*5.3.1*
I did not feel like eating; my appetite was poor	*5.3.2*
I felt that I could not shake off the blues even with help from my family	*5.3.3*
I felt that I was just as good as other people	*5.3.4*
I had trouble keeping my mind on what I was doing	*5.3.5*
I felt depressed	*5.3.6*
I felt that everything I did was an effort	*5.3.7*
I felt hopeful about the future	*5.3.8*
I thought my life had been a failure	*5.3.9*
I felt fearful	*5.3.10*
My sleep was restless	*5.3.11*
I was happy	*5.3.12*
I talked less than usual	*5.3.13*
I felt lonely	*5.3.14*
People were unfriendly	*5.3.15*
I enjoyed life	*5.3.16*
I had crying spells	*5.3.17*
I felt sad	*5.3.18*
I felt that people disliked me	*5.3.19*
I could not "get going	*5.3.20*

7.2 Common Consequence Ladders and Slope of the Probability Weighting Function

Exploratory Analysis - Tracking Individual Probability Weighting Function: By domain* treatment

7.2.1 Total: Gains

Rungs	Probability Range			SR = RS (p value)	Slope interpretation		
	S		R				
r5-r4	[0.7,0.8]	compared to	[0.9,1]	0.6014	$w(1)$ - $w(0.8)$	compared to	$w(0.9)$-w(0.7)
r5-r3	[0.6,0.8]	compared to	[0.8,1]	0.2153	$w(1)$ - $w(0.8)$	compared to	$w(0.8)$-w(0.6)
r5-r2	[0.5,0.8]	compared to	[0.7,1]	0.1471	$w(1)$ - $w(0.8)$	compared to	$w(0.7)$-w(0.5)
r5-r1	[0.35,0.8]	compared to	[0.55,1]	0.0617*	$w(1)$ - $w(0.8)$	<	$w(0.55)$-w(0.35)
r4-r3	[0.6,0.7]	compared to	[0.8,0.9]	0.1380	$w(0.9)$-$w(0.7)$	compared to	$w(0.8)$-w(0.6)
r4-r2	[0.5, 0.7]	compared to	[0.7,0.9]	0.0827*	$w(0.9)$-$w(0.7)$	<	$w(0.7)$-w(0.5)
r4-r1	[0.35,0.7]	compared to	[0.55,0.9]	0.1445	$w(0.9)$-$w(0.7)$	compared to	$w(0.55)$-w(0.35)
r3-r2	[0.5,0.6]	compared to	[0.7,0.8]	0.5000	$w(0.8)$-$w(0.6)$	compared to	$w(0.7)$-w(0.5)
r3-r1	[0.35,0.6]	compared to	[0.55,0.8]	0.0219**	$w(0.8)$-$w(0.6)$	>	$w(0.55)$-w(0.35)
r2-r1	[0.35,0.5]	compared to	[0.55,0.7]	0.0132**	$w(0.7)$-$w(0.5)$	>	$w(0.55)$-w(0.35)

7.2.2 Total: Losses

Rungs	Probability Range			SR = RS (p value)	Slope interpretation		
	S		R				
R5-r4	[0.05,0.2]	compared to	[0.15,0.3]	0.0964*	$w(0.15) - w(0.05)$	<	$w(0.3) - w(0.2)$
r5-r3	[0.05,0.5]	compared to	[0.15,0.6]	0.0019***	$w(0.15) - w(0.05)$	>	$w(0.6) - w(0.5)$
r5-r2	[0.05,0.65]	compared to	[0.15,0.75]	0.0694*	$w(0.15) - w(0.05)$	<	$w(0.75) - w(0.65)$
r5-r1	[0.05,0.7]	compared to	[0.15,0.8]	0.0875*	$w(0.15) - w(0.05)$	<	$w(0.8) - w(0.7)$
r4-r3	[0.2,0.5]	compared to	[0.3,0.6]	0.0000***	$w(0.3) - w(0.2)$	>	$w(0.6) - w(0.5)$
r4-r2	[0.2,0.65]	compared to	[0.3,0.75]	0.3875	$w(0.3) - w(0.2)$	compared to	$w(0.75) - w(0.65)$
r4-r1	[0.2,0.7]	compared to	[0.3,0.8]	0.3031	$w(0.3) - w(0.2)$	compared to	$w(0.8) - w(0.7)$
r3-r2	[0.5,0.65]	compared to	[0.6,0.75]	0.0002***	$w(0.6) - w(0.5)$	<	$w(0.75) - w(0.65)$
r3-r1	[0.5,0.7]	compared to	[0.6,0.8]	0.0001***	$w(0.6) - w(0.5)$	<	$w(0.8) - w(0.7)$
r2-r1	[0.65,0.7]	compared to	[0.75,0.8]	0.2880	$w(0.75) - w(0.65)$	compared to	$w(0.8) - w(0.7)$

7.2.3 Gains: By Season (Lean / Plenty)

Rungs	Probability Range (S compared to R)		Season	SR = RS (p value)	Slope interpretation		
r5-r4	[0.7,0.8]	[0.9,1]	Plenty	0.3101	$w(1)$ - $w(0.8)$	compared to	$w(0.9)$-w(0.7)
			Lean	0.4063	$w(1)$ - $w(0.8)$	compared to	$w(0.9)$-w(0.7)
r5-r3	[0.6,0.8]	[0.8,1]	Plenty	0.3359	$w(1)$ - $w(0.8)$	compared to	$w(0.8)$-w(0.6)
			Lean	0.0492**	$w(1)$ - $w(0.8)$	<	$w(0.8)$-w(0.6)
r5-r2	[0.5,0.8]	[0.7,1]	Plenty	0.5540	$w(1)$ - $w(0.8)$	compared to	$w(0.7)$-w(0.5)
			Lean	0.0704*	$w(1)$ - $w(0.8)$	compared to	$w(0.7)$-w(0.5)
r5-r1	[0.35,0.8]	[0.55,1]	Plenty	0.2135	$w(1)$ - $w(0.8)$	compared to	$w(0.55)$-w(0.35)
			Lean	0.1073	$w(1)$ - $w(0.8)$	compared to	$w(0.55)$-w(0.35)
r4-r3	[0.6,0.7]	[0.8,0.9]	Plenty	0.3389	$w(0.9)$-$w(0.7)$	compared to	$w(0.8)$-w(0.6)
			Lean	0.1611	$w(0.9)$-$w(0.7)$	compared to	$w(0.8)$-w(0.6)
r4-r2	[0.5, 0.7]	[0.7,0.9]	Plenty	0.1405	$w(0.9)$-$w(0.7)$	compared to	$w(0.7)$-w(0.5)
			Lean	0.2257	$w(0.9)$-$w(0.7)$	compared to	$w(0.7)$-w(0.5)
r4-r1	[0.35,0.7]	[0.55,0.9]	Plenty	0.5000	$w(0.9)$-$w(0.7)$	compared to	$w(0.55)$-w(0.35)
			Lean	0.1185	$w(0.9)$-$w(0.7)$	compared to	$w(0.55)$-w(0.35)
r3-r2	[0.5,0.6]	[0.7,0.8]	Plenty	0.3854	$w(0.8)$-$w(0.6)$	compared to	$w(0.7)$-w(0.5)
			Lean	0.4321	$w(0.8)$-$w(0.6)$	compared to	$w(0.7)$-w(0.5)
r3-r1	[0.35,0.6]	[0.55,0.8]	Plenty	0.3877	$w(0.8)$-$w(0.6)$	compared to	$w(0.8)$-$w(0.6)$
			Lean	0.0077***	$w(0.8)$-$w(0.6)$	>	$w(0.8)$-$w(0.6)$
r2-r1	[0.35,0.5]	[0.55,0.7]	Plenty	0.2025	$w(0.7)$-$w(0.5)$	compared to	$w(0.55)$-w(0.35)
			Lean	0.0201**	$w(0.7)$-$w(0.5)$	>	$w(0.55)$-w(0.35)

7.2.4 Losses: By Season (Lean / Plenty)

Rungs	Probability Range (S compared to R)		Season	SR = RS (p value)	Slope interpretation		
r5-r4	[0.05,0.2]	[0.15,0.3]	Plenty	0.1744	$w(0.15) - w(0.05)$	compared to	$w(0.3) - w(0.2)$
			Lean	0.2257	$w(0.15) - w(0.05)$	compared to	$w(0.3) - w(0.2)$
r5-r3	[0.05,0.5]	[0.15,0.6]	Plenty	0.0069***	$w(0.15) - w(0.05)$	>	$w(0.6) - w(0.5)$
			Lean	0.0676*	$w(0.15) - w(0.05)$	>	$w(0.6) - w(0.5)$
r5-r2	[0.05,0.65]	[0.15,0.75]	Plenty	0.4487	$w(0.15) - w(0.05)$	compared to	$w(0.75) - w(0.65)$
			Lean	0.0314**	$w(0.15) - w(0.05)$	<	$w(0.75) - w(0.65)$
r5-r1	[0.5,0.7]	[0.15,0.8]	Plenty	0.3294	$w(0.15) - w(0.05)$	compared to	$w(0.8) - w(0.7)$
			Lean	0.0920*	$w(0.15) - w(0.05)$	<	$w(0.8) - w(0.7)$
r4-r3	[0.2,0.5]	[0.3,0.6]	Plenty	0.0002***	$w(0.3) - w(0.2)$	>	$w(0.6) - w(0.5)$
			Lean	0.0182*	$w(0.3) - w(0.2)$	>	$w(0.6) - w(0.5)$
r4-r2	[0.2,0.65]	[0.3,0.75]	Plenty	0.2522	$w(0.3) - w(0.2)$	compared to	$w(0.75) - w(0.65)$
			Lean	0.1102	$w(0.3) - w(0.2)$	compared to	$w(0.75) - w(0.65)$
r4-r1	[0.2,0.7]	[0.3,0.8]	Plenty	0.3327	$w(0.3) - w(0.2)$	compared to	$w(0.8) - w(0.7)$
			Lean	0.4415	$w(0.3) - w(0.2)$	compared to	$w(0.8) - w(0.7)$
r3-r2	[0.5,0.65]	[0.6,0.75]	Plenty	0.0361**	$w(0.6) - w(0.5)$	<	$w(0.75) - w(0.65)$
			Lean	0.0008***	$w(0.6) - w(0.5)$	<	$w(0.75) - w(0.65)$
r3-r1	[0.5,0.7]	[0.6,0.8]	Plenty	0.0013***	$w(0.6) - w(0.5)$	<	$w(0.8) - w(0.7)$
			Lean	0.0182**	$w(0.6) - w(0.5)$	<	$w(0.8) - w(0.7)$
r2-r1	[0.65,0.7]	[0.75,0.8]	Plenty	0.4495	$w(0.75) - w(0.65)$	compared to	$w(0.8) - w(0.7)$
			Lean	0.1358	$w(0.75) - w(0.65)$	compared to	$w(0.8) - w(0.7)$

7.2.5 Gains: Relevant/Irrelevant

Rungs	Probability Range (S compared to R)		Attribute	SR = RS (p value)	Slope interpretation		
r5-r4	[0.7,0.8]	[0.9,1]	Relevant	0.3323	$w(1) - w(0.8)$	compared to	$w(0.9)-w(0.7)$
			Irrelevant	0.2197	$w(1) - w(0.8)$	compared to	$w(0.9)-w(0.7)$
r5-r3	[0.6,0.8]	[0.8,1]	Relevant	0.3177	$w(1) - w(0.8)$	compared to	$w(0.8)-w(0.6)$
			Irrelevant	0.2713	$w(1) - w(0.8)$	compared to	$w(0.8)-w(0.6)$
r5-r2	[0.5,0.8]	[0.7,1]	Relevant	0.1240	$w(1) - w(0.8)$	compared to	$w(0.7)-w(0.5)$
			Irrelevant	0.3454	$w(1) - w(0.8)$	compared to	$w(0.7)-w(0.5)$
r5-r1	[0.35,0.8]	[0.55,1]	Relevant	0.1445	$w(1) - w(0.8)$	compared to	$w(0.55)-w(0.35)$
			Irrelevant	0.3169	$w(1) - w(0.8)$	compared to	$w(0.55)-w(0.35)$
r4-r3	[0.6,0.7]	[0.8,0.9]	Relevant	0.5489	$w(0.9)-w(0.7)$	compared to	$w(0.8)-w(0.6)$
			Irrelevant	0.05**	$w(0.9)-w(0.7)$	compared to	$w(0.8)-w(0.6)$
r4-r2	[0.5, 0.7]	[0.7,0.9]	Relevant	0.2693	$w(0.9)-w(0.7)$	compared to	$w(0.7)-w(0.5)$
			Irrelevant	0.05**	$w(0.9)-w(0.7)$	compared to	$w(0.7)-w(0.5)$
r4-r1	[0.35,0.7]	[0.55,0.9]	Relevant	0.0361**	$w(0.9)-w(0.7)$	>	$w(0.55)-w(0.35)$
			Irrelevant	0.4161	$w(0.9)-w(0.7)$	compared to	$w(0.55)-w(0.35)$
r3-r2	[0.5,0.6]	[0.7,0.8]	Relevant	0.2559	$w(0.8)-w(0.6)$	compared to	$w(0.7)-w(0.5)$
			Irrelevant	0.4321	$w(0.8)-w(0.6)$	compared to	$w(0.7)-w(0.5)$
r3-r1	[0.35,0.6]	[0.55,0.8]	Relevant	0.0423**	$w(0.8)-w(0.6)$	compared to	$w(0.8)-w(0.6)$
			Irrelevant	0.1066	$w(0.8)-w(0.6)$	compared to	$w(0.8)-w(0.6)$
r2-r1	[0.35,0.5]	[0.55,0.7]	Relevant	0.0058**	$w(0.7)-w(0.5)$	>	$w(0.55)-w(0.35)$
			Irrelevant	0.1499	$w(0.7)-w(0.5)$	compared to	$w(0.55)-w(0.35)$

7.2.6 Losses: Relevant/Irrelevant

Rungs	Probability Range (S compared to R)		Attribute	SR = RS (p value)	Slope interpretation		
r5-r4	[0.05,0.2]	[0.15,0.3]	Relevant	0.2662	$w(0.15) - w(0.05)$	compared to	$w(0.3) - w(0.2)$
			Irrelevant	0.1659	$w(0.15) - w(0.05)$	compared to	$w(0.3) - w(0.2)$
r5-r3	[0.05,0.5]	[0.15,0.6]	Relevant	0.0063***	$w(0.15) - w(0.05)$	>	$w(0.6) - w(0.5)$
			Irrelevant	0.1231	$w(0.15) - w(0.05)$	compared to	$w(0.6) - w(0.5)$
r5-r2	[0.05,0.65]	[0.15,0.75]	Relevant	0.4487	$w(0.15) - w(0.05)$	compared to	$w(0.75) - w(0.65)$
			Irrelevant	0.01**	$w(0.15) - w(0.05)$	<	$w(0.75) - w(0.65)$
r5-r1	[0.5,0.7]	[0.15,0.8]	Relevant	0.4111	$w(0.15) - w(0.05)$	compared to	$w(0.8) - w(0.7)$
			Irrelevant	0.0687*	$w(0.15) - w(0.05)$	<	$w(0.8) - w(0.7)$
r4-r3	[0.2,0.5]	[0.3,0.6]	Relevant	0.0007***	$w(0.3) - w(0.2)$	>	$w(0.6) - w(0.5)$
			Irrelevant	0.0140*	$w(0.3) - w(0.2)$	>	$w(0.6) - w(0.5)$
r4-r2	[0.2,0.65]	[0.3,0.75]	Relevant	0.1418	$w(0.3) - w(0.2)$	compared to	$w(0.75) - w(0.65)$
			Irrelevant	0.0944*	$w(0.3) - w(0.2)$	<	$w(0.75) - w(0.65)$
r4-r1	[0.2,0.7]	[0.3,0.8]	Relevant	0.1746	$w(0.3) - w(0.2)$	compared to	$w(0.8) - w(0.7)$
			Irrelevant	0.3376	$w(0.3) - w(0.2)$	compared to	$w(0.8) - w(0.7)$
r3-r2	[0.5,0.65]	[0.6,0.75]	Relevant	0.0350**	$w(0.6) - w(0.5)$	<	$w(0.75) - w(0.65)$
			Irrelevant	0.0005***	$w(0.6) - w(0.5)$	<	$w(0.75) - w(0.65)$
r3-r1	[0.5,0.7]	[0.6,0.8]	Relevant	0.0188**	$w(0.6) - w(0.5)$	<	$w(0.8) - w(0.7)$
			Irrelevant	0.0047**	$w(0.6) - w(0.5)$	<	$w(0.8) - w(0.7)$
r2-r1	[0.65,0.7]	[0.75,0.8]	Relevant	0.4571	$w(0.75) - w(0.65)$	compared to	$w(0.8) - w(0.7)$
			Irrelevant	0.2084	$w(0.75) - w(0.65)$	compared to	$w(0.8) - w(0.7)$

7.2.7 Gains: Primed/Control

Rungs	Probability Range (S compared to R)		Scarcity Treatment	SR = RS (p value)		Slope interpretation	
r5-r4	[0.7,0.8]	[0.9,1]	Primed	0.2414	$w(1) - w(0.8)$	compared to	$w(0.9)$-$w(0.7)$
			Control	0.1568	$w(1) - w(0.8)$	compared to	$w(0.9)$-$w(0.7)$
r5-r3	[0.6,0.8]	[0.8,1]	Primed	0.0407**	$w(1) - w(0.8)$	<	$w(0.8)$-$w(0.6)$
			Control	0.2800	$w(1) - w(0.8)$	compared to	$w(0.8)$-$w(0.6)$
r5-r2	[0.5,0.8]	[0.7,1]	Primed	0.1037	$w(1) - w(0.8)$	compared to	$w(0.7)$-$w(0.5)$
			Control	0.5000	$w(1) - w(0.8)$	compared to	$w(0.7)$-$w(0.5)$
r5-r1	[0.35,0.8]	[0.55,1]	Primed	0.4511	$w(1) - w(0.8)$	compared to	$w(0.55)$-$w(0.35)$
			Control	0.0052***	$w(1) - w(0.8)$	>	$w(0.55)$-$w(0.35)$
r4-r3	[0.6,0.7]	[0.8,0.9]	Primed	0.1704	$w(0.9)$-$w(0.7)$	compared to	$w(0.8)$-$w(0.6)$
			Control	0.3327	$w(0.9)$-$w(0.7)$	compared to	$w(0.8)$-$w(0.6)$
r4-r2	[0.5, 0.7]	[0.7,0.9]	Primed	0.2612	$w(0.9)$-$w(0.7)$	compared to	$w(0.7)$-$w(0.5)$
			Control	0.1215	$w(0.9)$-$w(0.7)$	compared to	$w(0.7)$-$w(0.5)$
r4-r1	[0.35,0.7]	[0.55,0.9]	Primed	0.2800	$w(0.9)$-$w(0.7)$	compared to	$w(0.55)$-$w(0.35)$
			Control	0.2204	$w(0.9)$-$w(0.7)$	compared to	$w(0.55)$-$w(0.35)$
r3-r2	[0.5,0.6]	[0.7,0.8]	Primed	0.3220	$w(0.8)$-$w(0.6)$	compared to	$w(0.7)$-$w(0.5)$
			Control	0.2612	$w(0.8)$-$w(0.6)$	compared to	$w(0.7)$-$w(0.5)$
r3-r1	[0.35,0.6]	[0.55,0.8]	Primed	0.1144	$w(0.8)$-$w(0.6)$	compared to	$w(0.8)$-$w(0.6)$
			Control	0.0631*	$w(0.8)$-$w(0.6)$	>	$w(0.8)$-$w(0.6)$
r2-r1	[0.35,0.5]	[0.55,0.7]	Primed	0.1215	$w(0.7)$-$w(0.5)$	compared to	$w(0.55)$-$w(0.35)$
			Control	0.0330**	$w(0.7)$-$w(0.5)$	>	$w(0.55)$-$w(0.35)$

7.2.8 Losses: Primed/Control

Rungs	Probability Range (S compared to R)		Scarcity Treatment	SR = RS (p value)		Slope interpretation	
r5-r4	[0.05,0.2]	[0.15,0.3]	Primed	0.1510	$w(0.15)$ - $w(0.05)$	compared to	$w(0.3)$ - $w(0.2)$
			Control	0.2612	$w(0.15)$ - $w(0.05)$	compared to	$w(0.3)$ - $w(0.2)$
r5-r3	[0.05,0.5]	[0.15,0.6]	Primed	0.0427**	$w(0.15)$ - $w(0.05)$	>	$w(0.6)$ - $w(0.5)$
			Control	0.0119**	$w(0.15)$ - $w(0.05)$	>	$w(0.6)$ - $w(0.5)$
r5-r2	[0.05,0.65]	[0.15,0.75]	Primed	0.5000	$w(0.15)$ - $w(0.05)$	compared to	$w(0.75)$ - $w(0.65)$
			Control	0.0124**	$w(0.15)$ - $w(0.05)$	<	$w(0.75)$ - $w(0.65)$
r5-r1	[0.5,0.7]	[0.15,0.8]	Primed	0.1611	$w(0.15)$ - $w(0.05)$	compared to	$w(0.8)$ - $w(0.7)$
			Control	0.2204	$w(0.15)$ - $w(0.05)$	compared to	$w(0.8)$ - $w(0.7)$
r4-r3	[0.2,0.5]	[0.3,0.6]	Primed	0.0033***	$w(0.3)$ - $w(0.2)$	>	$w(0.6)$ - $w(0.5)$
			Control	0.0027**	$w(0.3)$ - $w(0.2)$	>	$w(0.6)$ - $w(0.5)$
r4-r2	[0.2,0.65]	[0.3,0.75]	Primed	0.0885*	$w(0.3)$ - $w(0.2)$	>	$w(0.75)$ - $w(0.65)$
			Control	0.0290**	$w(0.3)$ - $w(0.2)$	<	$w(0.75)$ - $w(0.65)$
r4-r1	[0.2,0.7]	[0.3,0.8]	Primed	0.3877	$w(0.3)$ - $w(0.2)$	compared to	$w(0.8)$ - $w(0.7)$
			Control	0.3830	$w(0.3)$ - $w(0.2)$	compared to	$w(0.8)$ - $w(0.7)$
r3-r2	[0.5,0.65]	[0.6,0.75]	Primed	0.1375	$w(0.6)$ - $w(0.5)$	compared to	$w(0.75)$ - $w(0.65)$
			Control	0.0001***	$w(0.6)$ - $w(0.5)$	<	$w(0.75)$ - $w(0.65)$
r3-r1	[0.5,0.7]	[0.6,0.8]	Primed	0.0049***	$w(0.6)$ - $w(0.5)$	<	$w(0.8)$ - $w(0.7)$
			Control	0.0057***	$w(0.6)$ - $w(0.5)$	<	$w(0.8)$ - $w(0.7)$
r2-r1	[0.65,0.7]	[0.75,0.8]	Primed	0.1831	$w(0.75)$ - $w(0.65)$	compared to	$w(0.8)$ - $w(0.7)$
			Control	0.0290**	$w(0.75)$ - $w(0.65)$	>	$w(0.8)$ - $w(0.7)$

7.2.9 Deducing Slopes – Gains

Rungs	Probability Range			Slope interpretation		
	S		R			
r5-r4	[0.7,0.8]	compared to	[0.9,1]	$w(1) - w(0.8)$	compared to	$w(0.9)-w(0.7)$
r5-r3	[0.6,0.8]	compared to	[0.8,1]	$w(1) - w(0.8)$	compared to	$w(0.8)-w(0.6)$
r5-r2	[0.5,0.8]	compared to	[0.7,1]	$w(1) - w(0.8)$	compared to	$w(0.7)-w(0.5)$
r5-r1	[0.35,0.8]	compared to	[0.55,1]	$w(1) - w(0.8)$	compared to	$w(0.55)-w(0.35)$
r4-r3	[0.6,0.7]	compared to	[0.8,0.9]	$w(0.9)-w(0.7)$	compared to	$w(0.8)-w(0.6)$
r4-r2	[0.5, 0.7]	compared to	[0.7,0.9]	$w(0.9)-w(0.7)$	compared to	$w(0.7)-w(0.5)$
r4-r1	[0.35,0.7]	compared to	[0.55,0.9]	$w(0.9)-w(0.7)$	compared to	$w(0.55)-w(0.35)$
r3-r2	[0.5,0.6]	compared to	[0.7,0.8]	$w(0.8)-w(0.6)$	compared to	$w(0.7)-w(0.5)$
r3-r1	[0.35,0.6]	compared to	[0.55,0.8]	$w(0.8)-w(0.6)$	compared to	$w(0.55)-w(0.35)$
r2-r1	[0.35,0.5]	compared to	[0.55,0.7]	$w(0.7)-w(0.5)$	compared to	$w(0.55)-w(0.35)$

7.2.10 Deducing Slopes – Losses

Rungs	Probability Range			Slope interpretation		
	S		R			
r5-r4	[0.05,0.2]	compared to	[0.15,0.3]	$w(0.15) - w(0.05)$	compared to	$w(0.3) - w(0.2)$
r5-r3	[0.05,0.5]	compared to	[0.15,0.6]	$w(0.15) - w(0.05)$	compared to	$w(0.6) - w(0.5)$
r5-r2	[0.05,0.65]	compared to	[0.15,0.75]	$w(0.15) - w(0.05)$	compared to	$w(0.75) - w(0.65)$
r5-r1	[0.05,0.7]	compared to	[0.15,0.8]	$w(0.15) - w(0.05)$	compared to	$w(0.8) - w(0.7)$
r4-r3	[0.2,0.5]	compared to	[0.3,0.6]	$w(0.3) - w(0.2)$	compared to	$w(0.6) - w(0.5)$
r4-r2	[0.2,0.65]	compared to	[0.3,0.75]	$w(0.3) - w(0.2)$	compared to	$w(0.75) - w(0.65)$
r4-r1	[0.2,0.7]	compared to	[0.3,0.8]	$w(0.3) - w(0.2)$	compared to	$w(0.8) - w(0.7)$
r3-r2	[0.5,0.65]	compared to	[0.6,0.75]	$w(0.6) - w(0.5)$	compared to	$w(0.75) - w(0.65)$
r3-r1	[0.5,0.7]	compared to	[0.6,0.8]	$w(0.6) - w(0.5)$	compared to	$w(0.8) - w(0.7)$
r2-r1	[0.65,0.7]	compared to	[0.75,0.8]	$w(0.75) - w(0.65)$	compared to	$w(0.8) - w(0.7)$

7.3 Report From Focus Group Discussion to Determine Seasonal Scarcities

Annual Liquidity Cycle in Bwikhonge Sub county, Bulambuli District

The report summarises the focus group studies from the field to determine periods of lean and plenty for 2020-2021. The report was prepared by associates from The Field Lab, Uganda and are the first authors for this part of the fieldwork.

The report in outline

1.0 Introduction

2.0 Findings

2.1 Commencement and end of the first and second season, related activities, and the crops grown

2.2 Farming-related and other expenses during the first and second season, and the different sources of the funds

2.3 Months of hardship when most people are worried, and the reasons for being worried

2.4 Indicators that local people use to infer that life's hard during the months of hardship

2.5 Comparison of the annual liquidity cycle with the findings from the interviews and FGD on the months people worry about

2.6 How people survive during the months of hardship

2.7 Months of the year when people are not worried/happy, the reasons, and the indicators

2.8 Comparison of the annual liquidity cycle with the findings from interviews and FGD on the months people are not worried

3.1 Changes in rainfall pattern, the impact of COVID 19, and the implications for the glut period this year

4.1 Conclusion and recommendations

Quotes coming from the interviews and FGD

1.0 Introduction

In this report, I share the findings from individual interviews and a Focus Group Discussion (FGD) conducted with farmers from Bwikhonge sub county. The interviews and FGD were conducted with two main objectives: one, to validate/update the annual liquidity cycle in Bwikhonge sub county based on earlier work by Osborne and Lambe (Osborne and Lambe, 2018); and two, to find out if the months of October and November have customarily been a glut period in the sub county; and if this will be the case this year. The findings on the annual liquidity cycle from the earlier work by Osborne and Lambe are summarized in a power point slide where the authors employ emojis to describe the extent to which people are worried/happy, depending on particular months of the year, and the reasons for being worried/happy.

Guided by the "annual weather, crop, and hardship cycle" as presented in the slide by Osborne and Lambe, I developed an interview guide based on the following themes: commencement and end of the first and second season, related activities and crops grown; farming-related and other expenses during the first and second season, and the different sources of the funds; months of hardship when people are worried, and the reasons for being worried; indicators that the local people use to infer that life's hard during the months of hardship; how people survive during the months of hardship; months of the year when people are less worried/happy, the reasons, and the indicators. During the course of the interviews and FGD, I came up with other new topics based on the insights of the informants. One of these topics relates to the changes in the rainfall patterns, the impact of covid 19, and the implications for the glut period this year.

Please take note that much as one of the objectives of conducting the interviews and FGD was to validate/update the findings from the earlier work by Osborne and Lambe as summarised in the slide, the updated findings have only been reflected in this report, and not the slide. What I mean is that the findings from the individual interviews, and the FGD revealed that the earlier findings about the liquidity cycle as summarized in the slide, were lacking in some areas and needed to be updated. The areas in which the liquidity cycle was lacking have been highlighted in this report, and the earlier findings updated accordingly.

However, no changes have been made to the liquidity cycle power point slide to reflect the new and updated findings. This is because the file could not allow changes to be made.

Next, I present the findings but before that, I will briefly make a note on how the process of collecting the data through interviews and a FGD was conducted. First, I conducted ten individual interviews with the primary objective of getting some preliminary ideas that I would discuss further during the FGD. The ten interviews were not conducted strictly with key informants, though two of the participants were. Whereas as the original plan was to conduct the individual interviews with key informants, I decided to go for ordinary informants because my plan was to constitute the FGD with key informants who were more informed to discuss the findings from the individual interviews. After conducting the individual interviews, I made note of a number of important points that I discussed further during the FGD; this was in addition to the main topics earlier mentioned.

Regarding the composition of the FGD, it was composed of six participants with equal representation of men and women. The participants were farmers but also leaders in a number of different local institutions. These included VSLAs, farmer associations, SACCOs; and other were leaders at the sub county. The participants in the FGD were also older people meaning that they were knowledgeable about what was happening in their communities and thus their views carried more weight. For that matter, in this report I have relied more on the views and analysis coming from the FGD in cases where there are controversies, or differences in opinion.

It should be noted that during the interviews and FGD, I didn't present the power point slide that summarizes the liquidity cycle findings to the informants. The reason for not presenting it was because there was a risk of of participants interpreting the emojis subjectively given their low literacy levels. My approach was first to throw an open question to the informants for instance, by asking them about the months they found to be hard and thus worried about, and the reasons. After listening to their responses, I compared this with the findings summarized in the liquidity cycle slide to see how they compared in terms of similarities and differences. I then probed accordingly by asking follow up questions to understand the reasoning of the informants.

2.0 Findings

The findings have been presented under several subheadings in line with the main themes earlier mentioned. However, before presenting the main findings, I will give a brief overview of the economic activities the people of Bwikhonge subcounty engaged in as shared by the informants. The people are predominantly farmers engaged in growing crops with a small proportion involved in keeping livestock. In addition to farming, some people are engaged in all kinds of small businesses ranging from buying and selling produce, charcoal and firewood, fresh vegetables, bananas, and operating small hotels. Others are involved in providing services like farm labour, masonry on construction sites, and ferrying passengers using motorcycles commonly known as “boda boda”.

Next, I present the main findings.

2.1 Commencement and end of the first and second season, related activities, and the crops grown

The first season usually starts in January and ends in June; and the second in July and ends in November. There were different views among participants regarding when the first season actually starts. Some were saying it starts in January, while the others were saying March. To some of the participants, the land preparation activity is what marked the beginning of the season, while to the others it was the planting activity. Since the activities preceding planting like land preparation are done according to each individual’s own schedule, it was agreed that the planting activity is what should determine the beginning of the season. This is because planting indicates that the rains have started, and most if not, all farmers try to plant on time. Following the “when planting starts” criteria, the season usually starts around the 6th of March because that’s when people start planting. However, this year, there were changes to the beginning of the first season. The rains started normally but by the 6th of March, it had stopped raining and the sun set in; unfortunately, some people had already planted. It was towards the end of March that it started raining again so most people planted in the first week of April after the rains had stabilised. However, around the 12th of May, the rains again disappeared, and the sun set in. The delay in planting during the first season also pushed the beginning of the second season from June to July.

In terms of the farming activities by month, during the first season, the ploughing of land is done in January and February; the planting in March depending on when the rains start; the first weeding is done in April, and the second in May; harvesting of beans is done in June, and by July maize has matured but still drying in the garden. The harvesting of maize usually takes place in August though by end of July those who planted early would be harvesting. As regards the farming activities during the second season, the planting starts in July-August. There's however no clear sequence of the farming activities as the case is with the first season because of the different crops that people grow during this season.

In terms of crops grown by season, just as depicted in the annual weather, crop, and hardship cycle, the first season is usually devoted to growing food crops like maize and beans; and the second to cash crops like sunflower, soybeans, sim sim cotton, and rice. Majority of the farmers grow beans again during the second season, but they are grown for food purposes. There are two reasons why the farmers in Bwikhonge devote the first season to growing food crops, and the second to cash crops. First, food security is very important to the wellbeing of the people of Bwikhonge and growing food crops during the first season is one way of ensuring that they are food secure. By March when the first season starts, the food stocks from the previous year have been depleted so there's always great urgency to replenish the "granaries" to avoid the risk of starvation.

However, the choice of growing food crops in the first season, and cash crops in the second season is also dictated by weather considerations and the gestation periods of the crops. Maize for instance, takes three months to mature and requires a lot of rainfall which is only available in the first season; it cannot therefore be grown in the second season. On the other hand, sunflower which is grown as a cash crop has a short gestation period of two months and requires little rainfall; it can therefore be grown in the second season with minimum risk of losing the harvest even if drought sets in at some point.

2.2 Farming-related and other expenses during the first and second season, and the different sources of the funds

As earlier noted, the first season usually starts in March with planting, and ends in July with the harvesting of maize. However, before the beginning of the season in March, farmers have to meet expenses related to hiring land, a tractor for ploughing; and buying seed. When the

season starts in March, there are expenses related to buying fertilizer; and hiring labour for planting and weeding. In addition to the farming related expenses, farmers also have to cover expenses related to school fees and the accompanying scholastic materials, buying food (in the later months of the first season), and medical expenses in the event of sickness. Around February, some people spend money on buying goats, and chicken because they are usually cheaper at this time. Most people sell goats and chicken around February to raise money to send children to school, and to cover farming-related expenses.

As regards the sources of money used to cover the above expenses, the main sources include proceeds from crops stored; savings from the cash crops grown during the second season; savings from VSLAs; loans from banks; income from businesses; and selling livestock like goats among others. It is important to note that after selling the cash crops grown during the second season, most farmers don't save the actual cash, but rather save in-kind by buying livestock especially cows and goats; and some buy chicken. When the first season starts, it is the livestock they dispose of and use the proceeds to meet the above expenses.

The second season runs from July-November though some informants noted that it can extend to December when some people harvest cotton. During the second season, farmers meet similar expenses like those mentioned for the first season though the expenditure on food goes down since they have harvested maize and beans. To cover expenses related to farming, school fees and sickness, most of them use the proceeds from selling the crops they have harvested especially beans. From the FGD, I learnt that when the second season starts, most people have not harvested maize so there's no income from maize coming in yet. What most farmers do to meet farming and other expenses like school fees is to borrow from the VSLAs; others from the produce dealers on the understanding that they will sell the maize to them once they harvest it; others sell their livestock. When farmers sell their livestock or borrow from the VSLAs to meet the second season expenses it's not an act of distress. Rather than sell their maize cheaply at harvest time, some find it prudent to borrow from the VSLA or sell off their livestock as they wait for the price to appreciate.

One thing I found interesting with regard to the sources of financing the second season farming was the way farmers acquire the seeds of sunflower. Sunflower is a major cash crop in the area though the seeds are expensive. A kilogram of the seeds costs 70,000 shillings and for an acre one needs 2kgs which translates to 140,000 shillings. However, farmers don't have to pay the full amount to get the seeds; they only pay half the amount thanks to Sebei SACCO.

This SACCO located in Kapchorwa has agents in Bwikhonge sub county who extend input loans to members of VSLAs interested in growing sunflower; the inputs are insured. In the case of sunflower, for 2kgs, a farmer pays 70,000 shillings. However, out of the 70,000, the SACCO deducts 30,000 as insurance premium. In addition to extending the seed loan, the SACCO also buys the sunflower from the farmers. At the point of paying for the sunflower, the SACCO deducts the 70,000 shillings which was the balance on the purchase of the seeds. In cases where the harvest fails, the farmer doesn't pay the balance, the insurance takes care of it. The informant who shared this information with me told me that the insurance company doesn't compensate them in the event of drought; they are only exempted from paying the balance.

One of the participants in the FGD was a leader in the Sebei SACCO and when I tried to get the details of how the insurance works, he told me that much as the SACCO extends input credit for sunflower, it doesn't include insurance. He told me that Insurance is only bundled with input credit for sim sim. The package includes sim sim seeds, fertiliser and pesticides. The SACCO buys the sim sim and in the event of a drought, the farmer is not only exempted from paying the loan, but he also receives 500,000 shillings as a pay-out for each acre.

2.3 Months of hardship when most people are worried, and the reasons for being worried

Out of the 10 respondents interviewed, 7 mentioned April and May as the hardest months people are worried about the most; 2 mentioned May and June; and 1 mentioned January and February. Much as there were differences in the months respondents considered the hardest, the reasons they gave for considering these months were similar in some cases. The participant who mentioned January and February as the hardest months reasoned that during these months, most of the money is going to farming and yet they are not earning.

Those who mentioned April and May reasoned that between these months, most people are worried because they don't have money as it has been spent on school fees related expenses and on earlier farming activities. Around April, money is needed to cover expenses related to the first weeding, and this is the month that hunger sets in because the food that people stored during the previous season has all been consumed. Due to the limited supply of maize during these months, the price of maize and flour goes up beyond the reach of most people.

There's usually no money to buy the food from the shops, and yet more money is needed to cover expenses related to second weeding which follows in May. Worse still, between April and May, the crops that they planted have not yet matured so they have nothing to sale to earn money. The alternative is usually to borrow food from the shop, but most traders are not willing to offer credit around this time because the default rate is usually high; they only lend to a few people they can trust.

The informants in the FGD just like the two interviewed individually mentioned May and June as the months people find hardship and worry about the most. The reasoning was that by May, most of the maize that farmers had kept from the previous year has been sold to send children to school, and cover farming expenses. Also, between May and June, there's a lot of hunger and limited opportunities for earning money. When participants mentioned that they sell the maize they had kept in January and February, I asked them what they do with the proceeds from the second season cash crops like sunflower and the rest. In response, they told me that sunflower for instance is sold around November and the proceeds are used to hire land which they pay for in December. Some of the money is used to cover expenses related to the festive season especially Christmas. Some of the proceeds from selling cash crops are also used to buy livestock and other capital assets as a form of in-kind saving. Most of the cash crops are sold immediately after harvest; its maize that most farmers keep and the moment it gets over, then hardships begin. One of the participants noted that people who don't find hardships during these are like 10%. These are the ones who have livestock they can sell and buy food; and those dealing in produce because they never run out of food, these are the ones most people run to for rescue.

I asked participants in the FGD why they mentioned June as one of the months that worries people and yet by this time, they have some food since they have harvested beans, and have some fresh maize. One of the participants answered me philosophically by saying that "you feel hungrier by the smell of food when it's about to get ready". His reasoning was that by June, much as the beans are ready, they are used for meeting the family's food needs. People are more anxious about harvesting maize so that they can earn money. By June, the harvesting of maize is shy by one month since it happens in July.

The philosophical reasoning of the participant from the FGD notwithstanding, I was still interested in understanding why June had been indicated as a month people worry about despite the availability of food. To that effect, I asked the participants between April and June

which month people worried about the most; in chorus, most of them mentioned April. The reasoning was that unlike June where they have something to eat, in April money and food are both scarce. The difference between April and June was that despite April being a hard month, there are opportunities for earning money by providing farm labour. However, the money earned from providing labour is eventually used to buy food. One of the participants later pointed out traditionally, June has not usually been a difficult month save for this year because of the changes in the season. Going by this participant's reasoning, I concluded that perhaps the recency bias was at play when participants mentioned June as one of the months they worry about. By the time we concluded this topic, participants had reached a consensus that April and May where the months that people in Bwikhonge sub county found hard, and worried about the most.

2.4 Indicators that local people use to infer that life's hard during the months of hardship

Much as there was already consensus amongst the informants about April and May being the months that people experienced hardship, I needed some anecdotal evidence of the experiences people go through these months. Such anecdotal evidence would help to validate/nullify the reasons given by participants for considering April and May months of hardship. Below are some of the indicators that informants mentioned.

During the months of April and May, there's a lot of hunger and in some families people go without a meal and others only have one meal; the sight of people taking tea in the morning is rare because people don't have no money to buy sugar; long queues of children returning home after being chased from school for non-payment of school fees are common; people sale their assets like land to raise money to buy food, pay school fees, and cover expenses related to weeding; the sound of maize mills is very rare during these months because there's no maize in most homes for people to mill, most people buy maize flour from the shops. Bwikhonge is a maize growing area so people rarely buy flour but mill their own. However, the moment you see people buying flour from the shops then it's an indicator that most people have run out of maize. Even when there's flour at the shops, most people don't have the money to buy it. Around May, some people just boil the leaves of beans locally known as "kamasafu" and that's what they have as food.

Two of the participants interviewed operate hotels but during the months of April and May, they substantially cut down on the amount of food they cook because most people cannot afford to eat in the hotels; the few customers who come sometimes want to eat on credit. In many cases, the food is left over and taken home to be consumed by their families.

During these months of hardship, cases of domestic violence where men beat their wives are very common; the fights are caused by the men's failure to provide for their families. When a woman asks a man for money to buy food and the man does not have it, he responds by beating her. In some homes, children don't go to school even if parents force them because they have slept hungry and as such have no energy to walk to school. During these months, the incidence of diseases both in adults and children is high. Participants attribute the increase in the incidence of disease to hunger and bad diet in the case of children, and stress in the case of adults. Adults usually worry a lot around these months on how they are going to feed their families. It is also common to see gardens of maize overgrown by weeds because the owners have no energy to weed them since they are hungry. Sometimes people have to make a difficult choice of abandoning their own gardens to be overgrown by weeds in order work on other people's farms to raise money to buy food.

2.5 Comparison of the annual liquidity cycle with the findings from the interviews and FGD on the months people worry about

Despite the annual liquidity cycle showing January-March as months people worry about the most as shown by the emojis, majority of the informants both in the FGD and those interviewed individually didn't agree with this finding. The exception was the one respondent who mentioned January and February as months of hardship for similar reasons mentioned in the liquidity cycle.

Whereas all the participants both in the FGD, and those interviewed individually agreed that January-March they have to meet expenses related to school fees, and farming as correctly stated in the slide, this never worries them at all. The reasoning was that the expenses related to farming and school fees that are characteristic of January-March are always planned for in advance; people are therefore not usually stressed by these expenses. As people spend during the festive season, they know that the new is soon approaching so they always prepare for the related expenses in advance. It was further noted that much as it is true that January-

February there's no money coming in, people still have money they saved from last year's crop proceeds. Also, most VSLAs open the boxes between January-February so people have money from their savings in the VSLAs.

One of the participants also noted that between January and February, most people still have maize they stored as food from last year's harvest. In cases of emergencies for instance sickness, they can sell some of this maize to cover the expenses. He added that people know that January-February there are no opportunities for farm labour so they try as much as they can to keep enough food that can sustain them until March when opportunities for farm labour become available.

One of the participants noted that January-March people have money because you might want to hire a tractor to plough your land, but you'll find that they are all busy because farmers have already paid in advance. This very participant operates a hotel business and she noted that between January-March, when she cooks food in the hotel, it all gets consumed which is a sign that people have money.

Based on the observations of informants and from my own analysis, the findings on the liquidity cycle as summarized in the slide needs updating with respect to the stress points in the months of January-March. The emojis corresponding to these months that portray very worried faces seem premised on wrong assumptions and might not be fairly accurate. A critical look at the liquidity cycle, and the text beneath each of the emojis corresponding to the months of January-March only mentions expenses and not the sources of money used to cover those expenses. The cycle also doesn't also talk about peoples' capabilities to deal with the expenditures(stresses) during those months.

As one of the participants noted, farmers know in advance that between January and February, there are no earning opportunities, so they prepare for such months in advance. They prepare for these months by saving both in cash, and in-kind, a factor that was not considered when developing the liquidity cycle. Also, around March when there's little food, there are opportunities for people to earn some money through providing farm labour, this too is not reflected in the liquidity cycle. My observation is that the capabilities of the people to deal with the hardships begin to weaken between April and May when they run out of food, and their savings get depleted due to the expenses related to weeding and the earlier activities. Before April and May, this capacity is still strong so it would be erroneous to categorize these months as hard and thus very worrying for the people.

On the balance, much as the liquidity cycle does not give an accurate picture of the extent to which people are worried in the months of January-March, it accurately describes the stress levels in the months of April-May. The findings in the liquidity cycle describe April and May as months of hunger a fact which has been validated by the accounts of the informants both in the FGD, and the individual interviews. My observation is that April and May are not only months of hunger, but also scarcity of money because most of it has been spent on the earlier farming activities. My recommendation is that for the month of April and May, the slide be updated by adding a second emoji with a worried face to the existing one with the text below it reading "little cash". By adding a second emoji, this gives more prominence to April and May as months farmers find hardship and are worried about the most, which is in line with the findings from the FGD, and the individual interviews.

2.6 How people survive during the months of hardship

The rationale for finding out how people survive during the months of hardship was to get an idea of the strategies they adopt to cope with the hardships that characterise those months. The strategies people adopt to survive can be used as a measure of the extent to which they are stretched by the hardships during those months.

A number of strategies were mentioned but prominent among them was that of providing farm labour commonly known as "lejja". There are many rich people from outside the sub county who hire land in Bwikhonge and farm on a large scale. The local people provide labour on these farms during the planting and weeding of maize. In May, more opportunities for providing labour are also available in the rice fields because this is the time when rice farmers plant rice. A family can devote four days to providing labour on other farms to earn money, and two on their own farms. Despite the availability of earning opportunities during the months of hardship, the informants noted that the money they earn is far too little in comparison to the demands at that time. The money they earn through lejja is basically used to buy food but cannot be used to cover expenses related to weeding which falls in the same months.

The subject of hiring out labour as a coping strategy during the difficult months of April and May generated a lot of discussion during the FGD with accusations, and counteraccusations between the male and female participants. The female participants accused the male for

being lazy because they don't want to do "lejja" but instead send their wives. The men for their part claimed that during the month of May, they are busy preparing the gardens for growing rice and it's the reason they send their wives to do "lejja" so as to raise money to buy food. However even then, they still fend for their families but accused the women for taking they have been given to meet home expenses to the savings groups.

In rebuttal, the women accused the men of going to the trading centres to chat with their friends as a way of running away from their responsibilities at home. Since women stay at home with the children, the sight of looking at them feeling hungry compels them to find ways of getting money to buy food; men only retire in the evening to sleep. The men were however insistent that women make savings from the money they've been given to buy home necessities. As an example, a male participant said that a man can give his wife 1000 shillings to buy sauce. The wife will instead buy sauce of 800 and save 200 shillings. If she saves 200 shillings daily, by the end of the week she would have saved 1000 shillings to take to the savings group. Since men are aware that women have some spare cash, even if the family is starving, they will sometimes create the impression that they don't have money knowing that their wives will step in. The men further claimed that when they are hard up financially, women withdraw some of their savings from the VSLA but instead lend it to them claiming that they've borrowed from the VSLA yet in reality it's their personal savings.

As a coping strategy during the difficult months of April and May, some people sell their land, and others their livestock to raise money to cover farming expenses, pay school fees and buy food. During April and May, land is very cheap and most rich people buy land cheaply around that time. Land that would cost 5million around December will go for 2-3 million around April and May. When someone is hard up financially, sometimes the intention is not to sell the land but to use it as security to get money to buy food. During these months, it is common for people to mortgage their land even for as low as 200,000 shillings to raise money to buy food or deal with emergencies like sickness. However, if they fail to pay back the loan at the agreed time, they can decide to sell the land to the person who lent them money even if that was not their original intention. During these months, some people negotiate with produce dealers to give them a bag of maize on the understanding that when they harvest, they pay back two.

From the FGD, I learnt that during May, some people get loans from banks and much as they use some of the loan money to buy food, most of it is used to cover expenses related to growing rice.

During the interviews, none of the informants mentioned people borrowing from the VSLAs during the months of hardship. This was in a way surprising given how active VSLAs are in Bwikhonge sub county; I therefore asked some of the informants why they had not mentioned borrowing from the VSLAs. I learnt that VSLAs share their savings during particular months of the year with some sharing in December, and others in January and February. Because of the hardships in April and May, most members don't save and as such there's no money to lend out. One of the informants who was a secretary of a VSLA who told me that during April and May, few members save, and those few only save small amounts. For instance, out of 15 members, only 2 will turn up during the weekly savings meetings. As an example, he noted that if in August during one meeting they were saving 200,000 shillings, in April they would save 20,000 shillings. The 20,000 collected during that meeting is by consensus immediately lent out immediately to a member who has a very pressing problem like the sickness of a child.

2.7 Months of the year when people are not worried/happy, the reasons, and the indicators

Just as was the case with the months that people are worried about, there were some differences in opinion regarding the months when they are happy, though the reasons were similar. The differences in opinion were not strictly about the exact months when people are not worried, but rather when these months begin. Some of the informants claimed that people begin being happy from August-December; while others claimed that it was from October-December. The reason people are happy during these months is because they have food in their homes, and have money coming in from selling some of the crops they have harvested and sold. By August, people have harvested maize, and by October, the second season beans have also been harvested so there's no hunger during these months. Also, August-October, there's money coming in from selling maize and beans; and November-December money comes in from selling sunflower, soya, rice and cotton.

The participants in the FGD however noted that by August-October, much as there's some little money coming in from selling maize and beans, it is mostly used to cover expenses

related to second season farming and paying school fees. The period when people have money “properly” (in plenty-the glut period) is usually November-December. By November, crops that bring in money the most like sunflower, soya, sim sim, rice and cotton would have been harvested and sold. Also, by November, there are no expenses related to farming or paying fees much as people with debts/loans pay them during this month, but these are usually few.

In a similar way I asked participants for the indicators they base on to infer that people are worried during the months of hardships, I also asked them for the same during the months when people are happy and not worried. From the FGD, I gathered the following indicators.

Between November-December, the periodic market which takes place every Thursday is always full of people buying clothes and other items; there are endless queues at the butcheries because most people have money to buy meat(they have four butcheries in the trading centre but during the month of November, meat gets over very fast because the demand is high); people buy assets like land and livestock; in many families, children are cheerful because they have eaten to their satisfaction; betting halls are filled up; men begin retiring home late in the evening from their drinking places; there are many parties around November(parties of social groups like ”kasale”(local friendship groups); weddings; men who haven’t paid pride price pay it in November; people who have distant relatives visit them around November because they have money to transport them and buy some gifts; people make investments like buying livestock; land, and others build houses.

The informants interviewed individually also mentioned several indicators in the months of October-December that show that people have money and are happy. These included: families having two meals a day; people open small businesses like selling charcoal, vegetables, and bananas; incidents of theft go down; grinding mills become busy because there’s maize to grind; there’s peace in homes because men can provide whatever their wives ask for; people buy household items like mattresses, and clothes for their family members; bars are too busy because people have money to spend on drinking; most people don’t eat posho but instead prefer rice; there’s a high a concentration of people in trading centres with each of them having a drink; people build houses; and others buy motorcycles; people grow fat during these months because they are feeding well; few people sale around during these months, and those who do sell it expensively.

2.8 Comparison of the annual liquidity cycle with the findings from interviews and FGD on the months people are not worried

With reference to the months when people are not worried, my analysis and conclusion is that the findings in the liquidity cycle agree with those from the FGD and individual interviews. As depicted by the emojis in the liquidity cycle slide, between June and July, farmers are happy because they have food as beans and maize are harvested between these months. Much as this year was an exception because of the disruptions in the rainfall pattern, we can still maintain that the findings in the slide are valid for normal seasons. The findings from the interviews and FGD further indicated that from August-December, people are happy because money starts coming in from the sale of their crops until the glut period approaches in November. This finding is also in agreement with that in the liquidity cycle where the emojis show happy faces because farmers have harvested and sold their crops.

3.1 Changes in rainfall pattern, the impact of COVID 19, and the implications for the glut period this year

While conducting the individual interviews, there were some participants who expressed pessimism about this year being a successful one for farmers in Bwikhonge. They expressed fears that this year people might not have enough food; and earn as much from their cash crops like the case has been in the previous years. The pessimism of these participants was based on two factors; the irregular nature of the rains both in the first and second season; and the impact of Covid 19.

As mentioned at the beginning, this year the first season rains came a bit late towards the end of March, so people planted at the beginning of April which is usually the case when the season is normal. However around mid-May, it started shining for about two weeks and this happened when the maize had begun tassling. Much as the rains resumed later, the damage to the crops had already been done; farmers got a poor harvest of maize and beans. One of the participants noted that “this year, much as people will get some money, it will not be like the case was 3-5 years ago. The first season harvest was poor in that you can find that someone got about 3 bags of maize in an acre, yet they have to pay a loan of about 200,000 shillings”. One of the informants who operates a hotel lamented that she had got money from her hotel business and invested in farming hoping to make a profit, but she instead made losses. Most people got just enough maize to cater for their food needs but not for selling.

The second season was not any different from the first one because it was also characterized by irregular rains. Around July when the second season begins, some farmers planted beans, but the rains stopped, those who had planted lost the seeds. Later when it started raining, some farmers planted sunflower but again the rain disappeared, and they lost the seeds. Some farmers replanted sunflower in August when it started raining again. He thinks that if the rains don't disappear again, those who replanted sunflower will get a good yield and earn money.

I shared the pessimism of these informants with the ones I interviewed later, and with the participants in the FGD. My idea was to get a balanced view of how the year will play out for the farmers in terms of income given the irregular nature of the rains during the first, and second season. The participants in the FGD and those I interviewed acknowledged the negative impact of the erratic nature of the rains, though they held different views on its ultimate impact on their incomes. One of the informants observed that "in October and November people will still have money like it has always been the case over the years". He noted that despite the sunshine that affected the first season harvest, he has observed that many people still have the maize they harvested from the first season. The fact that people still had maize was a sign that the harvest was not terribly bad for many farmers. He went on to say that in the course of the second season, the rains later stabilised and the crops that people had planted are growing well. Also, much as sunshine might have affected the yield of maize in the first season, maize is not the only crop people grow in the first season. Crops like rice that bring in a lot of money are grown in the first season but were not affected by sunshine. He sounded confident that this year people will still have money despite the season having started on a bad note.

Another informant observed that at the beginning of July, the beans that they planted were affected by sunshine but towards the end of July, they replanted, and these beans seem to be growing well. At the time when the interview was conducted, the beans were past the stage that could be affected by sunshine. The optimism of this informant about was also based on the fact that many farmers had planted sunflower which was already growing well. He added that sunflower doesn't require a lot of rainfall so even if the rain stopped today, the yield wouldn't be affected.

Most participants in the FGD were also optimistic that despite the irregular nature of the rains at the beginning of the first and second season, people would still have money in November

and December. The optimism of the members of the FGD is summarized in the words of one of the participants who observed that; “it is true that the two seasons began badly but there has now been some rain. When you move around, you will see that people have planted a lot during the second season because they lost out in the first season owing to the sunshine. The other reason people have planted a lot during the second season is because they are worried that next year there might be a drought. They have therefore decided to make the best of the second season by planting a lot just in case there’s a drought next year.” The participants think that the erratic nature of the rains this year could be announcing a drought next year.

As mentioned in the preamble to this sub section, during the interviews one of the informants hinted on the potential impact of covid-19 on the price of maize. In the FGD, I also learnt that covid-19 had partly contributed to the abandonment of tomato growing, which for a long time has been one of the biggest earners for some farmers in the sub county. Regarding the impact of covid-19 on the price of maize, the informant who brought up this issue lamented that in addition to the harvest of maize being poor, the price was also low. She claimed that in the previous years, a kilogram of maize cost 700-800 shillings at harvest time but this year it started at 500 shillings. She wasn’t sure of the exact cause of the low price, but she had heard from other people that it was caused by the movement restrictions occasioned by covid-19.

In the past, when there were no movement restrictions, traders used to come as far as Kenya to buy maize, and these used to offer a good price. Even in cases where the Kenyan traders had not come, the local traders would pay the farmers a good price knowing that they would take the maize to Kenya and get a good price. She added that in the past, at this time of the year there would be many Kenyan trucks moving around looking for maize; this has not been the case this year so farmers are at the mercy of the local traders.

When I shared this narrative with one of the other respondents, he was not in agreement. In his opinion, there was no way in which covid would affect them as farmers. He didn’t agree that the restrictions on movement because of covid 19 had impacted on the price of maize. He noted that for many years, the price of maize usually starts from 500 shillings and appreciates with time. In any case, this year it had appreciated faster because at the time of the interview, a kilo was going for 700 shillings. He observed that due to the poor harvest during the first season, there are many traders looking for maize which explains why the price has appreciated faster.

Participants in the FGD noted that this year, the harvest of maize has been poor so there isn't much maize to attract outside buyers. However last year, it is true that the price of maize dropped drastically partly because the season was good, and people got a bumper harvest. The drop in price had nothing to do with the covid-19 movement restrictions but rather the ban on Ugandan maize by the Kenyan government on suspicion of aflatoxin. Because of the ban, Ugandan maize couldn't cross to Kenya which caused the price to drop.

It was also interesting to learn from the FGD that many farmers had abandoned the growing of tomatoes mainly because of the movement restrictions imposed by covid-19. Initially, the number of people growing tomatoes had gone down because of some tomatoes diseases that had emerged and were resistant to pesticides. However over time, varieties of seed resistant to this disease came on the market but they were expensive; they used to cost 600,000 shillings which was beyond the reach of most farmers. However, because of the high demand for tomatoes by the Kenyan traders who were at the same time offering a good price, many farmers started growing tomatoes again. Even farmers who had no money to buy the seeds but were willing to grow tomatoes were given some advance by the Kenyan traders.

However, this year many tomato farmers made losses because the Kenyan traders didn't come due to the travel restrictions. The tomatoes floated and the price went miserably down. Some farmers mobilised themselves with the idea of transporting the tomatoes to Kenya, but they didn't succeed in getting the tomatoes to Kenya. Due to the delays in processing the covid clearance documents at the border, the tomatoes become ripe before taking them to Kenya. They ended up selling the tomatoes cheaply at the border. The clearance usually took more than seven days by which time the tomatoes had already gone ripe. Since this experience, many farmers have become reluctant to grow tomatoes.

4.0 Conclusion and recommendations

Just as a recap, the interviews and FGD were conducted with two main objectives; one, to validate/update the findings summarized in the annual liquidity cycle slide; and two, to find out if the months of October and December are usually a glut period in Bwikhonge sub county. With respect to objective one, the findings summarized in the liquidity cycle slide were to a great extent consistent with those from the interviews and FGD. For instance, the description of the expenses that farmers incur during particular months of the year, and the living conditions of the people has been accurately represented in the liquidity cycle. Consistent

with the findings from the FGD and the interviews, the liquidity cycle accurately shows that in terms of expenditure, January-March farmers have to cover expenses related to farming and school fees. In terms of living conditions, the cycle accurately shows April to May are months when farmers experience hunger; June to July food starts coming in since they are harvesting beans and maize; and August to November money starts coming in since they are selling their crops. These findings have been validated by those from the FGD, and the interviews.

One area where the liquidity cycle needs to be improved/updated related to the months of January-March. With respect to these months, the liquidity cycle uses emojis to show that people are more worried due to expenses associated with farming and paying school fees. The assumption was that between January-March, there are no cash inflows, so people have little money. However, as the findings from the interviews and the FGD have revealed, people are not worried about the expenditures associated with these months. This is because they save both in cash, and in-kind in anticipation of the January-March expenses.

My recommendation is that the liquidity cycle be updated with regard to the January-March period. In particular, the emojis showing very worried faces should be replaced with the ones showing less worried faces; and the appropriate text be written below. The emojis and text for the other months (April-December) should remain the same because they have been validated by the findings from the FGD and the interviews.

With regard to the second objective which was to verify if the months of October and November are a glut period, the findings have confirmed that this is the case. However, with particular reference to this year, we have to rely on the optimism of some of the participants that this will this be the case. This is because the interviews were conducted in August, and the glut period begins October-November; between these months factors could change with implications for the glut period. Maybe we might need to make regular contacts with the study area to monitor how the situation.

Lastly, as regards the correct timing for the experiments, I would recommend November and not October. Inasmuch as it is true that by October people have already started selling some of their crops and have money, it's advisable that the study coincides with a period where majority of the people have harvested and sold their crops.

Quotes coming from the interviews and FGD

About the glut period

"When you owe someone money, you tell them to be patient and come back in October. By then, we have enough food in the home, and we have harvested the second season beans, and waiting to harvest sunflower in October. Right from October to December people are okay."

"If a man is living with someone's daughter but he has never paid bride price, the girl's father usually writes a letter in June informing the son in-law that he will be visiting him on the 31st of November. This is because he knows that by that time, the son in-law will have money."

About the months of hardship

"*To speak the truth, as soon as the year starts in January, people already begin worrying about the month of May and June. For this reason, as early January, people are very economical with the maize they have in the house because they know that it will save them from hunger when May and June approaches. But sometimes due to many demands, this maize never makes it there especially with families that have many people."*

"The first weeding is done in April and the second in May. All these activities require money but you're not reaping anything in return because the crops have not yet matured. Around June that's when people begin breathing a little because they have started harvesting fresh beans."

"The reason the months of April and May are hard is because the gardens are pregnant but haven't given birth yet. There's nothing we can harvest but we are only depending on what we harvested during the last season."