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Informing the Design of Livestock Insurance Subsidy Programmes in Ethiopia: A Mixed Method Approach

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August 2024

Trinity Collge Dublin, The University of Dublin

Master of Science in Development Practice

Wordcount: 10,935

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Declaration of Authorship

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Abstract

Subsidies for index-based insurance are widely used across developing countries to protect farmers from increasingly frequent extreme weather events. This mixed-methods study on subsidies for Index-Based Livestock Insurance (IBLI) in Ethiopia evaluates three important yet unexplored aspects of such subsidies, namely (1) their aims as perceived by key stakeholders, (2) the implication of their design, and (3) exogenous factors which influence their effectiveness. Thematic coding was used to analyse primary qualitative data gathered via key informant interviews and focus group discussions conducted in Ethiopia, the results of which were combined with econometric analysis of secondary household survey data in deriving findings.

Findings indicate that stakeholders broadly agree on the intended outcomes of subsidies, yet coordination failures were identified to be constraining IBLI subsidies' effectiveness. Actual and perceived inaccuracies in the index underpinning the livestock insurance products also emerged as factors undermining subsidies' impact. Furthermore, results show that subsidy rates below 30% are fairly ineffectual at heightening uptake, whereas those exceeding 70% have a disproportionately large impact. Also, the effectiveness of subsidies diminishes as previous-period subsidy rates increase, yet the expectation of adverse climatic conditions had the opposite effect. No significant heterogeneities in responsiveness to subsidies were observed on the basis of livestock wealth or gender.

These findings are of practical significance for the myriad of governmental and non-government entities implementing subsidies for index-based insurance, and serve to guide future research. As hundreds of millions of dollars continue to be spent on such programmes, marginal improvements in cost-efficiency can deliver drastic improvements in beneficiaries' climate resilience and wellbeing; it is such advances which this study seeks to unlock.

Acknowledgements

First of all, I would like to thank Dr Tara Bedi for her guidance and assistance – both in organising the fieldwork underpinning this research and in supporting my personal and professional development throughout my studies at Trinity College Dublin.

My heartfelt thanks also go to Dr Nathan Jensen, who not only served as an inspiration for me in pursuing this work but also generously offered his technical and practical expertise in planning and conducting this research.

To Prof Alan Duncan, I would like to say thank you for shaping my personal and professional aspirations over the last three years and supporting me in working towards them, just as he has supported this project.

Without a doubt, this research would not have been possible without the calm, kind, and patient support of Mr Chala Gidissa, who was instrumental in organising and coordinating all the activities relating to this work.A special thank you goes to Ms Askale Aderaw, Ms Mestawot Ketema, and Mr Tsedeke Desalegn for welcoming me so kindly to their team, contributing so much to the conceptualisation and framing of this work, and supporting this research over this year.

I would also like to thank my colleagues and friends, Mr Guled Ismael and Mr Abdirashid Godana, for their support, companionship, and sense of humour. Special thanks also go to Mr Meseret and Mr Solomon Assefa, who were instrumental in making this work possible. Thanks to Mr Kenneth Macaria, Ms Deirdre McArdle, and Mr Guyo Denge for their kind support, as well as Dr Getachew Ayeha, Mr Mohammed Ebrahim, and Dr Wuletawu Abera from CIAT.

I also extend my sincere gratitude to all those individuals who we spoke to in Borana and Dassanach, and all those communities which welcomed us. Equally, I'd like to thank all those individuals and organisations who participated in this research: Ayuda en Acción, CIFA, Global Communities, GOAL Ethiopia, the International Livestock Research Institute, Nyala Insurance Company, Oromia Insurance Company, the Oromia Irrigation and Pastoralist Development

Office, and ZEP-RE Reinsurance Company. My thanks also go to the five translators who contributed to this work.

This research was made possible thanks to the support of the following entities: AWARD (African Woman in Agricultural Research and Development), the Jameel Observatory, the Trinity College Dublin Trust, and Trócaire/CST Ethoipia. This research is partially funded by the ENDEAVOUR II Scholarships Scheme (Malta), and may be co-funded by the ESF+ 2021-2027.

My gratitude also goes to my friends from the MDP, as well as all those whom I met through the AWARD One Planet Fellowship programme.

Grazzi lil familti u lil sħabi, lin-Nanna Mary, u lil Santa Liena.

List of Acronyms

AME – Average marginal effect

FGD – Focus group discussion

IBLI – Index-Based Livestock Insurance

KII – Key informant interview

NGO – Non-governmental organisation

TLU – Tropical livestock units, whereby 1 TLU is equivalent to 1 cow, 0.7 camels, 10 goats, or 10 sheep

WTP – Willingness to pay

1. Introduction

Climate change disproportionately affects the most vulnerable, among whom are small-scale farmers whose livelihood and food security are threatened by increasingly frequent and severe extreme weather events (Bezner Kerr *et al.*, 2022; Pörtner *et al.*, 2022). Over the last two decades, index-based insurance has emerged as an effective means of mitigating these burgeoning climate risks (Kramer *et al.*, 2022). By issuing compensation payouts during catastrophic weather events, insured farmers are better able to cope during times of crisis and are thus less likely to adopt harmful coping strategies (Janzen and Carter, 2019). Furthermore, studies demonstrate that the security offered by insurance coverage promotes the adoption of riskier but more profitable production strategies, heightening farmers' incomes (Nathaniel D. Jensen, Barrett and Mude, 2017; Janzen and Carter, 2019; Matsuda, Takahashi and Ikegami, 2019).

In view of these benefits, numerous governmental and non-governmental entities have implemented programmes to subsidise index-based insurance, with 80% of such insurance products offered across developing countries to date having been sold at subsidised rates (Hazell, Jaeger and Hausberger, 2021). However, research on such subsidies is scant, so much so that Hazell and Varangis (2020) remark that "very little is really known about the effectiveness of insurance subsidies in achieving their intended purposes" (p.1); Hazell, Jaeger and Hausberger (2021), Nshakira-Rukundo, Kamau and Baumüller (2021) and Kramer *et al.* (2022) all reach similar conclusions. The body of evidence upon which development practitioners may draw in designing index-based insurance subsidies is thus severely constrained, likely impinging on their efficacy.

The case of *Index-Based Livestock Insurance* (IBLI) in Ethiopia typifies these circumstances. Introduced to the country in 2012 to protect pastoralists from drought's pervasive effects, multiple organisations have since offered subsidies for the product (Figure 1). Nonetheless, key aspects of such subsidies – including their intended outcomes, design implications, and factors which influence their efficacy – have not been explored in the academic literature to date. This greatly limits the scope for improving IBLI subsidies' effectiveness and, by corollary,

detracts from the wellbeing of the country's pastoralist farmers, who are among the most vulnerable populations to climate change (Bostedt *et al.*, 2022).

Figure 1: International organisations which have funded, implemented, and/or otherwise supported index-based livestock insurance subsidy programmes in Ethiopia (Zewdie, Taye and Fava, 2020; Ayuda en Acción, 2021; ICRC, 2022; World Bank, 2022; GOAL Global, 2023; ZEP-RE, n.d.).

1.1. Research Objectives

This research evaluates the aims, design implications, and influencing factors of IBLI subsidies in seeking to inform the design of future index-insurance subsidy programmes. The research questions posed are detailed in Table 1 overleaf. These were conceived of and formulated in collaboration with *CST Ethiopia* and *CIFA* – two organisations with extensive experience implementing IBLI subsidies in Ethiopia – to ensure the relevance and applicability of results. A convergent mixed-methods approach is utilised, combining the findings of thematic coding of key informant interviews and focus group discussions, and multivariate regression analysis of secondary household survey data in answering the questions posed.

Table 1: The research questions addressed in this study. The third column uses Morse's system of notation (1991) to delineate the methods used in answering each question.

RQ1.	What do key stakeholders regard as the intended outcome/s of IBLI subsidies?	QUAL
RQ2.	How does subsidy design – specifically in terms of subsidy rate, targeting, and temporal distribution – influence subsidies' impact?	QUAN+qual
RQ3.	What factors other than subsidy design influence the attainment of intended outcomes?	QUAL+quan

1.2. Outline

The following chapter provides a review of the literature pertinent to index-based insurance subsidies. Chapter 3 then details the study's methodology whereas the fourth provides qualitative and quantitative results in turn. These are then integrated and jointly discussed in Chapter 5. Chapter 6 concludes.

2. Literature Review

This literature review consists of three sections. The first provides a brief review of IBLI's impacts, whereas the second section evaluates evidence pertaining to index-based insurance subsidies. The third section then synthesises the review to motivate this research.

2.1. IBLI's impacts

Index-Based Livestock Insurance (IBLI) is a commercial micro-insurance product designed to protect pastoralist households against the loss of livestock to drought. By integrating satellite-measured data on forage availability and historical records of livestock losses, insurance providers are able to estimate livestock mortality rates, paying policyholders compensation once the expected mortality reaches a pre-established threshold (Chantarat *et al.*, 2013).

Since the product's launch in Kenya in 2010 and in Ethiopia two years later, numerous studies have evaluated IBLI's impact on pastoralists who acquire coverage. The assessment is overwhelmingly positive, with three overarching benefits being delineated in the literature: reduced livestock mortality, avoidance of adverse coping strategies, and augmented incomes (Table 2). Reductions in livestock losses are particularly significant as herds which shrink below 10 Tropical Livestock Units (TLU)[1] tend to collapse in size, with households finding it exceedingly difficult to recover lost heads (Lybbert *et al.*, 2004; McPeak, 2006; Barrett and Santos, 2014; Toth, 2015). IBLI coverage therefore drastically alters the fate of pastoralists by improving short-term responses to drought and protecting against dilapidating long-term poverty traps (Janzen, Carter and Ikegami, 2012; Chantarat *et al.*, 2017).

[1] 1 TLU is equivalent to 1 cow, 0.7 camels, 10 goats, or 10 sheep.

Table 2: The three main benefits of IBLI identified by Jensen, Barrett and Mude (2017), Janzen and Carter (2019), Matsuda, Takahashi and Ikegami (2019), and Banerjee, Johnson and Mude (2022). Barrett et al.*'s (2023) longer-term study corroborates positive impacts on education and the shift in production strategies, though no impacts on income or wealth were observed.*

Impact	Explanation
Reduced livestock mortality during drought	IBLI payouts enable pastoralists to purchase forage, water, and medicine which they otherwise might not afford, averting the loss of livestock to drought
Asset protection and improved food security and education	IBLI stems the adoption of deleterious strategies during drought, such as selling off livestock, pulling children out of school to save on fees, or cutting down on food consumption
Higher incomes	The protection IBLI offers emboldens pastoralists to adopt production strategies previously deemed too risky (e.g., investing in veterinary services), in turn improving incomes

2.2. Subsidies for index-based insurance

2.2.1. Intended outcomes

In view of the above benefits, it is unsurprising that so many organisations have leveraged subsidies to promote IBLI adoption. However, studies note that the outcomes sought are often more specific than simply heightening insurance coverage. As expanded on in Table 3, subsidies are sometimes implemented to overcome initial barriers to commercial sustainability, in other cases being used to improve access among marginalised groups or replace other forms of social protection. No studies to date have evaluated the intended outcomes of IBLI subsidies, such that it is unclear whether and how these apply in this case.

Table 3: The intended outcomes of insurance subsidy programmes discussed by Hill et al. *(2014), Hazell and Varangis (2020), Hazell, Jaeger and Hausberger (2021), and Kramer* et al. *(2022).*

Intended outcomes of insurance subsidy programme	Rationale
To overcome initial hurdles to sustainable insurance markets	Subsidies can diminish initial scepticism by promoting experimentation, and give confidence to providers that the critical mass required for commercial viability will be reached
Inclusion/equity	Lowering the effective prices of insurance via subsidies grants access to individuals/households who would otherwise be excluded
Social protection, possibly to replace other social safety net/disaster relief aid programmes	Heavily subsidised agricultural insurance augments/protects incomes during crises at minimal costs to the beneficiary, thus serving the same purpose as other forms of social protection

The literature also makes clear that understanding subsidies' aims is rarely straightforward. Binswanger-Mkhize (2012) highlights that aims are rarely defined explicitly – particularly when these are intertwined with obscured political goals (Hazell and Varangis, 2020) – making it difficult to discern the intended purpose/s of such programmes. Furthermore, Johnson *et al.* (2019) show that different actors involved in a single programme – in their study the IBLI pilot project in Kenya – may hold competing and incongruent expectations, yet these remain held together by what Mosse (2004) refers to as *translation*, the process of "read[ing] the meaning of a project into the different institutional languages of its stakeholder supporters" (p.647). Subsidy programmes are presumably not immune from this, suggesting that perceiving aims may also vary among stakeholders in such instances.

2.2.2. Subsidy design

The literature on agricultural insurance subsidies repeatedly makes reference to 'smart' subsidy design[2], referring to subsidies which are effective, cost-efficient, and well-targeted (Hill *et al.*, 2014; Cai, de Janvry and Sadoulet, 2020; Hazell and Varangis, 2020). Although the body of evidence remains insufficient to clearly identify how different aspects of subsidies' design contribute to making them 'smart', several insights do emerge from the literature.

2.2.2.1. Subsidy rates

The subsidy rate offered is a key determinant of programmes' cost efficiency as this needs to be sufficiently large to have the intended effect but conservative enough to be affordable by funders (Hazell, Jaeger and Hausberger, 2021). While no studies to date have focussed on the implications of this aspect of subsidies' design, the literature on IBLI provides multiple findings of relevance. Studies by Timu *et al.* (2018), Matsuda, Takahashi and Ikegami (2019), and Takahashi *et al.* (2019) find that the probability of purchasing IBLI increases with the subsidy rate received. Demand for index-based insurance is, however, found to be price inelastic, suggesting that while higher subsidy rates do lead to increased uptake, the rise in demand is generally smaller than the increase in the subsidy rate (Cole *et al.*, 2012; Bageant and Barrett, 2017; Jensen and Barrett, 2017; Cai, de Janvry and Sadoulet, 2020).

Further to the above, studies by Takahashi *et al.* (2016), Bageant and Barrett (2017), and Jensen, Mude and Barrett (2018) demonstrate that over and above any price effect, the receipt of a subsidy itself increases the probability of acquiring coverage. Therefore, in addition to increasing demand by lowering the effective price of insurance, receiving a subsidy per se raises the likelihood of purchasing IBLI by between 4 and 18 percentage points on average[3]. This is explained on the basis of a 'reminder effect' in the latter study, whereby the subsidy – delivered via a physical discount coupon – serves as a "reminder to households of

[2] Some publications which make use of this term include Hill *et al.* (2014), Keno, Diriba and Lemesa (2018), Hazell and Varangis (2020), and Cai, de Janvry and Sadoulet (2020).

[3] Estimates taken from Bageant and Barrett (2017) and Jensen, Mude and Barrett (2018), respectively.

the availability of insurance" (p.22), rendering them more likely to consider acquiring coverage.

In spite of the above evidence as well as ILRI's finding (2023) that "pastoralists perceived that the…subsidy rate of 50% was adequate" (p.6), Castaing and Gazeaud (2022) note that "the optimal level of subsidies remains unclear" (p.7). Further research on the association between the insurance uptake and the subsidy rate offered as well as the broader implications stemming from the choice of subsidy rate are therefore pertinent.

2.2.2.2. Intertemporal effects and duration

The literature on index-based insurance also offers insights into the intertemporal implications of the subsidy rate. Most evidence in this regard relates to concerns that beneficiaries may become dependent on large subsidies, rendering subsidies "difficult to phase out or remove once established" (Hazell and Varangis, 2020, p.3) and thus causing programme costs to mushroom (Nshakira-Rukundo, Kamau and Baumüller, 2021). Research by Hill, Robles and Ceballos (2016) and Takahashi *et al.* (2019) explores whether current index-based insurance uptake is influenced by the subsidy rate received during previous periods, which they find not to be the case. This suggests the absence of price anchoring effects – referring to circumstances where "one-off subsidies…reduce future demand as the reduced price creates a focal point for purchasers who then become unwilling to pay more for the product later" (Takahashi *et al.*, 2016, p.334) – but also implies that the risk of subsidy dependence is low. However, neither of these studies considers whether previous-period subsidy rates alter beneficiaries' responsiveness to present-period subsidies – a pertinent consideration when determining the rate of subsidies offered over the course of a programme. Cai, de Janvry and Sadoulet's (2020) finding that farmers who received free index-based rice insurance were no more sensitive to the price of insurance during subsequent sales

windows suggests this not to be the case[4], yet the possibility of subsidies' impact being mediated by previous subsidies has not been tested.

2.2.2.3. Targeting

The targeting of subsidies – one of the key tenets of 'smart' design – is also treated in the literature, albeit indirectly. Hazell and Varangis (2020) note that low-income and/or marginalised groups tend to be the target population of such insurance subsidies, particularly where subsidies' aim is to replace other forms of social protection. According to research by ILRI (2023), this is regarded as an agreeable approach among Ethiopian pastoralists, themselves stating that "people who cannot afford to buy [IBLI]…and vulnerable households" (p.6) should be privileged in being provided access to IBLI. However, the evidence regarding the soundness of such an approach in pastoralist contexts is mixed. Jensen, Barrett and Mude (2017) find that IBLI disproportionately benefits poorer pastoralists who own fewer livestock, suggesting that targeting such low-income cohorts may augment insurance subsidies' social impact. On the other hand, simulation-based studies by Janzen, Carter and Ikegami (2012), Ikegami *et al.* (2017) and Chantarat *et al.* (2017)[5] suggest that targeting IBLI subsidies at those who are at risk of poverty – rather than those who are poor – tends to reduce poverty rates to a greater extent, augmenting programmes' overall social impact.

Further to the above, simulations conducted by Janzen, Carter and Ikegami and Chantarat *et al.* indicate that pastoralists' willingness to pay (WTP) for IBLI varies according to the number of livestock owned, with both converging on a somewhat U-shaped relationship between WTP and herd size (Figure 2). This suggests that price sensitivity varies according to pastoralists' livestock holdings, and thus that responsiveness to subsidies also differs according to herd size. However, no studies to date have empirically evaluated whether such heterogeneities

[4] Note also that their data is based on just two sales windows and treats a particular circumstance where insurance was offered for free, meaning that the extent to which this result is likely to hold in other contexts is fairly ambiguous.

[5] These studies are based on theoretically estimated willingness to pay for IBLI based on simulated herd dynamics over time. The fact that the IBLI demand is found to be price elastic, contrary to that in the empirical literature, means that the applicability of results to real-world situations should be treated with caution.

actually do exist, either on the basis of livestock owned or other characteristics on which subsidies may be targeted.

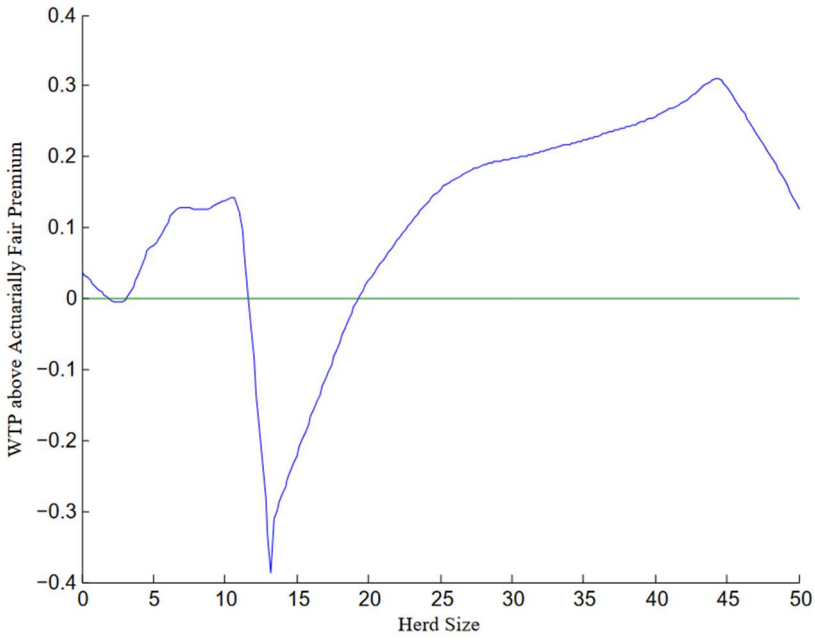

Figure 2: Variation in willingness to pay (WTP) for IBLI by households' livestock holdings. Figure taken from Janzen, Carter and Ikegami (2012).

2.2.3. Influencing factors

Studies demonstrate that several factors unrelated to the design of subsidies bear great influence on subsidies' impact. Amongst the most widely discussed of these is basis risk – the discrepancies between losses predicted by the index underpinning an insurance product and the losses actually experienced by policyholders. This is widely regarded as the "Achilles' heel" (Jensen, Mude and Barrett, 2018, p.1) of index-based insurance, having been shown to significantly reduce demand for IBLI (Keno, Diriba and Lemesa, 2018) and other index-based products (Mobarak and Rosenzweig, 2012; Clarke and Wren-Lewis, 2013; Hill, Robles and Ceballos, 2016). However, research by Jensen, Mude and Barrett (2018) also demonstrates that high levels of basis risk reduce households' responsiveness to IBLI subsidies – a result corroborated by Hill, Robles and Ceballos (2016). Basis risk thus doubly impinges on subsidies'

effectiveness; it diminishes demand and quells any impacts of subsidies. A lack of trust in the insurance product – which often stems from basis risk – also has a similar effect according to research by Clarke and Wren-Lewis (2013) and Keno, Diriba and Lemesa (2018).

Cai, de Janvry and Sadoulet (2020) and Chakraborty (2023) find that receiving a payout reduces subsidies' impact, their effect falling by over 75% among payout recipients in the latter study. Crisis events are however observed to have the opposite effect in that households become considerably more responsive to the receipt of an IBLI subsidy following the loss of livestock to drought (Chakraborty, 2023).

Furthermore, Jensen *et al.* (2024) demonstrate that the supply of insurance remains a major constraint on uptake in pastoralist contexts because of the high costs associated with marketing insurance in such remote, sparsely-populated areas (Keno, Diriba and Lemesa, 2018; Johnson *et al.*, 2019; Kramer *et al.*, 2022). It therefore follows that demand-side measures – including subsidies – can prove ineffective if not accompanied by supply-side support such as investment in insurance distribution networks.

2.3. Synthesis and motivation

Three overarching conclusions may be drawn from this chapter, which has reviewed the impacts of IBLI and evaluated the literature on index-based insurance subsidies.

Firstly, IBLI is effective at improving the wellbeing of pastoralist households, justifying its promotion via subsidies and thus motivating this study's aim of improving subsidies' effectiveness.

Secondly, in spite of the evidence presented above, "very little is really known about the effectiveness of insurance subsidies in achieving their intended purposes" (Hazell and Varangis, 2020, p.1) for at least two reasons. First, while general motivations for the use of insurance subsidies have been identified in the literature (Table 3), the intended purposes of subsidies as understood by key stakeholders remain unexplored in the case of IBLI and other products. Second, the implications of subsidies' design have scarcely been evaluated

empirically, with no studies to date having researched the influence of the rate, targeting, or temporal distribution of subsidies in detail. The first and second research questions of this study thus address these two lacunae, respectively exploring the aims of subsidies as held by different stakeholders and the significance of subsidies' design.

Thirdly, numerous factors exogenous to subsidies' design have been shown to influence subsidies' effectiveness, including basis risk, climatic conditions, and the supply of insurance. However, evidence on how these are experienced, perceived, and navigated by the implementers and beneficiaries of IBLI subsidies remains scarce. The bearing of other potentially significant factors, including intrahousehold dynamics and the bundling of subsidies with other demand-side measures (Timu and Kramer, 2021; Kramer *et al.*, 2022), remain unexplored. This study's third research question thus evaluates the significance of known influencing factors in greater depth while exploring the bearing of other factors which emerge from the data.

3. Methodology

3.1. Methodological underpinnings

To achieve the aim of informing the design of index-based insurance subsidies, the 'pragmatic approach' advanced by Morgan (2007) is adopted. This constitutes a "practical and applied research philosophy" (Creswell and Clark, 2018, p.40) that avoids choosing between positivist and constructivist paradigms and prioritises answering the research questions posed in a manner "oriented towards…real-world practice"(p.37). Furthermore, in line with this pragmatic orientation, no a priori theoretical framework is adopted. Rather, this research draws upon the existing literature such that the research questions and the study's design are based on the evidence presented in Chapter 2.

3.2. Research design

A fixed convergent mixed methods design was utilised, simultaneously drawing on key informant interviews (KIIs), focus group discussions (FGDs), and panel household survey data (Figure 3). Its *mixed methods* nature stems from the integration of qualitative *and* quantitative data, whereas it is *fixed* since the use of both qualitative and quantitative data was envisaged ahead of commencing with research, and *convergent* as qualitative and quantitative data were analysed *parallelly* (Creswell and Clark, 2018).

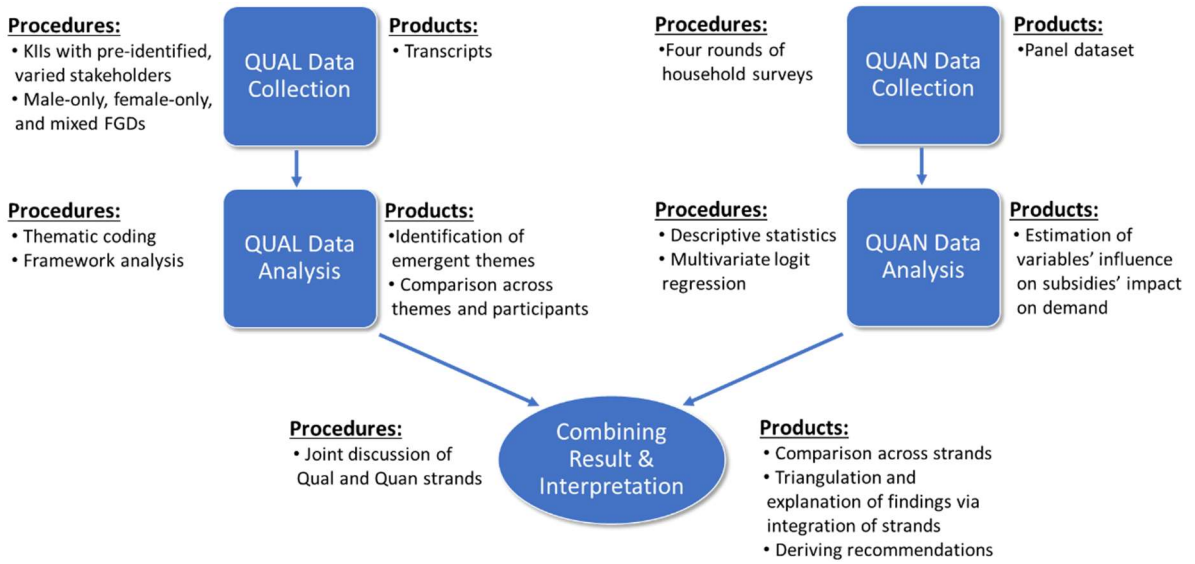

Figure 3: Diagram summarising the mixed methods design adopted in this study. The quantitative data used was a publicly available dataset provided by ILRI. Figure draws on Creswell and Clark (2018).

By using qualitative methods, stakeholders and beneficiaries are given voice in the study, encouraging reflexivity and allowing the research to align with Angus Deaton's position – with which I agree – that:

> *"social plumbing should be left to social plumbers, not outside experimental economists who have no special knowledge, and no legitimacy" (Deaton, 2020, p.26).*

The quantitative strand, on the other hand, allows for the observation of actual rather than stated behaviour. A mixed methods approach thus pools these benefits whilst allowing for completeness and triangulation (Fenech Adami and Kiger, 2005; Creswell and Clark, 2018).

3.3. Study sites

The data underpinning this study was collected from two sites in Ethiopia: the Borana plateau[6] in the Oromia Region, and the Dasenech district of the South Omo Zone in the Southern Nations, Nationalities and Peoples' Region.

The Borana plateau, located 570km south of Addis Ababa, encompasses arid and semi-arid areas covering 48,360km^2 (Amare *et al.*, 2019). It is characterised by a bimodal rainfall pattern with rainy seasons running from March to May and October to November (Takahashi *et al.*, 2016). Most of the population depends on transhumant pastoralism, though agropastoralism is practiced in parts (Amare *et al.*, 2019). Borana is also the area where IBLI was first piloted in Ethiopia (ILRI, n.d.) and has been the site of most insurance subsidy programmes implemented to date.

Dasanach, located 956km southwest of Addis Ababa, is bordered by South Sudan to its west and Kenya to its south (Fesseha *et al.*, 2022). This hot semi-arid area follows the same rainfall pattern as Borana, though rains are generally scarcer and more irregular, causing the area to be afflicted by flash floods (OCHA, 2023; Tadesse, 2023). Most of the population relies on pastoralism, with flood-recession agriculture being practiced along the banks of the Omo Delta (Adicha, Alemayeh and Darcho, 2022). IBLI was introduced to Dasenech later than Borana, with multiple subsidy projects having since been implemented.

Poverty and food insecurity are “widespread and severe” (Teka, Temesgen Woldu and Fre, 2019, p.2) across both areas, with recent droughts having significantly impinged on pastoralists’ wellbeing (Teka, Temesgen Woldu and Fre, 2019; OCHA, 2023; Nurie, 2024).

[6] Also known as the Borana zone.

3.4. Methods

3.4.1. Qualitative data collection

3.4.1.1. Key informant interviews

Interviews were conducted with eleven individuals (Table 4) who were purposefully selected to represent the following pre-identified stakeholder categories[7]: insurance companies, NGOs, government entities, research entities, and subsidy project donors. Where possible, a minimum of two interviewees from each stakeholder category were recruited to avoid limiting a stakeholder category's perspective to that of a single individual.

Table 4: The codes and affiliations of KII participants disaggregated by stakeholder category, and the location where each interview was conducted. Note that Global Communities is an NGO, though the interviewee was representing and overseeing the interests of donors in an IBLI subsidy project implemented by the NGO.

Category	KII Code	Affiliation	Location
(Re)Insurance Companies	*Ins1*	ZEP-RE Reinsurance Company	Company office, Addis Ababa
	Ins2	Oromia Insurance Company	Company office, Addis Ababa
	Ins3	Nyala Insurance Company	Virtual
NGOs	*NGO1*	GOAL Ethiopia	NGO office, Addis Ababa
	NGO2	CIFA	NGO office, Moyale
	NGO3	Ayuda en Acción	NGO office, Addis Ababa
Government bodies	*Gov1*	Oromia Irrigation and Pastoralist Development Office	Public coffee shop, Moyale
	Gov2	Oromia Irrigation and Pastoralist Development Office	Entity office, Addis Ababa
Researchers	*Res1*	ILRI	Hotel lobby, Yabelo
	Res2	African Development Bank	ILRI Campus, Addis Ababa
Donors	*Don1*	Global Communities	Virtual

[7] These were identified in collaboration with partner organisations, with many of the participants having been recruited via partners' networks.

Semi-structured interviews were used as they allow for an in-depth understanding of participants' views on the key aspects of this research and permit emergent points of interest to be probed (Ritchie *et al.*, 2013). An interview schedule[8] was prepared to facilitate comparison across interviewees, though this was adapted based on interviewees' background and the time available. Interviews lasted between twenty-five minutes and one and a half hours. They were conducted in English[9] and recorded, being subsequently transcribed verbatim (Bryman, 2012).

3.4.1.2. Focus group discussions

Twelve FGDs were conducted with pastoralists in Borana and Dasenech between April and May 2024. The use of this format was motivated by practical considerations, primarily the availability of facilitators and translators. Compared to an individual interview approach, FGDs allow for a greater number of participants over a given timeframe, thus enriching the perspectives and experiences documented. Bryman (2012) also notes that this group-based approach allows for individuals' statements to be challenged, possibly resulting in "more realistic accounts" (p.503), though this may have also dissuaded the expression of atypical views (Ritchie *et al.*, 2013).

Discussions were conducted in six locations (Figure 5), selected in view of logistical constraints and on the basis of there having been IBLI sales at the locations in recent years. Participants were not selected individually but a call for participants[10] was made, with those opting-in being allocated to either mixed, male-only, or female-only groups. Groups were stratified by gender to allow women to participate more actively given that women may have been hesitant to speak as openly in the presence of men. As far as possible, various age cohorts were represented in each discussion. Participants had to have acquired IBLI coverage at least once to ensure familiarity with IBLI and thus informed perspective about subsidies. In each

[8] See Appendix 1 – Interview scheulde and discussion guide

[9] The only exception to this was the interview with Gov1, which was conducted in Amharic with the assistance of a live translator.

[10] Where possible, discussions were scheduled on the same day as township meetings to facilitate recruitment.

site, however, one discussion was organised with individuals who had never acquired insurance to mitigate bias stemming from self-selection into insurance. A pre-prepared discussion guide[11] formed the basis of questions posed by Amharic-speaking facilitators. Questions were then translated to local languages, and vice-versa for responses. All discussions were recorded and translated verbatim directly from the local language to English.

Table 5: The location and composition of FGDs, listed in the order they were conducted. Codes are created using a system whereby the first letter represents the study side (B=Borana, D=Dasenech), the second character the gender composition (M=male, F=female, B=both/mixed), and the number serves to differentiate discussions in the same site with the same composition. Note that the asterisk (*) demarcates participants who had not previously had IBLI coverage.

Discussion code	Location (Kebele; Woreda)	Participants (Gender [Age])
BF1	Bade; Moyale	F(40s)x2, F(50s)
BM1	Bade; Moyale	M(50s)x2, M(60s)
BB1	Bolade; Moyale	F(20s), F(30s), F(40s), F(50s) M(30s), M(40s), M(50s), M(60s)
*BB2**	Bolade; Moyale	F(20s)*x2, F(50s)* M(30s)*, M(40s)*
BM2	Bokola; Moyale	M(20s), M(30s), M(40s)
BF2	Bokola; Moyale	F(20s)*, F(30s), F(40s)
DB1	Fejej; Dasenech	F(20s), F(30s), F(60s) M(50s)x2, M(60s)
*DB2**	Fejej; Dasenech	F(20s)*, F(30s)* M(40s)*x2, M(50s)*
DF1	Ocholoch; Dasenech	F(20s)x2, F(30s), F(40s), F(50s), F(60s)
DM1	Ocholoch; Dasenech	M(20s), M(30s), M(40s)x2, M(50s)x2
DF2	Arikol; Dasenech	F(20s)x3, F(30s)x2, F(50s)
DM2	Arikol; Dasenech	M(20s)x2, M(30s)x2, M(60s)x2

3.4.2. Qualitative data analysis

Thematic coding of KII and FGD transcripts was carried out using *NVivo* 14 (QSR International, 2023) on the basis of themes identified in the literature, with additional codes being created

[11] See Appendix 1 – Interview scheulde and discussion guide

based on themes emerging from the data[12]. To facilitate structured comparisons across respondents, framework analysis was then conducted whereby responses were tabulated[13], with rows representing different participants and columns different themes (Gale *et al.*, 2013). This approach proved particularly suited to this research as the data was fairly structured and homogenous in terms of questions asked and themes covered (Ritchie and Lewis, 2003).

3.4.3. Quantitative data collection

A publicly available dataset provided by the *International Livestock Research Institute* (ILRI), was utilised[14]. The author was not involved in its collection, so the procedures detailed hereunder are based on the codebook provided by Ikegami and Sheahan (2018).

A baseline survey was conducted in March 2012 among households from twenty-four *reeras*[15] across eight districts of Borana[16], selected to capture agro-ecological and livelihood variability and in view of logistical constraints. Household sampling was clustered at the *reera* level by conducting a census of each selected *reera*, stratifying households into terciles according to livestock holdings, then randomly selecting 15% of households – a third of which hailed from each tercile. Where 15% of households amounted to less than 25 households, neighbouring *reera*s were combined into a single sampling unit, referred to as a 'study site'. A total of 515 households were surveyed at baseline[17].

IBLI is sold during two windows annually – August/September and January/February – with contracts covering the subsequent twelve months (Figure 4). The product was first sold in Borana during Aug/Sept 2012, followed by a second sales window in Jan/Feb 2013, and so

[12] The a priori and emergent codes used are presented in Supplementary Table 1.

[13] Separate tables were used for FGDs and KIIs given that questions differed across the two.

[14] This is accessible at https://data.ilri.org/portal/dataset/ibli-borena-r1. Full surveys for each round are available at https://data.ilri.org/portal/dataset/ibli-borena-r1/resource/1e97501a-5789-4066-aa22-c33c04f1ff64?inner_span=True.

[15] A *reera* constitutes the second smallest administrative unit in Ethiopia, consisting of approximately 100-300 households (Takahashi *et al.*, 2019).

[16] Namely Arero, Dhas, Dillo, Dire, Moyale, Teltele, Yabello, and Miyo.

[17] 528 households were selected, but 13 could not be contacted.

forth (Table 6). The first follow-up survey was conducted in March 2013 – after the first two sales windows – with subsequent rounds conducted each March until 2015.

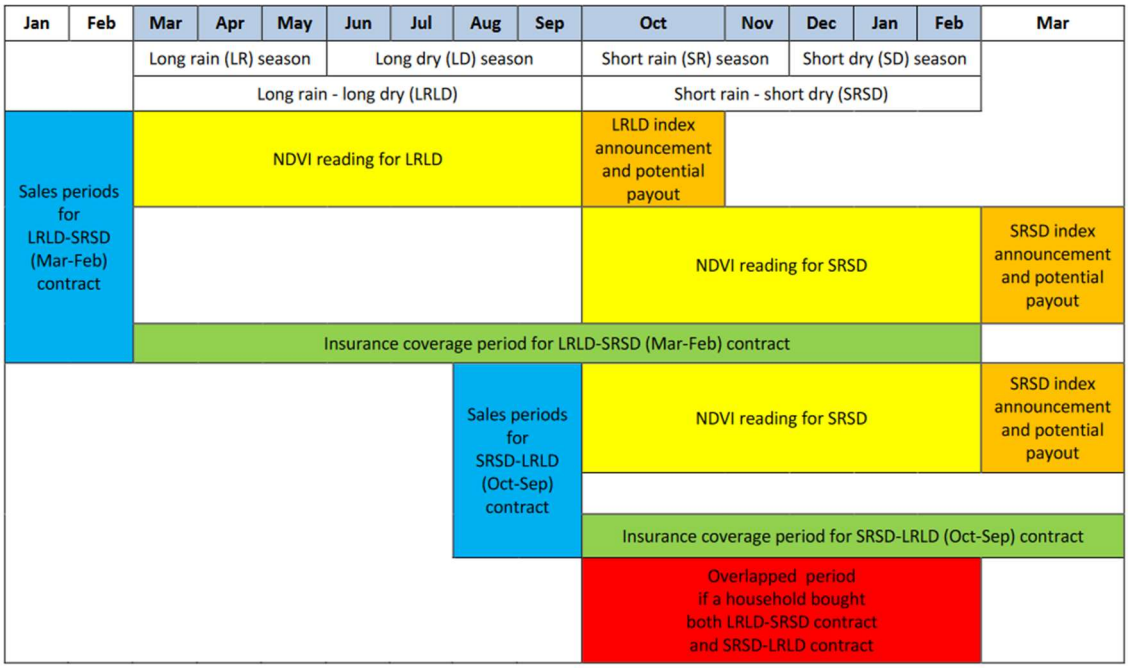

Figure 4: The timing of IBLI contracts sold in Borana. Figure taken from Ikegami and Sheahan (2018). For further details, see Ikegami and Sheahan (2018, p.4-6)[18].

To promote IBLI uptake, discount coupons were randomly distributed among surveyed households. In each window, a tenth of participating households received a 10% discount, a second tenth received 20%, and so forth up to an 80% discount, with 20% of households not receiving any coupon[19]. These discounts applied to the first 15 TLU insured and were only valid for the subsequent sales window. Coupons were rerandomized and redistributed each IBLI

[18] Note that since this data was collected, IBLI has shifted from an asset-replacement to an asset-protection model, whereby indexes are calculated earlier in the year and payouts are paid before or during the dry season, rather than afterwards (Mude, 2017).

[19] Ten surveyed households received a 100% subsidy each year for the purposes of a separate study; these are excluded from the sample used in this study. See Supplementary Table 2 for the balance tests between coupon recipients and non-recipients, which shows that the discount coupons were in fact randomly distributed.

sales window. Learning kits intended to improve participants' understanding of IBLI were also distributed randomly prior to the first two sales windows[20].

Table 6: The timing of survey rounds and IBLI sales. Each survey round covers the previous two sales windows. Table taken from Ikegami and Sheahan (2018).

Date	Activity
March 2012	Household survey round 1
August-September 2012	1st IBLI sales period
January-February 2013	2nd IBLI sales period
April 2013	Household survey round 2
August-September 2013	3rd IBLI sales period
January-February 2014	4th IBLI sales period
March 2014	Household survey round 3
August-September 2014	5th IBLI sales period
November 2014	1st IBLI indemnity payout
January-February 2015	6th IBLI sales period
March 2015	Household survey round 4

3.4.2. Quantitive data analysis

Households receiving a 100% subsidy (see Footnote 19) were excluded from the sample, as were replacement households, those which only participated in the baseline survey, and those which dropped out and subsequently rejoined the study. Data cleaning and variable creation were subsequently undertaken, with summary statistics then produced as relevant[21]. Prior to conducting econometric analyses, the top 1% of values for herd size were winsorized to mitigate the influence of outliers.

[20] For full details, see Takahashi *et al.* (2016, p.326).

[21] All the stages of quantitative analysis hereunder were carried out using R (R Core Team, 2024) and the packages cited in Appendix 3 – R packages used.

The following model was then constructed to evaluate variables' influence on insurance uptake,

$$\Pr(Uptake_{it} = 1) = \Phi\left(\alpha + \beta D_{it} + \delta X_{it} + \delta_1 L_{it} + \delta_2 {L_{it}}^2 + \varphi H_i + \omega + t + \mu_i + \varepsilon_{it}\right) \quad (1)$$

where $Uptake_{it}$ is a binary dependent variable capturing whether or not household i acquired insurance coverage in sales window t, and D_{it} is a binary variable representing the receipt of a discount coupon, and X_{it} and H_i respectively capture time-variant and -invariant household characteristics[22]. L_{it} is one time-variant household characteristic capturing the number of livestock owned by household i in period t, with ${L_{it}}^2$ representing the square of this value. ω and t represent study-site and sales window dummies, respectively. The error is composed of both μ_i, the unobserved time-invariant household effect, and ε_{it}, an idiosyncratic error with zero mean, finite variance σ_ε^2, and distributed independently and identically.

Estimating this model, however, poses econometric challenges. The use of a pooled probit estimator would produce biased results due to the presence of unobserved household fixed-effects (μ_i), yet a standard fixed-effect probit approach would produce inconsistent estimates owing to the incidental parameter problem which arises due to the panel being short compared to the number of households surveyed (Jensen, Mude and Barrett, 2018). Therefore, a variant of the probit pooled estimator developed by Wooldridge (2010, pp.483–490)[23] is used. This controls for household fixed effects via the introduction of within-household means of time-variant characteristics ($\bar{X}_i$), assuming independence conditional on those means and error terms to be normally distributed. The model estimated is thus:

$$\Pr(Uptake_{it} = 1) = \Phi\left(\alpha + \beta D_{it} + \delta X_{it} + \delta_1 L_{it} + \delta_2 {L_{it}}^2 + \varphi H_i + \omega + t + \vartheta \bar{X}_i + \varepsilon_{it}\right) \quad (2)$$

To further explore the implications of targeting subsidies, an interaction term between D_{it} and the number of livestock owned by the household (L_{it}, ${L_{it}}^2$) was added to Model (2) given

[22] Time-variant and invariant control variables are detailed in Supplementary Table 3, the choice of which is in the expansive body of evidence on the determinants of IBLI uptake.

[23] This is referred to as *Chemberlain's random effects probit model*.

the significance of livestock assets in pastoralist systems[24] and the association between herd size and willingness to pay for insurance posited by Janzen, Carter and Ikegami (2012) and Chantarat *et al.* (2017). Modelling herd size using variables capturing the number of livestock owned (L_{it}) as well as its square ($L_{it}{}^2$) allows non-linearities in this association, in line with the U-shape shown in Figure 2.

Three other variants of Model (2) were then constructed to study the significance of subsidy rates in detail. In the first, a continuous variable capturing the discount rate of the coupon received was used instead of the binary variable capturing the receipt of a discount, whereas the second incorporated both of these variables. Instead of these two variables, the third model incorporated a set of dummy variables representing the different discount rates distributed.

Four further models were then constructed to study intertemporal effects of subsidies. The first incorporated two binary variables representing the receipt of a coupon in the two previous sales windows ($D_{it-1}; D_{it-2}$) into Model (2). Both these variables were interacted with D_{it} in the second model. Similarly, the third model included two variables capturing the discount rate received in the previous two windows, with these being interacted with D_{it} in the fourth.

3.5. Ethics and data storage

This research was approved by the School of Natural Sciences at Trinity College Dublin[25] and the partner organisations. Written consent was sought from all participants. Given the low literacy levels among pastoralist populations, particular attention was paid to ensuring that the aims of the research and the implications of participating were clear to participants before

[24] As discussed by Anderson and Broch-Due (1999) and Little *et al.* (2008), animals simultaneously serve as a source of income, depository of value, and the primary form of wealth.

[25] See Appendix 4 – Ethical Approval

soliciting written consent[26]. Furthermore, local community-based organisations were consulted in determining the compensation to be provided to participants to ensure this was suitable. Regarding KIIs, these were conducted under the condition of anonymity, and all efforts were made to protect participants' identities. All materials were handled and stored in line with TCD's data storage policies.

[26] Sample information and consent forms are provided in Appendix 4 – Ethical Approval. A fingerprint was collected from participants who were illiterate, with a second individual signing to confirm that the participant wilfully provided their consent in such instances.

4. Results

4.1. Qualitative results

4.1.1. Intended outcomes of subsidies

Table 7 below gathers the intended outcomes of IBLI subsidies expressed by KII participants. Heightening IBLI uptake was the most frequently cited, with subsidies generally being framed as a "pull factor" to promote this "new product" (NGO2). Both KII and FGD participants noted that subsidies heighten demand on both the extensive and intensive margins, both "encouraging pastoralists to join the scheme" (Don1) and to purchase larger policies when they do. Many participants also linked the aim of increasing IBLI uptake to that of creating awareness about the product, with insurance company representatives generally associating this with the creation of sustained demand: "The objective is to create awareness in all pastoralist areas so that when the time comes for sales they come…and ask for insurance" (Ins1).

Table 7: The intended outcomes identified by KII participants, disaggregated by stakeholder classification and listed in order of frequency.

Stakeholder category	Insurance	NGO	Government	Research	Donor	*Total*
Respondents (n)	3	3	2	2	1	*11*
Increased uptake	2	2	2	2	0	*8*
Awareness creation	2	1	1	2	0	*6*
Support commercial sustainability	1	3	0	2	0	*6*
Inclusion	0	3	1	1	0	*5*
Resilience/risk reduction	0	2	1	0	1	*4*
Geographical dissemination	1	2	0	0	0	*3*
Social protection	2	0	0	1	0	*2*
Intensification	0	1	0	0	1	*2*
Increase trust, show commitment	1	0	0	0	0	*1*
Political goals	0	0	0	1	0	*1*
Donor recognition	1	0	0	0	0	*1*

NGO representatives and researchers consistently underscored that one intended outcome of IBLI subsidies was "to keep…insurance compan[ies] in the market" (Res1). Most interviewees framed these commercial barriers as 'teething problems', though others thought these challenges to be structural and argued for continuous subsidies: "making it [IBLI] a commercial product is difficult, which means that continuous subsidy must be there" (NGO1).

Facilitating access to livestock insurance for vulnerable/disadvantaged groups[27] was another aim of subsidies consistently identified by NGO representatives, this also being widely recognised among FGD participants. Nonetheless, only two KII participants explicitly identified IBLI subsidies as a form of social protection, one of whom remarked: "instead of providing other social security like food transfer or cash transfer, [it is] better to finance their livestock insurance" (Ins3). Multiple participants did however note that IBLI subsidies serve as a form of climate adaptation and means of augmenting pastoralists' resilience, with one interviewee also highlighting that subsidies "support the pastoral peoples from dropping out from pastoralism" (Don1).

Three interviewees mentioned that subsidies are employed to further IBLI's geographical dissemination. For NGOs, this was thought of in terms of subsidies attracting insurance providers to neglected areas, thus granting access to previously excluded groups. However, promoting geographical dissemination via subsidies was framed by an insurance company representative as a means of reducing companies' risk, explaining that "the projects so far are concentrated in one region. If risk happens, then there is a lot of payout but…where you do in different location, risk is diversified" (Ins1).

Men and women who participated in FGDs conducted in Borana also noted that subsidies also instill confidence and trust in the product – a sentiment echoed in Ins1. The same interviewee also mentioned that subsidies serve to bolster donors' recognition and status, with another citing the use of subsidies for political reasons[28].

[27] Women and female-headed households, people with disabilities, the elderly, and youth were identified as forming part of this cohort.

[28] More specifically, this interviewee mentioned that subsidies could be used as a means of channelling resources along lines of political allegiance or as a means of winning political favour.

4.1.2. Subsidy design

Interviewees from across stakeholder groups explicitly employed the notion of 'smart subsidies', yet views on subsidies' design did vary. Prior to evaluating these divergences, it is worth noting that among KII participants, the subsidy design conceived of was generally linked to the perceived aims of subsidies. When highlighting subsidies' role in heightening demand to overcome initial hesitancy, participants generally spoke of relatively widely-distributed subsidies to be phased out over time, referred to as the 'start block approach'. Where subsidies were conceived of as a tool for inclusion, resilience, or social protection, continuous subsidies targeted at households/individuals meeting certain criteria tended to be cited, referred to as the 'protection approach' (Table 8). While generally conceived of as two entirely distinct interventions, these were not mutually exclusive, with the vast majority of participants advocating for the use of both. One interviewee, for example, said that "there's no way that you're going to provide subsidy for long period of time" (NGO2) but subsequently claimed that "the families who cannot afford need to be subsidised, maybe for long time" (NGO2).

A third approach to subsidies emerged from conversations with three KII participants from different groupings. These highlighted the value of directly supporting insurance companies via financing for outreach, awareness creation, and supply network development which is here termed a 'direct finance approach'.

Table 8: A characterisation of the different approaches to insurance subsidies conceived of by KII participants. These are not mutually exclusive, with 10 of 11 interviewees explicitly or implicitly advocating for at least two of these.

Start block approach	Design: Widely distributed and temporary Primary aim/s: Overcome initial hesitancy and increase demand
Protection approach	Design: Continuous and targeted Primary aim/s: Inclusion, climate resilience, and social protection
Direct finance approach	Design: NGO/donor pays for or reimburses (a share of) insurance companies' activities related to insurance offering Primary aim/s: Support product's commercial viability/sustainability

4.1.2.1. Subsidy rate

There was no consensus among KII participants regarding an appropriate subsidy rate, with a split emerging between Government and insurance company representatives on the one hand, and NGOs and the donor representative interviewed on the other. The former group advocated for a "minimum of fifty percent subsidy" (Ins1), rising to as much as 85%, whilst the latter generally held that "the subsidy…should not be more than 50%" (Don1). FGD participants tended to agree with the former: "We want the percentage increased to 80 or 85; the 75 is not sufficient" (F:DF2). Three KII participants were, however, quick to mention that there was a gap in evidence on this point, one stating that "the amount [subsidised]…has not been supported with sufficient data…my response will be too subjective" (Ins3).

4.1.2.2. Duration and temporal distribution

As noted above, the majority of KII participants advocated for both temporary subsidies (to be offered more broadly) and continuous subsidies (targeted at vulnerable households). In speaking of the former, three participants spoke of a phase-out approach, whereby the subsidy rate is subject to a pre-determined "periodic reduction" (NGO1) such that it "decline[s] gradually" (Ins3) down to 0%, with one government official arguing that this setup served to avoid breeding dependence among beneficiaries.

Most interviewees felt that subsidies (not referring to temporary or continuous subsidies specifically) should be adaptive, in that their rate and duration should vary according to circumstances. Two NGO participants cited climatic conditions as one such factor to consider, noting how their organisations had raised subsidy rates amid droughts[29], whereas another participant argued that offering large subsidies where "the community has been already investing" (Res1) in IBLI served to undermine the product's sustainability, suggesting that subsidies should be adapted according to prevailing demand. One Government official spoke of the importance of "decreasing the amount of subsidy…as the people understand more

[29] "With drought…and the last drought we feel that there are a lot of changes in the community – people have lost everything, so we feel that there's a need now to increase ee subsidy. We have discussed this with partners like [partner organisation name]. We are also in this venture. Then we increase it to fifty percent." (NGO2)

about the livestock insurance" (Gov1), with another interviewee noting that their organisation had also raised subsidy rates in view of the introduction of a different organisation's subsidy project.

4.1.2.3. Targeting

KII participants unanimously supported the idea of targeting, particularly in relation to the offering of continuous subsidies (Table 8). A split among interviewees similar to that cited above was nonetheless evident in terms of the approach to targeting. For Government officials and insurance company representatives, targeting was conceived of in terms of differentiating the subsidy rate across recipients, such that those with "better [more] wealth can be subsidised with minimum rate, the others can be subsidised with maximum rate" (Ins2). On the other hand, NGO and donor representatives conceived of offering subsidies solely to vulnerable individuals/households identified via community wealth ranking, making no reference to heterogeneous subsidy rates. GOAL Ethiopia's approach was unique in that different subsidy rates were offered for different classes of livestock – "cattle fifty percent, sheep and goat eighty percent" (NGO1) – the reasoning being that this would favour women who tend to own smaller ruminants. In the same vein as GOAL, most participants spoke of targeting subsidies on the basis of gender – discussed further below – though it was more often the case that participants thought of targeting based on income or wealth.

In FGDs, participants' sentiments towards targeting were mixed. In only one of the mixed-gender discussions did participants express a preference for targeted subsidies (BB1), with the other mixed groups insisting on subsidies being "distributed equally" (DB2). Men were generally more open to targeting vulnerable, poor, and/or female-headed households, whereas participants in South Omo were more reluctant than those in Borana. Where targeting was opposed, the main reason cited was that "differences in service [i.e., subsidies] promote grievances" (M:BB1) and thus conflict within communities. Two male participants from Borana also argued that "people are the same due to drought…wealthy people that had more cattle have come to poverty by drought so that support has to be given in equal means" (BB1).

4.1.2.4. Limits

One aspect of subsidies' design which emerged from KII interviews was the idea of limits on the number of heads subsidised. One insurance company representative noted that an upper limit was important to prevent better-off households from "abusing the benefits" (Ins3) of such programmes, whereas an NGO endorsed a lower limit on the basis of this dissuading the participation of those with few livestock, for whom programmes other than IBLI subsidies were better suited.

4.1.3. Influencing factors

4.1.3.1. Stakeholder coordination

All bar one KII participants cited coordination among project stakeholders as a significant determinant of subsidies' effectiveness, with many highlighting "how significant a lack of coordination can be in hindering programmes [from] being implemented properly" (NGO3). Participants spoke of multiple subsidy projects – generally having different subsidy rates, targeting criteria, etc – being simultaneously implemented "in the same community, the same village…[while] in next village there is no other organisation". This was "confus[ing] the community" and fostering "competition rather than collaboration", as organisations were effectively being forced to raise subsidy rates in order to reach donor targets.

KII participants also proposed solutions to this "coordination gap". Researchers and NGO representatives called for a "policy that regulates agricultural insurance" (Res1) and "map[s] out the responsibilities of the private sector, NGOs, research organisations,…Government and the like clearly" (Res2), with one participant highlighting the need for a Government-convened stakeholder forum. Others pointed towards the approach adopted by the Kenyan Government in implementing the Kenyan Livestock Insurance Programme, whereby IBLI subsidies are funded and "institutionalised through the government structures" (NGO1), with one interviewee remarking: "I can say that the Government is of paramount importance here; it has to come in [and] support the programme" (NGO2). The fact that one Government official spoke of "mainstreaming" IBLI subsidies into their office's work suggests that they too saw scope for an increased Government role.

4.1.3.2. Bundling and digitalisation

KII participants from across stakeholder groups spoke of the importance of bundling IBLI subsidies with interventions which improve access to complimentary inputs and services, such as agricultural inputs[30], financial services (particularly credit), and market information systems. This was often mentioned in conjunction with digital tools, with six interviewees – predominantly from NGOs and insurance companies – speaking of their value vis-à-vis providing pastoralists with information about IBLI and insurance subsidies, whilst also reducing the costs of programme delivery.

4.1.3.3. Gender and intrahousehold dynamics

Women were consistently recognised as more vulnerable than men among KII and FGD participants[31], with many citing women's household and childbearing responsibilities as constraining their income-earning opportunities: "women cannot give up her children to going another place for searching money" (W:BB1). However, multiple KII participants also noted that because women in Borana have superior financial management skills – acquired via their engagement in "business" (NGO2) and "petty trade" (Res1)[32] – they are able to make better use of subsidies, suggesting that recipients' gender may mediate subsidies' impact: "subsidy…mainly benefitted women-headed household" (Res1).

Linked to this, one interviewee remarked of Borana that "a husband and…a wife, they buy different contract" (Res1), this being reiterated during one female-only discussion in the same site. While one participant from Dasenech did claim that "it is mostly women who took out

[30] Including forage and veterinary services.

[31] As one interviewee noted, "in any pastoral community, the most disadvantaged people are the women" (NGO2).

[32] Moyale, one of the major cities in Borana, is a particularly active site for trade given that it transverses the Kenya-Ethiopia border.

the insurance" (W:DF2), there were no references to husbands' and wives' IBLI uptake decisions being made in isolation in this site[33].

4.1.3.4. Insurance product quality

FGD participants – particularly those in Dasenech – spoke strongly about insurance products which, in their view, had not paid out when they were meant to. One man recalled that when this had occurred, "all the people decided to let go of the insurance" (M:DM2), another rebuked the insurance company for "not honour[ing] their promise" (M:DM2), and a third stated that: "the satellite should not be used, we refuse to agree to satellite feedback" (M:DM2). While not stated explicitly, these statements strongly suggest that subsidies would have done little to heighten insurance uptake of the products in question.

4.1.4. Other findings

Despite showing lower levels of understanding about IBLI[34], participants in Dasenech – particularly women – were extremely eager to purchase insurance policies, with one woman claiming that "we really want to purchase insurance" (F:DF2), another remarking: "I would have been purchasing more insurances as big as the sky" (F:DF1). However, many spoke of IBLI as a pathway to acquiring livestock rather than a means of protecting those owned. When asked about "the best thing about insurance", one man responded: "The fact that I was able to purchase an animal through that" (DB2). Linked to this, participants from this site consistently indicated that it was common practice to purchase IBLI policies despite not owning any livestock[35]; "it's not only those who have livestock, also people without livestock

[33] On the contrary, one man stated that "either the woman can purchase or the man can purchase on behalf of the family. If the payout is done, it is then again a joint decision to purchase whatever is necessary and required" (M; DM1).

[34] Many seemed unaware that IBLI policies offered coverage for 12 months, speaking of insurance policies purchased multiple years ago for which they were still awaiting payouts.

[35] In contrast, one woman from Borana stated: "we know about insurance…the criteria for membership of insurance is someone who have cattle" (F:BF2).

have the insurance" (F:DF1) one woman remarked, with another reiterating that "persons…without cattle also purchased the insurance" (F:DF1).

4.2. Quantitative results

4.2.1. Summary statistics

The data consists of 454 unique households from across 17 study sites, of which 438 participated in all four survey rounds[36]. As shown in Table 9 below, the vast majority of households were headed by men, with the average head being 50 years old and having received less than one year of formal education. The results of a risk preference experiment conducted indicate that an eighth of households were highly risk averse, with 41% showing low levels of risk aversion.

Table 9: Summary statistics of the data. The first six variables are time-invariant and calculated based on the first survey round, whereas other values are calculated by pooling data across all four rounds.

Variable	Mean	Median	Std. dev.
Head age (years)	50.15	48.00	18.21
Head years of formal education	0.59	0	2.20
Head gender = female (% of sample)	22%		
Risk aversion = low (% of sample)	41%		
Risk aversion = moderate (% of sample)	46%		
Risk aversion = high (% of sample)	13%		
Nomadic (% of sample)	5%		
Partially settled (% of sample)	38%		
Fully settled (% of sample)	58%		
Household members (n)	6.79	6.00	2.66
Livestock owned (TLU)	17.30	9.63	28.57
Annual household income (ETB)	11062.75	6240.00	30486.23
Share of income from livestock (% of income)	73%	96%	0.36
Household cash savings (ETB)	1718.80	0.00	12977.09
Rangeland expectation (1=much worse than average, 5=much better than average)	1.81	1.00	1.02
Livestock lost to drought since last sales window (TLU)	0.14	0.00	0.95
Social groups (n)	0.80	1.00	0.86

[36] Tests of balance (see Supplementary Table 4) show that dropouts were more likely to have younger heads, fewer household members, formed part of fewer social groups, and derived a larger share of their income from livestock. Econometric results discussed hereunder were nonetheless unchanged when dropouts were excluded.

Households had a median of 6 members and a mean annual income of 6,200 Ethiopian birr[37]. Nearly all of the median household's income was derived from livestock-related activities, yet only 24% were nomadic or semi-nomadic[38]. While average cash savings were 1,700 ETB (~100 USD), the median household had no savings. The mean number of livestock owned across the four rounds was 17.3 TLU[39] with the median being just below 10 TLU, though as shown in Figure 5, this tended to increase over the course of the panel. In spite of households generally expecting worse than average rangeland conditions, households lost the equivalent of three sheep to drought each year on average. The expected conditions and loss of livestock to drought were effectively unchanged over the period surveyed.

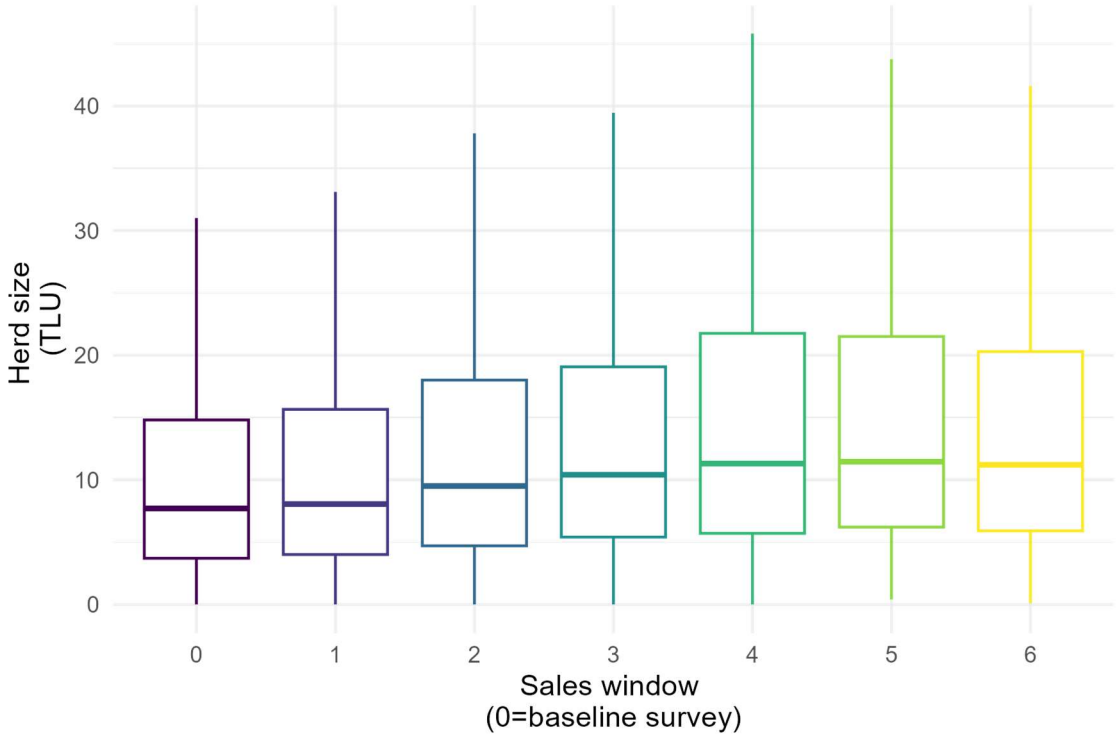

Figure 5: The distribution of households' herd sizes over the course of the panel, measured in TLU. Sales window 0 refers to the data at the baseline survey.

[37] This equates to approximately 60 USD (2012) per capita annually.

[38] This refers to instances where certain household members stay in a fixed base camp, and others travel with the majority of households' herd.

[39] Equivalent to roughly 173 goats/sheep, 17 cows, or 14 camels.

With regards to IBLI uptake, an average of 15% of households purchased insurance coverage per sales window, though Figure 6 below demonstrates that this level varied considerably over the period covered, declining following the first sales window, before climbing then falling again. Less than a tenth of households' livestock assets were covered by the average policy. The mean coverage rate over the course of the panel is 26%, though this also fluctuates (Figure 6). Approximately 41% of households did not acquire coverage in any of the six sales windows.

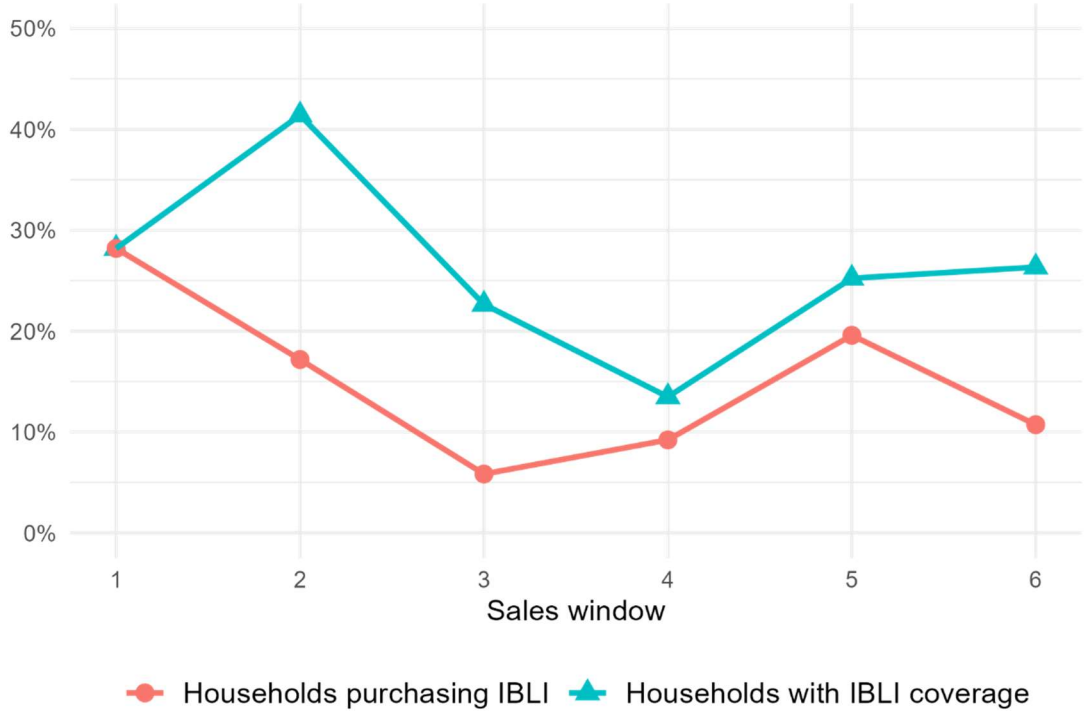

Figure 6: The proportion of households purchasing insurance in each sales window (red) and those with coverage at the end of each sales window (blue).

Table 10 provides a comparison of the characteristics of households which purchased and did not purchase IBLI in a given sales window when pooling the data across sales windows. Those purchasing IBLI were more likely to have received a discount coupon and tended to have received higher discount rates. Households owning more livestock[40] and which formed part

[40] Supplementary Figure 1 shows that the pattern of purchasing households tending to have larger herds is consistent across survey rounds, though particularly pronounced during the 3rd, 4th, and 5th sales windows.

of a larger number of social groups were more likely to purchase coverage, as were those with fewer members and which expected worse rangeland conditions. There were only two instances of fully nomadic households purchasing coverage.

Table 10: Tests for differences in characteristics of purchasing and non-purchasing households when pooling data across sales windows. S.D. stands for standard deviation, F denotes an F-test, and X2 a chi-squared test. Values differ from Table 9 as the first survey round is not included in this table given that IBLI started to be sold after this round.

Variables	**N**	**Mean**	**S.D.**	**N**	**Mean**	**S.D.**	**Diff.**	**Test**
Purchased IBLI		**No**			**Yes**			
Received discount coupon (1=yes)	2254	0.794		403	0.931		0.137	X2=41.449***
Discount rate (% of premium price)	2254	35.8	27.4	403	48	25.6	12.2	F=68.76***
Head age (years)	2253	52.1	18.3	402	51.8	17.7	-0.318	F=0.10
Head years of formal education	2247	0.619	2.2	402	0.575	2.4	-0.0444	F=0.14
Head gender (1=female)	2253	0.218		402	0.239		2.04	X2=0.71
Risk aversion	2254			403				X2=5.53*
... high	296	13.1%		36	8.9%			
... moderate	933	41.4%		176	43.7%			
... low	1025	45.5%		191	47.4%			
Settlement status	2254			403				X2=16.53***
... fully settled	1126	50%		231	57.3%			
... nomadic	88	3.9%		2	0.5%			
... partially settled	1040	46.1%		170	42.2%			
Household members (n)	2254	7.03	2.75	403	6.69	2.27	-0.343	F=5.58**
Livestock owned (TLU)	2238	17.5	27.8	400	20.7	35.7	3.25	F=4.21**
Annual household income (ETB)	2254	5691	20634	403	4969	9446	-722	F=0.48
Household cash savings (ETB)	2252	1612	12803	403	2380	14219	768	F=1.19
Share of income from livestock (% of income)	2254	0.635	0.439	403	0.616	0.456	-0.0194	F=0.66
Social groups (n)	2254	0.829	0.864	403	0.923	0.89	0.0939	F=4.00**
Rangeland expectation	2252	1.75	1.05	403	1.57	0.945	-0.184	F=10.78***
Livestock lost to drought since last sales window (TLU)	2254	0.184	1.07	403	0.211	1.28	0.0279	F=0.22

** p<0.1; ** p<0.05; *** p<0.01*

When comparing households which purchased IBLI at least once over the course of the panel to those which never acquired coverage (shown in Supplementary Table 5), results regarding livestock ownership, household members, and social group membership are consistent with those above. However, results indicate that female-headed households are significantly more

likely to have purchased IBLI at least once ($p<0.001$), whereas the head's median age is higher among those who never acquired coverage.

Where households did not purchase IBLI, they were asked to cite the primary reason for not acquiring coverage. These responses are summarised in Table 11 below, which shows that a lack of sufficient financial resources[41] was the main barrier in a quarter of instances. A fifth of respondents each mentioned insufficient understanding of the product or not having had an opportunity to purchase it, though the frequency of the former decreased over the study period. Owning an insufficient number of livestock was mentioned as the main reason for not purchasing IBLI in 17% of instances, though it is unclear why this is the case given that there was no lower limit on the number of livestock that could be insured.

Table 11: The frequency of primary reasons cited for not purchasing an IBLI policy across different rounds (Pooled refers to the pooling of responses from rounds 2-4). Round 1 is not included as the first IBLI sales took place following round 1.

	Pooled	**Round 2**	**Round 3**	**Round 4**
Responses (n)	2007	620	683	704
Do not have money	24%	27%	26%	20%
Did not have an opportunity to buy it	21%	21%	21%	21%
Did not understand insurance enough	20%	25%	19%	17%
Do not have enough animals	17%	16%	19%	17%
Afraid of uncertainty	6%	2%	7%	8%
Waiting to see what happens to others	5%	5%	3%	7%
Don't think insurance will help me	4%	2%	3%	6%
Don't trust companies	2%	1%	2%	3%
Can rely on others	1%	1%	1%	1%

[41] Because the response logged in the survey was "Do not have money", it is not possible to determine with certainty whether responses refer to a lack of liquidity – i.e. households actually lacking cash to pay for the insurance – or simply the inability to afford to purchase coverage.

4.2.2. Econometric results

Column 1 of Table 12 below presents the full regression results for Model (2). Receiving a discount coupon is shown to increase the probability of purchasing an IBLI policy in a given window by 10.6 percentage points on average. Of all the control variables included in the regression, only two were statistically significant; nomadic households were found to be 10% less likely than fully settled households to acquire coverage, with the likelihood of purchase falling as households' income rose.

The second column of this table presents regression estimates when discount coupons' effect is interacted with households' livestock holdings. The coefficients associated with the number of livestock owned as well as its interaction with discount coupons' effect are statistically insignificant, suggesting that herd size does not influence the probability of acquiring coverage or the impact of insurance subsidies. Plotting the association between households' livestock holdings and the marginal effect of receiving a discount coupon does, however, yield a U-shaped association (Figure 7).

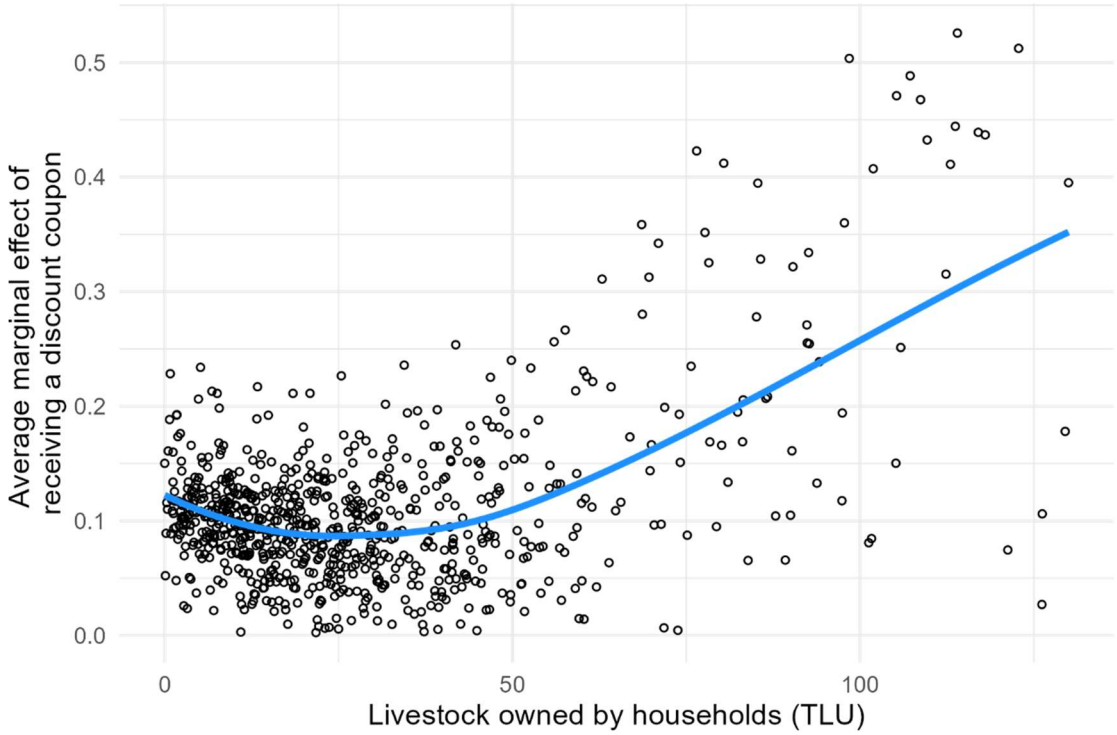

Figure 7: Variation in the marginal effect of receiving a discount coupon with the number of livestock owned (measured in TLU). The blue line is fitted onto plotted points using locally estimated scatterplot smoothing (LOESS). Results are based on the model presented in column 2 of Table 12.

Table 12: The estimated coefficients and average marginal effects of Model 2 (in column 1), and Model 2 including an interaction term between the number of livestock owned and the receipt of a discount (column 2). Estimation was carried out using a variant of the probit pooled estimator developed by Wooldridge (2010). Standard errors clustered at the household level are shown in parentheses. For details on control variables, see Supplementary Table 3.

	(1)				(2)			
	Coef estimates		***AME***		***Coef estimates***		***AME***	
Intercept	-2.53**	(0.836)			-2.477**	(0.825)		
Received discount = Yes	0.721***	(0.128)	0.106***	(0.014)	0.668***	(0.2)	0.107***	(0.014)
TLU	0.002	(0.011)	0.001	(0.002)	0.009	(0.017)	0.001	(0.002)
TLU^2	0	(0)			0	(0)		
Received discount * TLU					-0.009	(0.015)		
Received discount * TLU^2					0	(0)		
Head gender = Female	0.389	(0.26)	0.03	(0.018)	0.149°	(0.085)	0.031°	(0.018)
Head age	-0.001	(0.002)	0	(0)	-0.001	(0.002)	0	(0)
Risk aversion=Low	0.052	(0.108)	0.01	(0.02)	0.047	(0.107)	0.009	(0.02)
Risk aversion=Mod	0.125	(0.106)	0.025	(0.02)	0.124	(0.106)	0.024	(0.02)
Skit tape	0.061	(0.151)	0.013	(0.032)	0.048	(0.15)	0.01	(0.031)
Cartoon	-0.047	(0.139)	-0.009	(0.027)	-0.045	(0.139)	-0.009	(0.027)
Income †	0.047	(0.045)	-0.013*	(0.005)	0.047	(0.046)	-0.013*	(0.005)
$Income^2$ †	-0.008°	(0.004)			-0.008°	(0.004)		
Savings †	0.004	(0.013)	0.001	(0.003)	0.003	(0.013)	0.001	(0.003)
Ratio of income from livestock	0.097	(0.13)	0.02	(0.026)	0.096	(0.13)	0.019	(0.026)
Expected rangeland conditions	0.002	(0.054)	0	(0.011)	0.002	(0.053)	0	(0.011)
TLU lost to drought	0.008	(0.031)	0.002	(0.006)	0.016	(0.037)	0.003	(0.007)
Household members ††	-0.001	(0.015)	0	(0.003)	-0.001	(0.015)	0	(0.003)
Social groups	0.003	(0.064)	0.001	(0.013)	-0.001	(0.065)	0	(0.013)
Status=Nomadic	-0.67°	(0.342)	-0.1**	(0.035)	-0.671*	(0.34)	-0.1**	(0.035)
Status=Partially settled	-0.025	(0.074)	-0.005	(0.015)	-0.027	(0.074)	-0.006	(0.015)
Within-household means of time-variant variables	Yes		Yes		Yes		Yes	
Sales round dummies	Yes		Yes		Yes		Yes	
Study site dummies	Yes		Yes		Yes		Yes	
n	2626		2626		2626		2626	
Prob > Chi^2	<0.0001		<0.0001		<0.0001		<0.0001	
McFadden $P.R^2$	0.147		0.147		0.149		0.149	

*** $p < 0.001$, ** $p < 0.01$; * $p < 0.05$; °$p < 0.1$

† Variables are IHC transformed

†† Variables is lagged one round

Three further regressions were constructed to evaluate the significance of the subsidy rate offered, the results of which are shown in Table 13. The average marginal effect of the discount rate received is $+2.05x10^{-3}$, equating to a 2% increase in the uptake probability with each 10 percentage point increment in the discount rate received (column 1). When incorporating both a binary variable for the receipt of a coupon as well as a continuous variable for the discount rate of coupons received (column 2), results indicate that receipt of the coupon itself – i.e. over and above any price reduction effect – increases the likelihood of purchasing IBLI in a given window by 4.4%, though this is only significant at the 90% level. The impact of the discount rate remains highly significant, its effect falling slightly compared to the previous model ($+1.70x10^{-3}$). These results jointly indicate that while the discount coupon itself may serve to increase uptake, this effect is weakly significant ($p<0.9$) and dwarfed by coupons' price-reduction effect.

Table 13: Average marginal effects of discount coupons on IBLI uptake. Column 1 includes a continuous variable capturing the discount rate and does not include a binary variable for the receipt of a coupon, whereas Column 2 incorporates both. In column 3, the discount coupon's effect is modelled as a series of dummy variables. Standard errors are clustered at the household level. See Supplementary Table 3 regarding control variables.

	(1)	(2)	(3)
Received discount = Yes		0.044° (0.023)	
Discount Rate (% of premium price discounted)	0.002*** (0)	0.002 *** (0)	
Discount Rate = 10%			0.032 (0.02)
Discount Rate = 20%			0.082 *** (0.022)
Discount Rate = 30%			0.074 ** (0.024)
Discount Rate = 40%			0.110 *** (0.023)
Discount Rate = 50%			0.086 *** (0.024)
Discount Rate = 60%			0.109 *** (0.026)
Discount Rate = 70%			0.141 *** (0.025)
Discount Rate = 80%			0.197 *** (0.026)
Time-variant characteristics controls ($\boldsymbol{X_{it}}$)	Yes	Yes	Yes
Time-invariant characteristics controls ($\boldsymbol{H_i}$)	Yes	Yes	Yes
Time dummies ($\boldsymbol{t}$)	Yes	Yes	Yes
Study site dummies ($\boldsymbol{\omega}$)	Yes	Yes	Yes
Within-household means of time-variant variables ($\boldsymbol{\bar{X}_i}$)	Yes	Yes	Yes
n	2626	2626	2626
Prob > Chi^2	<0.0001	<0.0001	<0.0001

*** p < 0.001, ** p < 0.01; * p < 0.05; °p < 0.1

Treating the different discount rates as a discrete set of dummy variables (column 3) shows that the effect of receiving a 10% discount coupon (AME=+0.03) is not statistically significant, whereas a 20% discount increases the likelihood of adoption by 8.2%, this being statistically significant. As shown in Figure 8, further increases in the discount rate up to 60% only had a marginal effect; 40% and 60% discounts both had an average marginal effect of approximately 0.11. The impact of coupons increases markedly thereafter, with 70% and 80% discounts heightening the uptake likelihood by 14% and 20%, respectively.

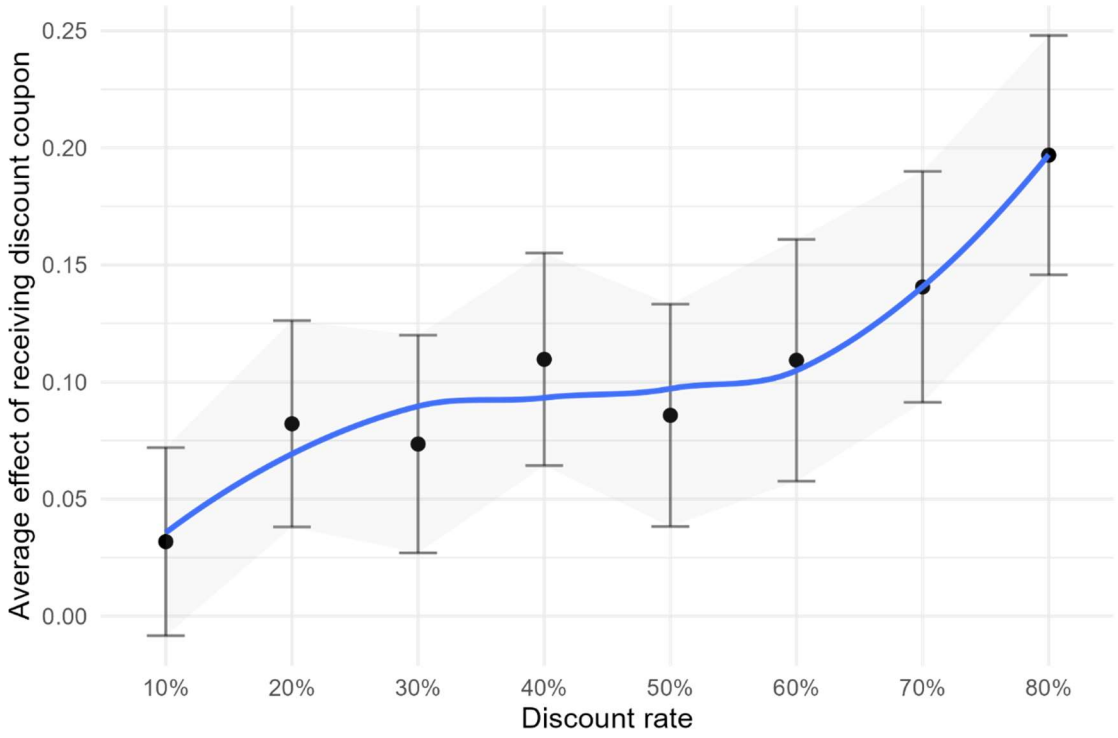

Figure 8: Visual representation of the average marginal effect of receiving insurance discount coupons of different rates on the likelihood of purchasing IBLI, with whiskers showing upper and lower confidence intervals. The blue line is fitted onto plotted points using locally estimated scatterplot smoothing (LOESS) to approximate the shape of the association between discount rate and uptake.

Table 14 show regression results when incorporating the effect of previous period discounts. The receipt of a coupon in either of the previous two windows and the discount rates of those coupons had no significant influence on households' likelihood of purchasing IBLI in the current period (columns 1 and 2). However, previous periods' discount rates do appear to

reduce the effect of receiving a coupon in the current period, with the influence of the prior period's discount rate being more pronounced (-2.017 x10^{-2}) and significant (p=0.019) than that lagged two windows (AME=-1.696 x10^{-2}, p=0.052). A clear downward trend is also evident when mapping the association between the marginal effect of receiving a coupon in the current period and the discount rate lagged 1 and 2 windows[42] (Figure 9).

Table 14: Coefficient estimates and average marginal effects of present and previous period discounts. Column 1 includes the estimated effects of receiving a discount in the current period, and the receipt of discounts in the previous two sales windows. Column 2 includes the estimated effects of the receipt of a coupon in the current period, and the discount rate in the previous two sales windows, with column 3 incorporating an interaction between these two sets of variables. Standard errors clustered at the household level. It was not possible to interact the receipt of a subsidy in the current period with receipt in previous windows due to separation issues. Control variables are detailed in Supplementary Table 3. The number of instances varies across models due to the removal of extremely high influence points.

	(1)		**(2)**		**(3)**	
	Coef estimates	*AME*	*Coef estimates*	*AME*	*Coef estimates*	*AME*
Received discount= Y	1.064***	0.106***	1.055***	0.105***	2.744***	0.104***
	(0.235)	(0.013)	(0.237)	(0.013)	(0.799)	(0.012)
Received discount lag 1 = Y	0.022	0.003				
	(0.121)	(0.017)				
Received discount lag 2 = Y	0.000	0.000				
	(0.121)	(0.017)				
Discount rate lag 1			0.001	0.000	0.020*	0.000
			(0.002)	(0.000)	(0.008)	(0.000)
Discount rate lag 2			-0.002	-0.000	0.014	-0.000
			(0.002)	(0.000)	(0.009)	(0.000)
Received discount x discount rate lag 1					-0.020*	
					(0.009)	
Received discount x discount rate lag 2					-0.017°	
					(0.009)	
Time-variant characteristics controls ($\boldsymbol{X_{it}}$)	Yes	Yes	Yes	Yes	Yes	Yes
Time-invariant characteristics controls ($\boldsymbol{H_i}$)	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies ($\boldsymbol{t}$)	Yes	Yes	Yes	Yes	Yes	Yes
Study site dummies ($\boldsymbol{\omega}$)	Yes	Yes	Yes	Yes	Yes	Yes
Within-household means of time-variant variables ($\bar{\boldsymbol{X}}_{\boldsymbol{i}}$)	Yes	Yes	Yes	Yes	Yes	Yes
n	1733	1733	1731	1731	1731	1731
Prob > Chi^2	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

*** p < 0.001; ** p < 0.01; * p < 0.05; °p < 0.1

[42] As shown in Supplementary Figure 2, this pattern is consistent across present-period discount coupon rates. Balance tests (not shown in the interests of space but available via R script) also shows that the present period subsidy rate received is randomly distributed and does not vary according to previous subsidies. These demonstrate that this result is in fact driven by an interaction between previous and present subsidies.

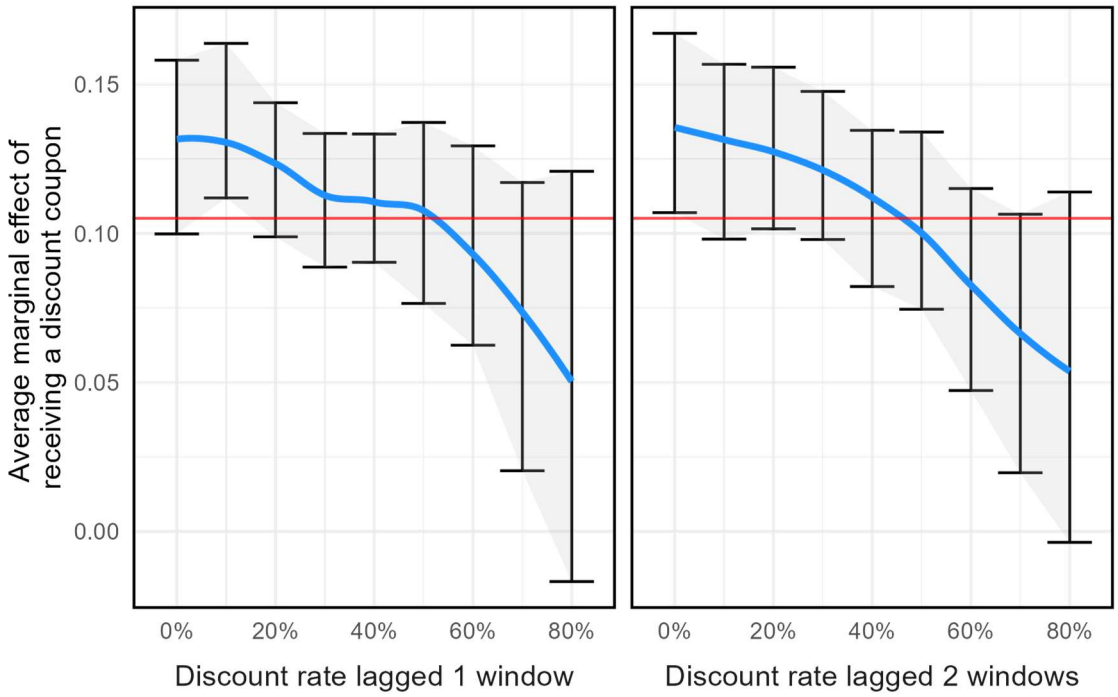

Figure 9: Visual representation of the average marginal effect of receiving an insurance discount coupon against the discount rate of coupon received in the prior sales window (left) and that receiving two sales windows prior (right). The blue line is fitted onto plotted points using locally estimated scatterplot smoothing (LOESS). The solid red line shows the estimated average marginal effect of receiving a coupon based on the results of column 2 of Table 14, i.e. when this is not interacted with previous period subsidies.

4.2.2.1. Robustness checks

Given that participants cited instances where IBLI purchase decisions were made separately within a household, regressions were rerun excluding those households which at any point purchased an IBLI policy in the name of a household member other than the household head (n=14). The size and significance of estimated coefficients and marginal effects were unchanged. Results were also unchanged when dropouts were excluded and when a simple pooled probit estimator is used.

5. Discussion

5.1. Intended outcomes and coordination

Heightening insurance uptake was, as expected, the intended outcome of IBLI subsidies most commonly cited by KII participants, with many of the more specific aims mentioned aligning with those identified in the literature (Table 3). The pursuit of inclusion, social protection, and political goals via subsidies were common to both the qualitative data here gathered and the work of Hill et al. (2014), Hazell and Varangis (2020), Hazell, Jaeger and Hausberger (2021), and Kramer et al. (2022), with interviewees' references to subsidies as a means of supporting commercial sustainability, creating awareness, and showing stakeholders' commitment to insurance products all aligning with the aim of overcoming initial hurdles commercial viability discussed in the literature.

The significant divergences in stakeholders' perspectives observed by Johnson *et al.* (2019) were, however, not evident during KIIs. As shown in Table 7, the vast majority of intended outcomes cited were shared across multiple stakeholder groupings, with the most salient goals also being recognised by FGD participants. Where differences across groupings were present, these were not particularly stark. For instance, interviewees from insurance companies did not explicitly refer to inclusion or risk reduction, but two spoke at length regarding subsidies' contribution to "people on the absolute poverty line, all those who are…food insecure" (Ins3). It is, however, worth noting that divergent understandings of terms may have somewhat exaggerated the appearance of consensus. One case of this, evocative of Mosse's (2004) notion of translation (see pg.16), was NGOs' and insurance companies' contrasting framing of geographical dissemination as an aim of subsidies, with the former construing this as a pathway to equitable access to IBLI and the latter as a means of mitigating companies' risk.

This broad agreement in intended outcomes suggests that the "coordination gap" presently hampering IBLI subsidy programmes does not stem primarily from gross divergences in values or goals among actors, but rather may be driven by a lack of structured avenues for communication and collaboration. Interviewee's calls for multi-stakeholder fora and policies

to delineate key actors' roles – as also advanced by Hazell, Jaeger and Hausberger (2021, p.37) – thus appear well-suited to address this pertinent challenge.

Another finding of note from the qualitative analysis conducted is that subsidies' role in supporting IBLI's commercial viability was cited more frequently than their role in advancing inclusion. This unexpected result underscores that challenges to IBLI's commercial viability – treated at length by interviewees from insurance companies and in the literature (Keno, Diriba and Lemesa, 2018; Johnson *et al.*, 2019; Lung, 2021; Kramer *et al.*, 2022) – continue to persist.

5.2. Subsidy rates

This study simultaneously corroborates and extends the body of evidence on subsidy rates' influence. The positive association between the subsidy rate and uptake probability which emerges from the econometric conducted aligns with the results of Bageant and Barrett (2017), Jensen, Mude and Barrett (2018), and Takahashi *et al.* (2019). The AME of the subsidy rate being consistently below 0.01 (Table 13) is also in line with the literature showing demand for index-based insurance to be inelastic (Cole *et al.*, 2012; Bageant and Barrett, 2017; Jensen and Barrett, 2017; Cai, de Janvry and Sadoulet, 2020; Kramer *et al.*, 2022).

Furthermore, the quantitative data here analysed provides evidence of the 'reminder effect' identified by Bageant and Barrett (2017) and Jensen, Mude and Barrett (2018), with the results presented in Table 13 (column 2) showing that both the subsidy rate and the receipt of a coupon itself increase uptake (albeit the latter only being significant at the 90% level). Further evidence of such a reminder effect also emerges when mapping the main reasons for not purchasing IBLI cited in the household survey data against the subsidy rate received by households. As shown in Figure 10, the proportion of households citing financial constraints was higher among surveyed households receiving a 10-30% discount than those who did not receive any discount (right panel), whereas awareness constraints are cited less frequently among the former cohort compared to the latter[43] (left panel). The latter indicates that

[43] This pattern persists when only those households which had previously purchased IBLI are included.

subsidies may spur improvements in recipients' knowledge of the insurance product – akin to a reminder effect – whereas the combination of both patterns suggests that this effect is larger than any price effect in the case of smaller subsidies.

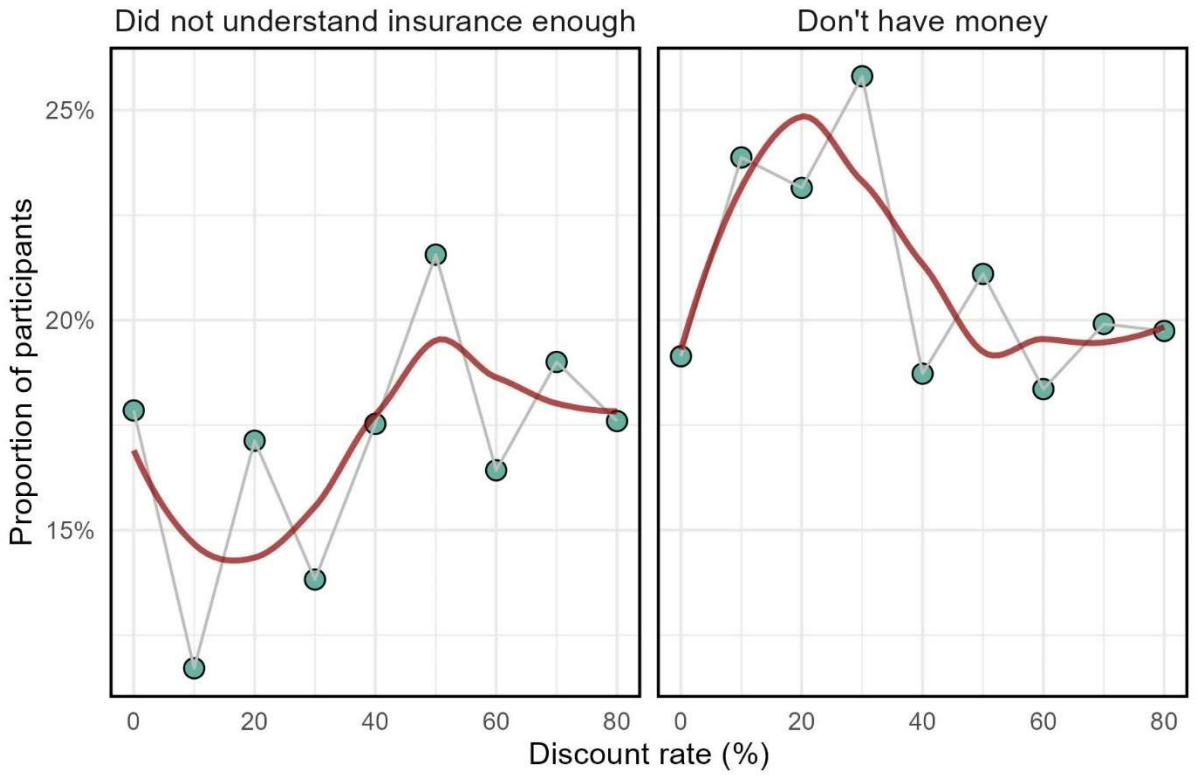

Figure 10: Plots showing the frequency at which households receiving a given subsidy level cited different reasons for not purchasing IBLI. The red line is fitted onto plotted points using locally estimated scatterplot smoothing (LOESS). Data is pooled across the panel, though no marked changes were evident when these were plotted for each round[44].

The novelty of this study stems primarily from the in-depth econometric analysis of the relationship between subsidy rate and uptake summarised in Figure 8. This demonstrates that low subsidy rates (<30%) have a fairly limited impact, which Figure 10 suggests may be due to the price reduction being too slight in such instances. On the other hand, subsidy rates

[44] For a similar figure including all reasons for not purchasing insurance cited, see Supplementary Figure 3.

exceeding 60-70% spur considerable increases in coverage rates, with an 80% subsidy heightening the probability of purchasing IBLI by around 20% [45].

While it is not possible to corroborate these results quantitatively since no studies to date have undertaken a similar analysis, the qualitative data gathered from the FGDs lends support to the above results. In Dasenech, where participants had benefitted or heard of 75% subsidies offered by a local NGO and/or 90% subsidies offered as part of the WorldBank's DRIVE[46] programme, demand was so boisterous that pastoralists spoke of purchasing IBLI in spite of not owning any livestock, whereas no such behaviour was evident in Borana where participants were more familiar with 35-50% subsidy rates. These findings therefore suggest that the price elasticity of demand (measured on the extensive margin) increases when 70%+ subsidy rates are offered, thus spurring disproportionately large increases in uptake observed in such instances. This likely relates to the fact that beyond a certain subsidy rate (here estimated to be approximately 60% [Figure 8]), the value of payouts is expected to exceed the cost of acquiring coverage, rendering IBLI a profitable investment irrespective of livestock holdings or reliance on pastoralism, and thus spurring such broad adoption.

It is worth noting that the behaviour of purchasing IBLI despite not owning animals or as a means to acquiring animals observed during FGDs in Dasanech contrasts sharply with the household survey data analysed, in which insufficient livestock was cited as a reason for not purchasing IBLI in a sixth of instances and only two households purchased IBLI without owning livestock. It is unclear what factors/circumstances may have driven this difference. However, this suggests that the widespread offering of high subsidy rates coupled with the poor understanding of IBLI evident among FGD participants in Dasenech – exemplified by the widely-held expectation that policies purchased multiple years ago were still to pay out – may have promoted uptake among recipients who did not own livestock and encouraged the unrestrained acquisition of insurance policies[47] rather than judicious purchases.

[45] Note that a simple analysis of the association between adoption frequency and discount rates, shown in Supplementary Figure 4, also aligns with this pattern.

[46] Short for *De-risking, inclusion and value enhancement of pastoral economies in the Horn of Africa*; see World Bank (2022).

[47] "I would have been purchasing more insurances as big as the sky" (F:DF1).

What implications emerge from the above discussion? First, this study reiterates that insurance subsidies are effective at spurring substantial increases in uptake, showing that their impact is predominantly driven by reducing the price of IBLI. Second, household survey data suggests that subsidy rates of less than 30% are ineffective at significantly heightening coverage, likely because they fail to adequately alleviate financial constraints. Higher subsidy rates therefore appear warranted, particularly when targeting low-income groups. Third, qualitative and quantitative data here analysed indicate that the impact of subsidies increases markedly when the subsidy rate exceeds 70%, yet this may lead to inefficient, unintended, and/or undesirable outcomes if implemented in the presence of information deficiencies among recipients. This somewhat warrants the hesitancy of 50%+ subsidy rates expressed by NGOs during KIIs, but also underscores the importance of linking such subsidies with regular, accurate information provision. In addition, the circumstances observed in Dasenech suggest that implementing livestock restocking programmes in combination with or prior to IBLI subsidies may minimise the use of index-based insurance as a means of acquiring animals and improve the attainment of intended outcomes. Further research to evaluate whether the thresholds identified in this study (~30% and ~70%) hold in other contexts is, however, pertinent to test the robustness of the insights hereabove.

5.3. Temporal distribution and adaptation of subsidies

Econometric results show that the receipt and rate of discount coupons during either of the two previous sales windows did not significantly affect households' likelihood of purchasing IBLI, consistent with the literature to date and thus reiterating the absence of price anchoring effects (Takahashi *et al.*, 2019; Cai, de Janvry and Sadoulet, 2020). However, the finding that responsiveness to present-period subsidies diminishes as the subsidy rate received in previous windows rises is a novel finding. This is suggestive of a 'subsidy anchoring' effect, whereby the impact of a subsidy is conditioned by previously received subsidies, and thus lends credence to concerns of subsidy dependence expressed by one KII participant (Res1) and repeatedly highlighted in the literature (Hazell and Varangis, 2020; Nshakira-Rukundo, Kamau and Baumüller, 2021; Kramer *et al.*, 2022) since a given subsidy is less effective when preceded by

large subsidies. Furthermore, this appears to motivate the gradual phase-out of subsidies cited by multiple KII participants in that this may minimise the discrepancy between present and previous subsidies and thus limit the impact of any subsidy anchoring effect. Further research on this is left to future work.

Numerous individuals who participated in KIIs spoke of adapting the rate and duration of subsidies according to prevailing conditions. This echoes the perspective advanced in the literature that "subsidies need to be continuously adapted based on local recent events" (Cai, de Janvry and Sadoulet, 2020, p.27) to maximise their impact and/or cost-efficiency. Furthermore, Chakraborty's (2023) finding that responsiveness to subsidies increases following climatic crises suggests that heightening subsidy rates following droughts – as mentioned by two NGO representatives interviewed – is an effective example of such adaptive programming in that it may significantly augment subsidy programmes' impact, though their impact may also have been quelled by the negative effect of payouts identified in the same study.

To further test the significance of prevailing conditions, a regression was constructed using the household survey data in which the receipt of a subsidy was interacted with a variable capturing expected rangeland conditions[48]. As shown in Table 15 (column 1), this interaction term is negative and statistically significant, implying that subsidies' impact on uptake increases substantially when worse (i.e., drought) conditions are expected by households. When the best possible rangeland conditions are expected, subsidies' impact vanishes completely. In view of this, development practitioners could consider designing subsidy programmes such that the provision or rate of subsidies increases when drought (or other relevant climatic crises) is expected rather than when it takes place as this could heighten responsiveness, augment coverage rates when vulnerability is highest, and avoid payouts' negative effect on subsidies' impact (Chakraborty, 2023)[49].

[48] See Supplementary Table 3 for details.

[49] Note that this may not be well received by insurance companies as it would likely inflate the number of clients during payout seasons but lead to smaller increases during non-payout seasons, thus reducing company profits, possibly motivating retaliation via insurance price increases. This issue could possibly be remedied via adaptive insurance pricing or longer policies though more research on this required.

Table 15: Coefficient estimates and average marginal effects of Model (2), the dependent variable of which is the probability of purchasing IBLI, including an interaction between the receipt of a discount and a variable capturing expected rangeland conditions (column 1), and an interaction with the gender of the household head (column 2). Standard errors are clustered at the household level. Control variables are detailed in Supplementary Table 3. Note that the variable used to capture expected rangeland conditions is a continuous variable ranging from 1 (much worse than normal conditions) to 5 (much better than normal).

	(1)		(2)	
	Coefficient est.	AME	Coefficient est.	AME
Received discount = Y	1.182***	0.108***	0.721***	0.106***
	(0.210)	(0.014)	(0.210)	(0.014)
Expected rangeland conditions	0.265**	0.001	0.002	0.000
	(0.098)	(0.011)	(0.054)	(0.011)
Household head gender	0.137	0.028	0.389	0.030
	(0.084)	(0.018)	(0.260)	(0.018)
Received discount x Expected rangeland conditions	-0.298**			
	(0.095)			
Received discount x Household head gender			-0.273	
			(0.264)	
Time-variant characteristics controls ($\boldsymbol{X_{it}}$)	Yes	Yes	Yes	Yes
Time-invariant characteristics controls ($\boldsymbol{H_i}$)	Yes	Yes	Yes	Yes
Time dummies ($\boldsymbol{t}$)	Yes	Yes	Yes	Yes
Study site dummies ($\boldsymbol{\omega}$)	Yes	Yes	Yes	Yes
Within-household means of time-variant variables ($\boldsymbol{\bar{X}_i}$)	Yes	Yes	Yes	Yes
n	2626	2626	2626	2626
Prob > Chi^2	<0.001	<0.001	<0.001	<0.001

5.4. Targeting

The quantitative analysis of household survey data indicates that the association between subsidies' impact and households' livestock holdings is U-shaped (Figure 7), similar to that posited in the literature (Janzen, Carter and Ikegami, 2012; Chantarat *et al.*, 2017). It is, however, important to note that the curve is very shallow over the most part of the data, with responsiveness to subsidies only changing substantially among those with herd sizes above the 95th percentile (Supplementary Figure 5). As suggested by the literature, untargeted subsidies are thus expected to cause a disproportionate increase in uptake among the very wealthiest households, but their impact is likely to be fairly homogenous across much of the population. This suggests that identifying and excluding the wealthiest households is the

priority when targeting on the basis of livestock wealth, given that the poorest are no less likely to take up subsidised livestock insurance than other households once the top 5% have been excluded.

With regards to one KII participant's claim that "subsid[ies]…mainly benefitted women-headed household" (Res1), the quantitative data suggests that any such differences are not significant. As shown in Table 15 (column 2), the interaction between household heads' gender and subsidies impact was non-significant, despite female-headed households being more likely to have purchased IBLI at least once over the panel (Supplementary Table 5). This quantitative result echoes the lack of gendered differences in demand for IBLI observed in the literature (Bageant and Barrett, 2017; Timu, Gustafson and Mieno, 2023), and therefore suggests that gendered differences cited during KIIs likely stem from women making better use of the money saved via subsidies as indicated by KII participants' recurrent reference to superior financial management skills amongst female pastoralists. The work of Timu, Gustafson and Mieno (2023) further supports this hypothesis in that they find household nutrition improves to a greater extent following insurance payouts where the head is female, implying the better use of financial resources in such instances. Similarly to the above, the overarching implication of this result is that women-head household will benefit no less from subsidies than male-headed households, ceteris paribus.

The absence of significant heterogeneities in responsiveness to subsidies in terms of livestock wealth (excepting the top ventile) and gender somewhat vindicates many FGD participants' opposition to targeting. It is nonetheless interesting why women often fervently opposed targeting despite broad recognition of the systematic disadvantages faced by female pastoralists (Timu and Kramer, 2021; Timu, Gustafson and Mieno, 2023). One explanation for this offered by the literature is that "when program benefits are skewed towards women, it may trigger backlash and cases of gender-based violence from men" (Timu and Kramer, 2021, p. 13); FGD participants' repeated reference to avoiding conflict further indicates that this may be the case.

Also relevant to the targeting of subsidies are the intrahousehold dynamics regarding IBLI purchases that emerge from KIIs and FGDs. While it is not possible to corroborate participants' testimonies of husbands and wives making IBLI purchases separately due to a gap in the

literature on this point (Bageant and Barrett, 2017), this suggests that the level of targeting – whether it is at a household or individual level – may significantly alter the outcomes of programmes. Bageant and Barrett's (2017) and Timu *et al.*'s (2018) call for more research on such intrahousehold processes is thus here reiterated.

5.5. Insurance product design and bundling

FGD participants' frustration at and rejection of insurance products which – in their view – had not paid out when they ought to is firmly aligned with the literature demonstrating basis risks' adverse effects on index-insurance uptake and subsidies' effectiveness (Hill, Robles and Ceballos, 2016; Jensen, Mude and Barrett, 2018; Keno, Diriba and Lemesa, 2018; Takahashi *et al.*, 2019). This study therefore provides further impetus to Jensen and Barrett's proposals (2017) to (a) develop regulatory frameworks establishing minimum standards to be met by index-based insurance products and (b) implement an independent microinsurance quality rating system[50]. These could motivate insurance companies to improve the accuracy of products on offer, provide prospective policyholders with the means of differentiating between products, and guide donors' decisions as to which products to subsidise.

It is worth noting that the pronounced rate at which issues relating to basis risk were highlighted during FGDs in Dasenech, where pastoralists' understanding of IBLI was evidently constrained, suggests that perceptions of insurance inaccuracy may have been driven by misunderstandings on the part of policyholders. Nonetheless, this underscores the importance of accurate, timely information provision given that such misunderstandings may undermine trust in insurance, which has also been shown in the literature to quell subsidies' effectiveness (Clarke and Wren-Lewis, 2013).

KII participants' calls for insurance to be bundled with other inputs and services echo similar claims made in the literature to date (Jensen and Barrett, 2017; Hazell, Jaeger and Hausberger, 2021). A detailed evaluation of the role bundling is beyond the scope of this study, though the

[50] Given that "such standards and processes would be a public good" (Jensen and Barrett, 2017, p. 211), there is a reasonable argument for these to be financed by government.

data gathered from FGDs suggest that greater attention to addressing information deficiencies – both regarding IBLI itself and well as the rate, duration, and basis for targeting subsidies on offer – is particularly pertinent, echoing one KII participants' view that information-provision is the "backbone" of effective subsidy programmes as well as numerous publications in the academic literature (Hill, Robles and Ceballos, 2016; Jensen, Mude and Barrett, 2018; Keno, Diriba and Lemesa, 2018; ILRI, 2023).

5.6. Limitations and future work

Numerous factors may have impinged on the rigour of qualitative data acquired, chief amongst which were translation challenges during FGDs (Squires, 2009). There was evidence of terms or questions being mistranslated or misunderstood in transcripts, primarily due to a shortage of live translators and tedious double translation[51]. Social-desirability bias (Bergen and Labonté, 2020) and the 'white-man effect' (Cilliers, Dube and Siddiqi, 2015) are expected to have affected responses, whereas the representativeness of data is limited by the recruitment mechanisms used[52].

The fact that the quantitative data used was collected at a household level limits this study's insightfulness in that it obfuscates intrahousehold dynamics. Recall bias is assumed to have affected the household survey data, and despite triangulating the results of its analysis with more recent qualitative data and the literature, the fact that the data is considerably dated may have affected the outcomes of this study. It is also worth noting that all econometric analyses solely considered a binary dependent variable of insurance uptake; subsidies' influence on the level of coverage thus remains unexplored, this being left to future work.

Study sites being limited to two relatively small areas of Ethiopia also means that the external validity of results is uncertain.

[51] English-Amharic-Dasenech/Afaan Oromo followed by Dasenech/Afaan Oromo-Amharic-English.

[52] Opt-in for FGDs, via partner organisations' network for KIIs.

6. Conclusion

Government entities and NGOs across the globe continue to offer subsidies for index-based insurance to mitigate the impacts of climate change on vulnerable farmers and pastoralists. By studying the case of subsidies for IBLI in Ethiopia, this mixed-method research has sought to evaluate three key aspects of such subsidies which remain understudied in the academic literature: their aims as conceptualised by key stakeholders, the implications of their design, and exogenous factors which influence their effectiveness. Five overarching conclusions emanate from the analysis of primary data gathered via focus group discussion and key informant interviews as well as secondary household survey data.

First, there is broad agreement among stakeholders regarding the aims of subsidies, suggesting that the lack of coordination presently hampering the effectiveness of IBLI subsidies offered in Ethiopia may be remedied via policies to advance structured dialogue and cooperation.

Second, subsidy rates below 30% appear fairly ineffectual at heightening insurance uptake. While those exceeding 70% have a disproportionately large impact on uptake, qualitative findings suggest that these can spur inefficient and/or outcomes – such as IBLI being used as a means of acquiring livestock rather than a form of asset protection – if not coupled with regular, accurate information provision.

Third, quantitative analyses show that subsidies become less effective at heightening insurance uptake as previous subsidy rates increase, but their impact rises when climatic crises are anticipated. This motivates careful consideration of subsidies' timing and inter-temporal distribution, though further research is necessary to develop more specific guidance in this regard.

Fourth, subsidies' impact on insurance uptake appears to be fairly homogenous across pastoralist populations, such that the use of subsidies does not inherently disadvantage vulnerable groups (e.g. female-headed/livestock-poor households). More research on intrahousehold dynamics is however pertinent to further understand the implications of targeting subsidies at specific individuals within a household.

Fifth, it is critical that the accuracy and perceived accuracy of indexes underpinning index-based insurance products are maximised. This calls for sector-wide measures to improve the accuracy of insurance offerings, as well as continuous investment in the provision of accurate, timely information to prospective policyholders.

This study seeks to inform future subsidy programmes by developing actionable recommendations and identifying key considerations, as well as guide much-needed future research by identifying pertinent research questions and giving voice to the aims, attitudes, and experiences of stakeholders and beneficiaries. With hundreds of millions of dollars being spent on index-based insurance subsidies, even marginal improvements in subsidy programming can lead to substantial improvements in the resilience of vulnerable pastoralists and farmers, and marked improvements in their wellbeing and dignity. These are the outcomes which this study ultimately aims to advance.

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Appendix 1 – Interview scheulde and discussion guide

The interview schedule and discussion guide below are the final version of these documents used. These were adapted iteratively over the course of data collection. Previous versions are not here presented but are available on request.

KII interview schedule

Section	Questions/Prompts	Time
Greeting/logistics	1. Greeting, gratitude, rapport 2. Confirm engagement with participant information sheet 3. Reiterate recording and anonymity, reconfirm consent 4. Introduce the project and interview structure 5. Ask participant if they have any questions	5mins
Background on IBLI	1. Could you tell me about your and your organisation's role in programmes related to livestock insurance? 2. How would you describe IBLI to someone unfamiliar with it in one minute? 3. What would you say are the aims of IBLI? 4. What do you/your organisation regard as the main challenges of IBLI? 5. In spite of these challenges, what are the opportunities you see for IBLI?	10mins
IBLI beneficiaries	1. Who would you say are the beneficiaries of IBLI? (Do all pastoralists stand to benefit from it, or does it favour certain cohorts? If so, who?) 2. Why is this the case?	5mins
Background on Subsidies	1. Do you think that the cost of livestock insurance should be subsidised for pastoralists? 2. Have existing or planned subsidy programmes affected your entity, and if so how? 3. Have subsidy programmes implemented to date been effective? Why, why not?	10mins
Aim/s of subsidies	1. What would you say are the aim or aims of livestock insurance subsidies? (Are there any other aims?) 2. If there are multiple aims, how would you rank these? Which is most important? 3. Would you say that all pastoralists stand to benefit equally from insurance subsidies? Do certain cohorts stand to benefit more than others?	10mins

FGD discussion guide

Part 1 – Greetings, information, and consent

Duration: 10 minutes

Objective: To provide participants with information about this research project and ensure that they consent to participate.

Tasks:

1. Welcome participants and thank them for being present
2. Give each participant a participant information sheet
3. Read out the information sheet and consent form
4. Explain that the discussion will be recorded, and that all information will be anonymised so that it is not possible to identifying anyone who participates or is mentioned
5. Ask the participants if they have any questions
6. Ask participants to fill and support them in filling informed consent forms
7. Collect consent forms once filled

Part 2 – Participant introduction

Duration: 15 minutes

Objective: To provide context about participants' background. It is very important that the number of livestock they own is clear.

Questions:

1. Ask participants to introduce themselves
2. How many livestock do you control?
3. Who makes decisions about livestock in your household?
4. Do you have any other sources of food or income?
5. How were you affected by the recent drought?

Part 3 – Experience with livestock insurance

Duration: 20 minutes

Objective: To understand participants experience with and perspective on livestock insurance, and *whether livestock insurance's impact varies or is perceived to vary according to livestock wealth and pastoralist/decisionmaker gender*.

Tasks/questions:

1. Introduce livestock insurance, ask how many participants know about it, explain it briefly in terms familiar and accessible to those present
2. Have you ever had livestock insurance? How many livestock were insured? Why did you decide to acquire insurance coverage?
3. How did livestock insurance coverage affect you? Did anything change because of it? Were there any benefits?
4. Would you say that the impact/benefits of livestock insurance is/are the same for everybody?
    a. So, does the impact of livestock insurance change according to how many livestock one has?
    b. Do you think that livestock insurance affects men and women differently?
5. Do you still have insurance coverage? Why or why not?

Part 4 – Insurance subsidies

Duration: 25 minutes

Objective: To understand the impact that subsidies have on pastoralists, and how they perceive the benefits of these subsidies. It is *especially important to understand what the benefits of subsidies were for those present* – did they allow them to buy coverage where they otherwise would not have, did they allow them to cover more livestock, did they allow them to spend more money other items, etc. It is also import to understand how

Tasks/questions:

1. Briefly introduce the idea of subsidies, ask how many participants are familiar with it, briefly explain what subsidies are.
2. Have you ever received a subsidy for livestock insurance?
3. How did this subsidy affect you? What was the main benefit of it? Were there any other benefits?
   NOTE: If participants say that it lowered the cost of insurance, the interviewer should ask about what the impact/benefits of that lower price was.
4. How would you be affected if there were no subsidies for livestock insurance?
5. Who are subsidies most beneficial for? Or are the benefits of subsidies equal for everyone?
   a. Does the impact of subsidies vary according to how many livestock one has?
   b. Do subsidies affect men and women differently?
6. Do you think that everyone should receive the same subsidy for livestock insurance, or should different people receive different amounts of subsidies?
   a. Other participants have mentioned that women are generally less able to undertake manual labour, and may be unable to travel due to household responsibilities. Their capacity to earn enough money to purchase insurance may thus be lower. Would you agree that this is the case? In light of this, do you think that subsidies for women/female-headed households and men/male-headed households should be different?
   b. If people should receive different amounts of subsidies, how should this be done/decided in practice?
   c. What are some of the benefits and challenges of this in your opinion?

Part 5 – Conclusion

Duration: 5 minutes

Objective: To thank participants and remind them that they can contact the researchers with any questions.

Tasks:

1. Thank everyone present for participating and sharing their views and experiences.
2. Remind them that they can contact the researchers listed on the information sheet with any questions or issues

Appendix 2 – Supplementary figures and tables

Supplementary Table 1: A priori and emergent codes utilised during thematic coding of KIIs and FGDs. Subcodes are not shown for brevity.

Theme	A priori codes	Emergent codes
	KIIs	
Intended outcomes	– Increase demand – Social inclusion – Social protection – Awareness creation	– Risk reduction – Support for commercial product – Promote geographical distribution – Donor recognition – Promote intensification – Sustain pastoralism
Subsidy design	– Rate/size – Targeting – Temporal distribution	– Limits – Funding
Influencing factors	– Basis risk – Trust – Insurance payout/s – Climatic conditions – Insurance supply – Gender dynamics – Bundling/packaging	– Implementation – Product design – Conflict
	FGDs	
Subsidy design	– Rate/size – Targeting – Temporal distribution	– Limits
Influencing factors	– Basis risk – Trust – Insurance payout/s – Climatic conditions – Insurance supply – Gender dynamics – Bundling/packaging	– Conflict
Impacts of subsidy		– Increased awareness – Increased confidence – Increased demand

Supplementary Table 2: Tests of balance between discount recipients and non-recipients across the panel. F denotes an F-test, and X2 a chi-squared test.

Variables	**N**	**Mean**	**Std. Dev.**	**N**	**Mean**	**Std. Dev.**	**Test**
Received discount		No			Yes		
Head age (years)	495	51.543	18.141	2181	52.259	18.212	F=0.623
Head years of formal education	494	0.67611	2.539	2176	0.59191	2.1425	F=0.579
Head gender	495			2181			X2=1.007
…male	394	79.60%		1688	77.40%		
…female	101	20.40%		493	22.60%		
Risk aversion	495			2183			X2=0.283
... high	59	11.92%		275	12.60%		
... moderate	226	45.66%		1006	46.08%		
... low	210	42.42%		902	41.32%		
Settlement status	495			2183			X2=0.871
... fully_settled	253	51.11%		1121	51.35%		
... nomadic	20	4.04%		70	3.21%		
... partially_settled	222	44.85%		992	45.44%		
Household members (n)	495	7.204	2.9846	2183	6.9253	2.6066	F=4.363**
Livestock owned (TLU)	495	20.783	42.148	2181	17.864	27.11	F=3.706*
Annual household income (ETB)	495	10978	17704	2183	11215	30674	F=0.027
Household cash savings (ETB)	495	1568.7	10338	2181	1752.9	13506	F=0.081
Share of income from livestock (% of income)	495	0.73278	0.3646	2183	0.75124	0.36224	F=1.046
Social groups (n)	495	0.82828	0.91147	2183	0.84471	0.85908	F=0.144
Rangeland expectation	495	1.6889	0.9755	2180	1.7317	1.0469	F=0.69
Livestock lost to drought since last sales window (TLU)	495	0.21798	1.3584	2183	0.1823	1.033	F=0.424

** p<0.1; ** p<0.05; *** p<0.01*

Supplementary Table 3: The control variables included in the regression models estimated.

H_i	Time-invariant household head characteristics	– A categorical variable representing the household head's risk aversion (high, moderate, low)[53] – Household head gender – Household head age in years
X_{it}	Time-variant household characteristics	– Whether the household received a randomly distributed learning kit (either a skit tape or a cartoon) in the period since sales window *t-1*; this instruments for participants' level of knowledge on IBLI, the use of which would be endogenous (see Takahashi *et al.*, 2016) – IHS transformed household income between the end of the sales window t-1 and the end of sales window *t,*and its square – IHS[54] transformed household cash savings reported in the previous survey round prior to *t* – The proportion of household income derived from livestock over the same period – A continuous variable capturing expected rangeland conditions over the period covered by IBLI policies sold during sales window *t* (1 [much worse than normal] to 5 [much better]) – The number of livestock lost to drought between the end of the sales window t-1 and the end of sales window *t* – The number of household members reported during the previous survey round[55] – The number of social groups the household reported forming part of during the previous survey round – A categorical variable representing household settlement status (nomadic, partially settled, or fully settled)
$\bar{X}_i$	Within-household mean of time-variant characteristics	– The mean number of animals owned (measured in TLU) across all survey rounds, and its square – The mean of IHS transformed household income across all survey rounds, and its square – The mean of IHS transformed household cash savings across all survey rounds – The mean of the proportion of household income derived from livestock across all survey rounds – The mean of expected rangeland conditions across all survey rounds – The mean number of livestock lost to drought between the end of the sales window t-1 and the end of sales window *t* across all sales windows – The mean number of social groups the household reported forming part of across all survey rounds

[53] This was established via a risk preference experiment described in Ikegami and Sheahan (2018, p.4).

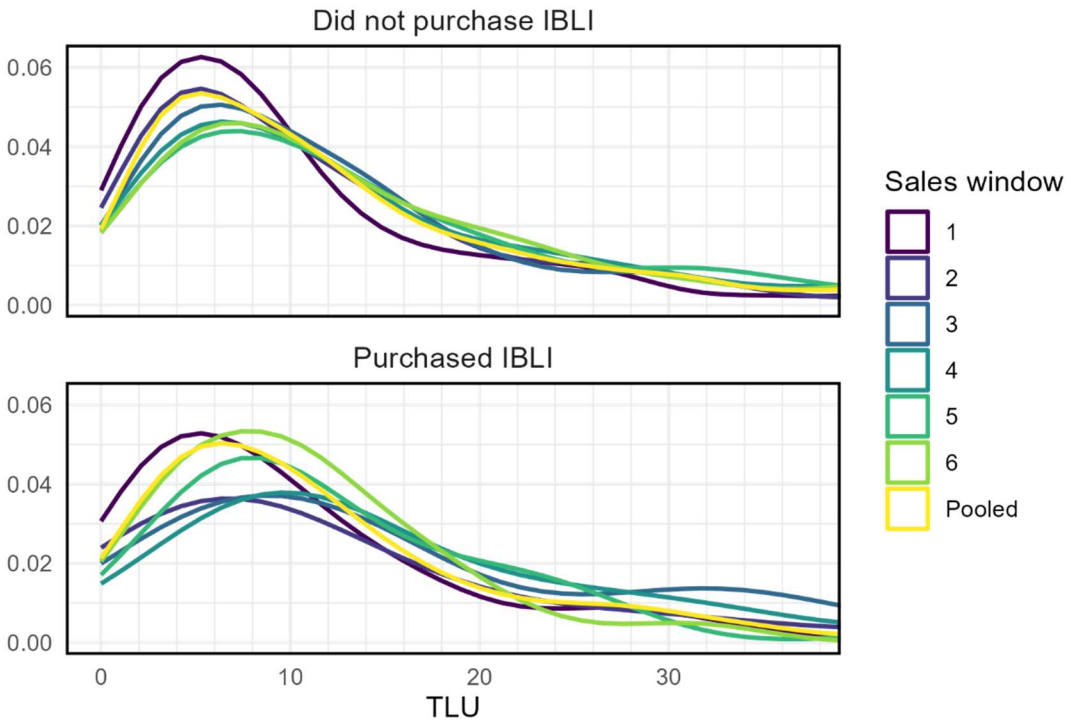
[54] IHS stands for *inverse hyperbolic sine*. See Bellemare (2018) for explanation and motivation.

[55] The number of household members was lagged a survey round given that it the number of household members could increase following instances of payout due to relatives sending children to reside in that household, which would render household size endogenous to the decision to purchase IBLI.

Supplementary Table 4: Tests of balance between dropout and panel households. F denotes an F-test, and X2 a chi-squared test.

Variables	**N**	**Mean**	**Std. Dev.**	**N**	**Mean**	**Std. Dev.**	**Test**
Dropped out		No			Yes		
Head age (years)	3502	51.839	18.263	82	42.488	13.42	F=21.227***
Head years of formal education	3494	0.61591	2.2392	82	0.073171	0.26202	F=4.814**
Head gender	3502			82			X2=0.18
…male	2728	77.90%		66	80.49%		
…female	774	22.10%		16	19.51%		
Risk aversion	3504			82			X2=1.121
... high	440	12.56%		8	9.76%		
... moderate	1608	45.89%		42	51.22%		
... low	1456	41.55%		32	39.02%		
Settlement status	3504			82			X2=1.527
... fully_settled	2018	57.59%		46	56.10%		
... nomadic	156	4.45%		6	7.32%		
... partially_settled	1330	37.96%		30	36.59%		
Household members (n)	3504	6.7979	2.6591	82	6.2927	2.5555	F=2.898*
Livestock owned (TLU)	3502	17.257	28.747	82	18.935	19.312	F=0.277
Annual household income (ETB)	3504	11036	30726	82	12207	17476	F=0.118
Household cash savings (ETB)	2626	1706.2	13054	50	2380.4	8048.6	F=0.132
Share of income from livestock (% of income)	3504	0.7258	0.3667	82	0.90746	0.16675	F=20.023***
Social groups (n)	3504	0.80308	0.86055	82	0.4878	0.7411	F=10.818***
Rangeland expectation	3501	1.8143	1.0275	82	1.7683	0.89303	F=0.162
Livestock lost to drought since last sales window (TLU)	3504	0.14319	0.96292	82	0.05	0.44173	F=0.764

** p<0.1; ** p<0.05; *** p<0.01*

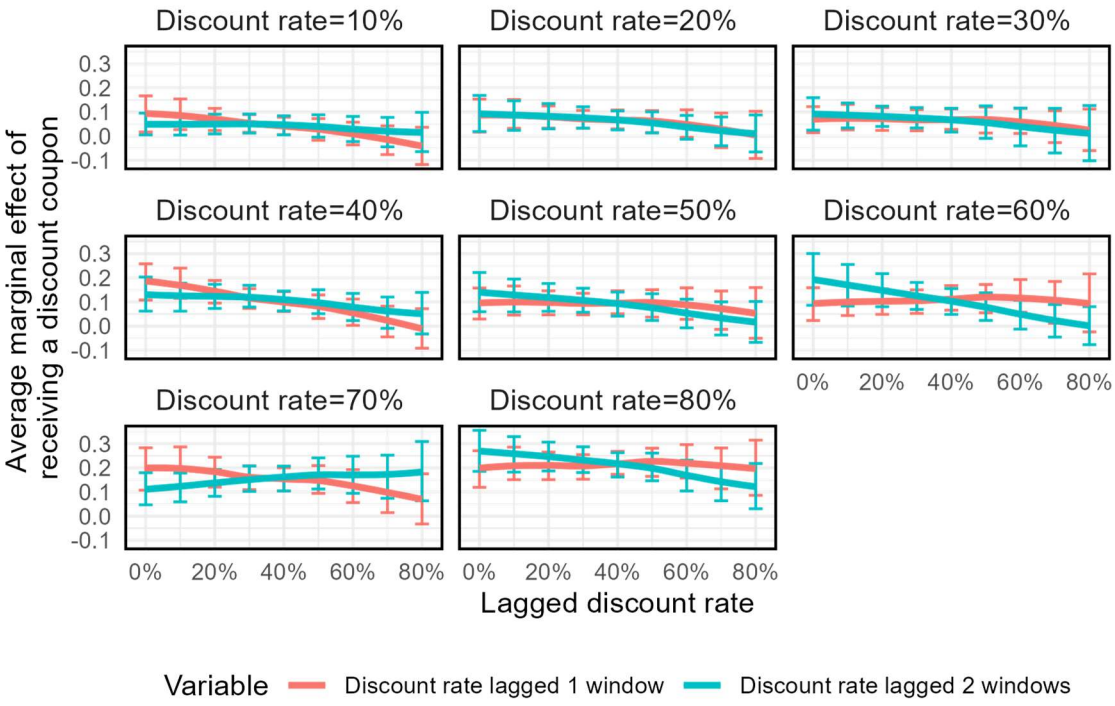


Supplementary Figure 1: Density plots showing the distribution of herd sizes at the end of each sales window and across the entire sample among purchasing (bottom) and non-purchasing (top) households. Only data until the 90th percentile of TLU values is shown.

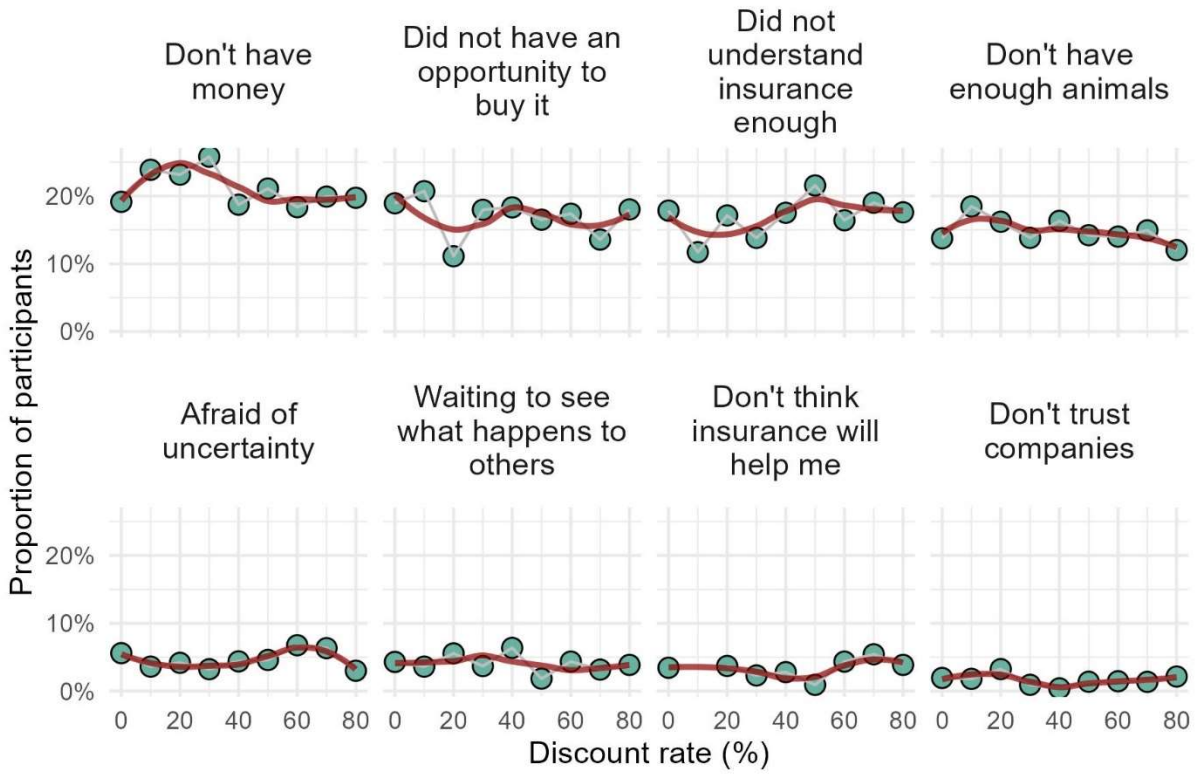
Supplementary Table 5: Balance tests of characteristics of households which did not purchase IBLI in any *of the sales windows, and those which purchased IBLI at least once. F denotes an F-test, and X2 a chi-squared test.*

Variables	**N**	**Mean**	**Std. Dev.**	**N**	**Mean**	**Std. Dev.**	**Test**
Purchased IBLI at least once		No			Yes		
Head age (years)	1478	52.89	18.85	2106	50.74	17.71	F=12.093***
Head years of formal education	1470	0.6585	2.099	2106	0.5651	2.292	F=1.541
Head gender	1478			2106			X2=12.555***
…male	1196	80.92%		1598	75.88%		
…female	282	19.08%		508	24.12%		
Risk aversion	1478			2108			X2=8.047**
... high	212	14.34%		236	11.20%		
... moderate	660	44.65%		990	46.96%		
... low	606	41%		882	41.84%		
Settlement status	1478			2108			X2=2.63
... fully_settled	862	58.32%		1202	57.02%		
... nomadic	74	5.01%		88	4.17%		
... partially_settled	542	36.67%		818	38.80%		
Household members (n)	1478	7.126	2.912	2108	6.548	2.436	F=41.487***
Livestock owned (TLU)	1091	16.68	21.14	1568	18.95	33.72	F=3.886**
Annual household income (ETB)	1478	4971	8188	2108	5924	24445	F=2.081
Household cash savings (ETB)	1100	1233	9362	1576	2058	14986	F=2.614
Share of income from livestock (% of income)	1478	0.608	0.4446	2108	0.6267	0.4377	F=1.555
Social groups (n)	1478	0.7145	0.8478	2108	0.8529	0.8628	F=22.7***
Rangeland expectation	1475	1.839	1.038	2108	1.796	1.015	F=1.536
Livestock lost to drought since last sales window (TLU)	1478	0.1157	0.8585	2108	0.1589	1.016	F=1.782

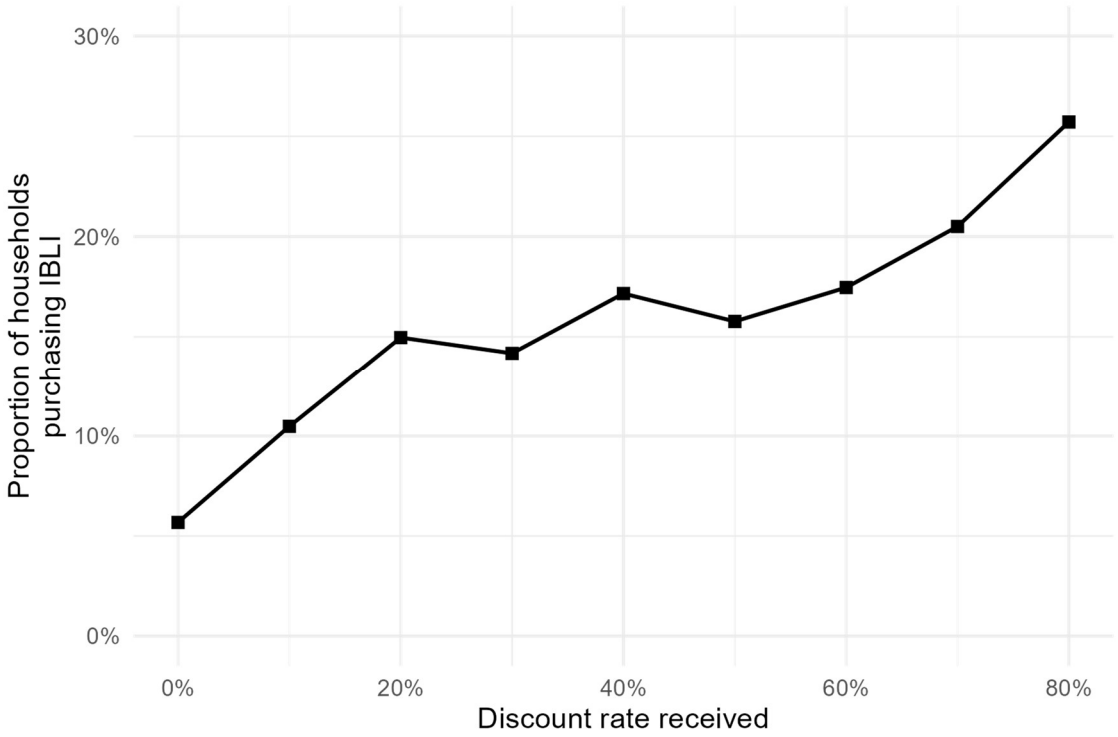
** p<0.1; ** p<0.05; *** p<0.01*



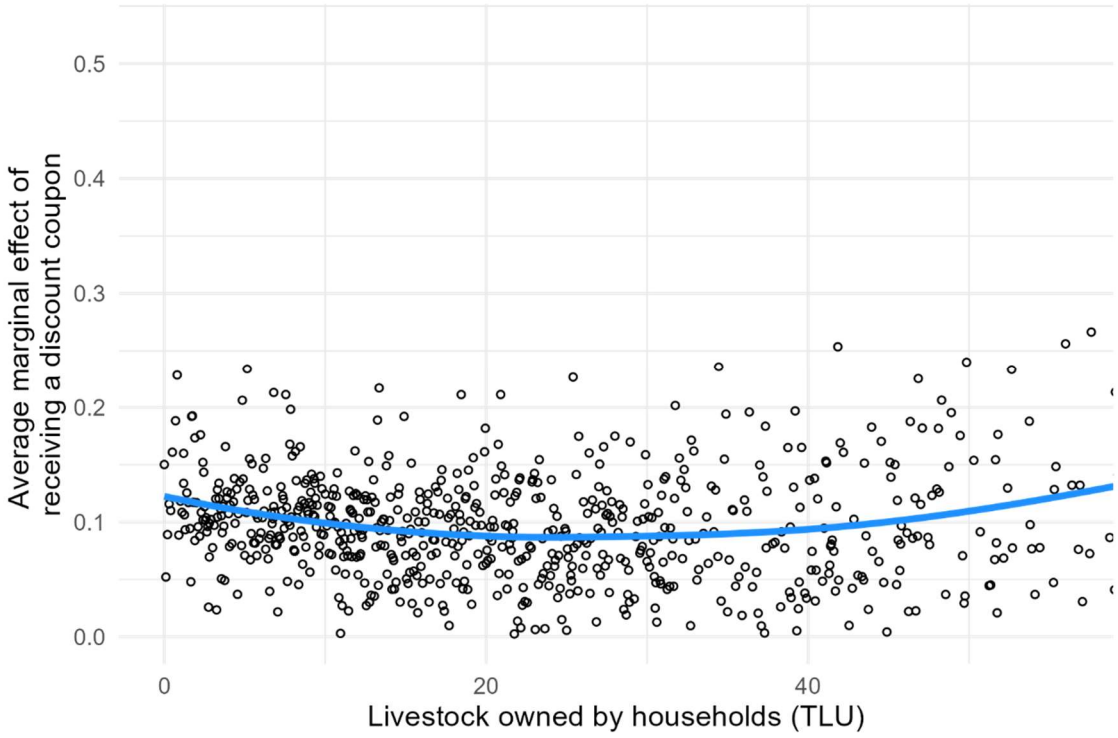
Supplementary Figure 2: Visual representation of the average marginal effect of receiving insurance discount coupons against the discount rate of coupon received in the previous sales window (red) and that receiving two sales windows prior (blue), with different panels showing the effect of receiving a present-period discount coupon of different rates. Values were calculated by running a regression based on the data underpinning Figure 9 in which the present-period discount receipt was captured via a set of dummy variables representing different discount levels, which were interacted with the discount rate lagged 1 and 2 sales windows.



Supplementary Figure 3: Plots showing the frequency at which households receiving a given subsidy level cited different reasons for not purchasing IBLI. The red line is fitted onto plotted points using locally estimated scatterplot smoothing (LOESS). Data is pooled across the panel, though no marked changes were evident when these were plotted for each round. Panels are in order by he number of instances that reason was provided. The least common reason for not acquiring IBLI, "Can rely on others", is not shown in the interest of space.



Supplementary Figure 4: Line chart plotting the proportion of households purchasing IBLI against the discount rate received.



Supplementary Figure 5: Variation in the marginal effect of receiving a discount coupon with the number of livestock owned (measured in TLU), showing data up until the 95th percentile of TLU values. The blue line is fitted onto plotted points using locally estimated scatterplot smoothing (LOESS). Results are based on the model presented in column 2 of Table 12.

Appendix 3 – R packages used

Package name	Citation
broom	(Robinson, Hayes and Couch, 2024)
car	(Fox et al., 2022)
DescTools	(Signorell *et al.*, 2023)
flextable	(Gohel *et al.*, 2023)
ggplot	(Wickham, Chang, et al., 2023)
ggthemes	(Arnold *et al.*, 2021)
haven	(Wickham, Miller and Smith, 2023)
huxtable	(Hugh-Jones, 2022)
janitor	(Firke et al., 2023)
jtools	(Long, 2022)
lmtest	(Zeileis and Hothorn, 2002)
marginaleffects	(Arel-Bundock *et al.*, 2023)
performance	(Lüdecke et al., 2023)
purr	(Wickham and Henry, 2023)
readxl	(Wickham, Bryan, et al., 2023)
ResourceSelection	(Lele, Keim and Solymos, 2023)
sandwich	(Zeileis, 2006; Zeileis, Köll and Graham, 2020)
scales	(Wickham, Pedersen, and Dana Seidel, 2023)
skimr	(Waring et al., 2022)
tidyverse	(Wickham et al., 2019)
viridis	(Garnier *et al.*, 2024)
vtable	(Huntington-Klein, 2023)
writexl	(Ooms, 2023)

Appendix 4 – Ethical Approval

School of Natural Sciences (SNS) Research Ethics Policy

School of Natural Sciences, Trinity College Dublin

UG/PGT Modified Form

In line with Trinity College Dublin's Policy on Good Research Practice, all research in the School of Natural Sciences (SNS) should be conducted according to the overarching ethical principles of "respect for the individual subject or population, beneficence and the absence of maleficence (research should have the maximum benefit with minimal harm) and justice."

All individuals involved in research should facilitate and ensure research is conducted ethically. Ethical conduct in research is a shared responsibility. Primary responsibility rests with the Principal Investigator(s). Ethical responsibilities and legal obligations may overlap. All staff and students conducting research are required to ensure that their research is carried out in compliance with this policy. Ethical review is required before any studies involving human subjects, other living organisms and/or the natural environment, encompassing biosphere, geosphere, hydrosphere and atmosphere, commence. This requirement applies to staff, postgraduate and undergraduate students and volunteers/interns. Field- and laboratory work cannot commence until ethical review has been completed and approval has been gained. Staff or students planning to undertake research should complete the Research Ethics Application (Appendix 2).

Projects involving researchers from other Schools or institutions which have ethical approval from those bodies do not need further ethical approval, but evidence of the approval must be submitted to the Module Coordinator.

The process for applying for ethical approval is outlined in the following steps:

1. **Read the Trinity College Dublin** Policy on Good Research Practice

2. **Complete the** SNS Research Ethics Application**.** Applications should be sent to the Module Coordinator. **Deadlines** for ethical approval submission are set by the Module Coordinator.

   For any applications that cannot be approved by the Module Coordinator and that require escalation to the Research Ethics Committee (REC, Chaired by Prof Steve Waldren), applications must be submitted by the **15th of each month**, and the School of Natural Sciences Research Ethics Committee will aim to respond by the **1st of the following month**.

   All researchers must complete the **Section 1** 'Applicant Details' and **Section 2** 'Initial Research Ethics Checklist'. If the study is desk-based or does not include interaction with live organisms, including humans as research models, nor does it involve working in natural or human-made outdoor habitats, then it is deemed not to require ethical approval, and the study can proceed without the approval of an ethics committee, but the completed and signed (Section 5) form should be submitted to the Module Coordinator. If the study is deemed to require ethical approval, then the applicant should complete **Section 3** 'Checklist for School REC suitability' to

determine if the application is suitable for consideration by the School REC. Checklists for student projects must be endorsed by their supervisor. If the study is suitable for consideration by a Level 1 committee (ie none of section 3 questions were answered "Yes" without the possibility of mitigation to reduce ethical risk), the researcher should complete **Section 4** 'Ethical Approval Application'. Students should ensure that this is approved by the project supervisor before being sent to the Module Coordinator (as indicated on the form). *All researchers must complete* ***Section 5*** *'Declaration'*.

If any of the answers to the checklist in Section 3 are yes, and suitable mitigation cannot be applied, the study requires the approval of a Level 1 and possible Level 2 committee. The applicant should then download the application and procedures for the appropriate Level 1 SNS REC and/or Level 2 REC (the Faculty of Engineering, Mathematics and Science REC, or the Animal REC for vertebrate research).

All animal (vertebrate) research must be ultimately approved by the Animal REC; research involving vertebrates in their natural habitats will be assessed by the Module Coordinator initially; if necessary this will be sent to the SNS REC; and then the decisions will be overseen by the AREC, but any research involving vertebrates in a laboratory setting needs to be submitted directly to the AREC. Please see HPRA guidelines.

3. Submit participant information and informed consent forms where applicable (Appendix 2).

4. The ethics application will be reviewed by the Module Coordinator in the first instance.

5. Respond if necessary to any requests for further information, or clarification, that the Module Coordinator might make in relation to the approval request. Discuss these with your supervisor where necessary. The student will be advised when the Module Coordinator has made a decision.

6. For projects of more than one year duration, if there are changes to the project details which may have a bearing on ethical considerations, then applicants must submit an **annual report** (**Appendix 3**). **All applicants must submit an end of project report upon completion of the study (Appendix 4).**

Appendix 1

Research Ethics Application

School of Natural Sciences, Trinity College Dublin

Section 1: Applicant Details

Name (Student/lead researcher)	Xandru Cassar
Staff/Student Number	23330705
Applicant E-mail Address	cassarx@tcd.ie
Name(s) of Additional Researcher(s)	Challa Gidissa – point of contact at host organisation (Trócaire Ethiopia)
Name of Supervisor (for students)	Tara Bedi
Supervisor E-mail Address	*tbedi@tcd.ie*
What School/Discipline are you affiliated to?	**School of Geography**
Title of Project	**Targeting Insurance Subsidies for Sustainable Drought Protection**
Brief description of the project (max 200 words)	Ethiopian pastoralists rely on livestock for their income and nutrition. Drought-induced livestock mortality is thus the primary threat for these communities, as evidenced by the country's unfolding food crisis. Livestock insurance has been shown to avert the hunger, school dropouts, and long-term poverty traps typically triggered by drought, yet insurance coverage remains low despite subsidies offered by state and non-state actors. The proposed research seeks to improve the impact and sustainability of insurance subsidies by (a) investigating the association between household wealth and insurance subsidies' effect on uptake and (b) exploring stakeholders' perception of subsidies' aims. Towards (a), I will carry out an econometric analysis of insurance purchase patterns using survey data in the public domain. The findings from this will be complemented via focus group discussions with pastoralists in southern Ethiopia. Re (b), I will conduct key informant interviews with multiple stakeholders (donors, community representatives, implementers.

	The consent form is appended in Appendix 2.
Highlight the category that best describes the research	Taught MSc dissertation research project
Has this application been submitted to another TCD Ethics Committee for approval?[1]	No
Has ethical approval for this project been sought from outside TCD? What was the outcome?	No, but this will be conducted in line with the ethical and research protocols of the host organisation, Trócaire.

[1] All research involving animals (vertebrates) must ultimately be approved by the Animal Research Ethics Committee (AREC); research involving vertebrates in their natural habitats will be assessed by the SNS REC initially and then the decisions will be overseen by the AREC, but any research involving vertebrates in a laboratory setting needs to be submitted directly to the AREC.

Section 2: Initial Research Ethics Checklist

DOES YOUR RESEARCH PROJECT FALL CLEARLY UNDER ANY OF THE FOLLOWING CATEGORIES?

	YES	NO	
1. Quality assurance study (e.g. assessment of teaching practice)[2]		X	
2. Audits of standard practice (not involving identifiable records)		X	
3. Research on existing publically available information, documents or data (i.e. already gathered and in the public domain)	X		BUT NOT SOLELY

If you have answered YES to one or more of the above questions, your research project can proceed without the need for ethical approval from the School Research Ethics Committee (REC). Please be aware that all researchers have a responsibility to follow TCD's Policy on Good Research Practice, (available here) as well as any academic or professional code of practice or guidelines relevant to the specific research project. Even if you answer YES to one of the above question, **please return a signed (Section 5) copy of this form to the MODULE COORDINATOR** as a record must be kept of all projects.

If you have answered NO to all of the above questions, proceed to Section 3 to determine whether your application is suitable for consideration for the Module Coordinator or if the application needs to be evaluated by a Level 1 and/or Level 2 committee.

[2] Quality assurance and audit studies do not routinely require ethical approval. However, if following the study there is scope to publish the findings of a study, an REC may grant a letter of approval if required.

Section 3: Checklist for School REC suitability

This checklist needs to be completed in order to determine whether your application is considered "low risk" and is therefore suitable for consideration by the Module Coordinator or the School REC[3].

Please indicate if your application falls into any of the categories below (categories from TCD "Criteria for Research Ethics Committees" document, Jan 2014). Answer "NO" if your work does not involve the scenario. Answer "YES" if it does and ethical risks cannot be mitigated. Answer "YES but see…" if ethical risks can be mitigated by appropriate actions such as designing the study to minimize the chances of potentially endangering people, populations of study organisms and/or the environment (and list these in Section 4).

	NO	YES	YES but see mitigation strategy in Section 4
1. Surveys asking questions of a sensitive or private nature	X		
2. Questionnaires or observational studies involving children or vulnerable adults.	X		
3. Research where there is a risk of a participant feeling undue pressure to participate by virtue of his/her relationship with the researcher (e.g. student/supervisor; patient/clinician).	X		
4. Projects involving a justifiable degree of deception.	X		
5. Analysis of archival irrevocably anonymised human tissue samples for which consent for research was not originally given, and was not acquired in the course of clinical treatment. (Archived samples taken for a previous research study must always get new ethical approval).	X		
6. Research involving invasive procedures on humans (other than those listed above).	X		
7. Research other questionnaires or observational studies involving vulnerable persons[4].	X		
8. Research where identifiable information obtained may have legal, economic or social consequences for research subjects.	X		
9. Research that may identify illegal activity on the part of the participant.	X		

[3] In situations where research ethics approval has been granted by an appropriate body outside TCD, approval must also be sought from an appropriate TCD REC, although, at the discretion of the REC chair, the submission may qualify for fast-tracked approval.

[4] Vulnerable persons: Certain individuals who face excessive risk of being enrolled in research include those with limitations in their ability to provide informed consent to research because of factors such as immaturity or cognitive impairment. Vulnerability can also stem from individuals' relationships with others, and it is imperative that coercive situations are avoided. Such cases may occur when an employee/student/dependent is asked to participate in research being conducted by a supervisor/mentor. Additional social factors, such as poverty and lack of access to health care, can also make individuals vulnerable to coercion, exploitation or other risks and need to be considered and appropriately mitigated for.

10. Projects where each subject is paid (over and above token gestures).	X		
11. Research that may potentially cause irrevocable damage to[5] the population of subjects, and/or researchers, and/or 3rd parties, and/or the environment. **See note below.**	X		
12. Research involving the collection of human tissue.	X		
13. Research that may have a direct military application.	X		
14. Potentially harmful research involving humans conducted outside Ireland[6].	X		
15. Research involving psychological intervention.	X		

Official Approval/licensed research: Research involving elements that may cause harm to the environment, to invertebrate animals or plants; or deal with endangered fauna and/or flora and/or protected areas; or involve the use of elements that may cause harm to humans, including research staff; may need formal approval/licensing by outside body, and such approval for the research (e.g. from the relevant Government Department) must be attached to this application. If formal approval for the work has been granted please give details in the box below:

Approval for work granted by:	*N/A*
Licences held relating to research activities	Research activities will be coordinated with the host organisation, which is an approved NGO in Ethiopia. For this reason, all processes will be in line with the host organisation's obligations under its status as a legally recognised NGO.
Details of approval:	

If you have answered YES to any of the above questions and cannot mitigate ethical risks, then the application is deemed to be of moderate or high risk (*i.e. risk or discomfort is greater than that usually encountered during normal daily life*) and should be submitted to SNS REC for Level 1 review; and then the appropriate Level 2 Ethics Committee. The applicant should download the application and procedures for the appropriate Level 2 REC (the Faculty of Engineering, Mathematics and Science REC, or the Animal REC for vertebrate research).

If you have <u>not</u> answered YES to any question in Section 3, your application can be submitted for consideration by the Module Coordinator after completion of Section 4.

[5] Relevant Health and Safety Risk Assessment forms must be completed before work can be undertaken.
[6] Does not apply to material publically available in another jurisdiction. Note that the same ethical standards will apply to research carried out by SNS researchers within and outside of Ireland. Work must comply with legal requirements of the State in which it is carried out.

Section 4: Ethical Approval Application Form for School of Natural Sciences Level O RE via Module Coordinator

All student applications should be reviewed and approved by the project supervisor prior to submission.

Project Description

Title of research project	Targeting Insurance Subsidies for Improved Drought Protection: towards effective and sustainable livestock insurance subsidies amongst Ethiopian pastoralist communities
Start date of research project	22/04/2024
End date of research project	29/08/2024
Potential ethical issues	
There is potential risk of individuals participating in this research – this is both in key informant interviews and focus group discussion – being identified. Particularly amongst focus group discussion participants, there may be challenges with obtaining written consent from certain individuals given high illiteracy rates in the region and low fluency in English. During key informant interviews or focus group discussion, it may be – but it is extremely unlikely – that individuals may mention behaviours, activities, or events which are fraudulent. NB: The questions to be asked and information pertaining to such are available in Appendix 5 of this document.	
Ethical considerations, reducing potential risks and mitigating impacts	
To reduce the risk of identification, all personal information relating to focus group discussions will be anonymised by the data controller, which is the host NGO, Trocaire, before being provided to me, such that at no point will I have access to personal data of focus group participants or individuals which are referred to. All personal information of participants in Key Informant Interviews or individuals referred to in the same interviews will be anonymised, and the minimum information required will be communicated with any individuals who are not part of this project. Furthermore, any information which could lead to the identification of the individual in question – such as reference to particular documents with select access, or particular events – will be omitted or scrambled. To deal with the issue of obtaining written consent amidst prevalent illiteracy, all the information will be provided in a format which is clear and accessible to the individual in the presence of a trusted third party selected by the given participant. The individual will then be able to sign using their fingerprint, and the third party will also sign to confirm that informed consent has been provided. All materials will be translated to the local language by a member of staff from the host organisation, and this cross-checked by a second individual to ensure accuracy and completeness – this will ensure all material is provided in a language accessible to focus group discussion participants	

In the case of participants disclosing deceitful or malicious behaviour, these issues will be anonymously brought to the attention of the relevant entities (which may be the host organisation itself or other entities).
Data storage
At no point will I have access to personal data of individuals who participate in or are referred to in focus group discussion. The personal data collected from Key Informant Interview participants will be kept to a minimum, and information which is not required (eg date of birth) will not be collected at all. All personal data of participants and any individuals who may be mentioned by the same participants will be anonymised. Data will be stored in a password protected laptop, and made available to members of the team via systems which are GDPR compliant, meet the standards of the host organisation, and have a high security threshold (such as requiring authorisation to access and password protection). Data will be stored for a period of 5 years by myself in case of any auditing activities, or in case this work may inform research publications at a later data. This data may also be stored by the host organisation, the data controller, for a period of up to 10 years, in line with the recommendations of Trinity College Dublin.
Published ethical guidelines to be followed
All processes as part of this project will be conducted in line with the ethical guidelines and research standards of the host institution. All work will also follow the TCD Policy on Good Research Practice and the UK Academy of Social Sciences Ethical Principles.

Section 5: Declaration

Signature of applicant *I declare that the information given herein is accurate. I have read the TCD Ethics Policy and will follow the guidelines therein. I have read and understood the TCD Data Protection Policy.*	**Signature:**  **Date: 26/03/2024**
Signature of Supervisor (in case of students) *I declare that the information given herein is accurate. I have read the Ethics Policy and will follow the guidelines therein.*	**Signature:**  **Date: 12/04/2024**

To be completed following Module Coordinator review:

Approval by the School's Ethics Committee *Based on the information available on this form, the Module Coordinator believes the ethical risks in this project are negligible and will be appropriately mitigated during the course of the research*[7]*.*	**Sign/Stamp:**  **Date:12/04/2024**

[7] Primary responsibility for ensuring ethical conduct in research rests with the Principal Investigator(s).

Appendix 2

Participant Information Form

1. **Title of study**

Targeting Insurance Subsidies for Improved Drought Protection amongst Ethiopian Pastoralist Communities

2. Details

Principal investigator: Askale Aderaw on behalf of Trócaire (AskaleA@cst-together.org, +251911035360)
Research assistant: Xandru Cassar from Trinity College Dublin (CASSARX@TCD.IE, 356 99503720
Research supervisors: Prof Alan Duncan, Dr Nathan Jensen, Dr Tara Bedi, Dr Wuletawu Abera
This research is funded by (a) ENDEAVOUR II Scholarships Scheme, which is funded by the Government of Malta and may be co-funded by the ESF+ 2021-2027, (b) AWARD One Planet Fellowship, (c) Trócaire, and (d) The Jameel Observatory.

3. Introduction

This research project has two aims.
The first is to evaluate how the impact of livestock insurance subsidies varies amongst pastoralist households. This will be done by conducting a quantitative analysis of household survey data and focus group discussions with community members.
The second is to identify key stakeholders' perceptions of livestock insurance, insurance subsidies, and their aims. This will be done via interviews with the same stakeholders and analysis of documents.
The ultimate goal is to improve the effectiveness and sustainability of livestock insurance amongst Ethiopian pastoralist communities.

4. Procedures

In the case of Focus Group Discussions:
You have been invited to participate in a discussion with approximately 4 other individuals. This will be led by a trained researcher, who will introduce themselves. The focus of the discussion will be on your impressions of livestock insurance, subsidies for this insurance, and how they can be improved. This discussion will not last longer than 1hour 15 minutes. To participate, it is also required that you consent to being audio recorded.

In the case of Key Informant Interviews:
You have been invited to participate in an interview during which you will be asked about your role in livestock insurance related programmes as part of the organisation you work with, and your understanding of such programmes. You will also be asked about your perceptions of the aims of livestock insurance programmes and, and how these relate to the sustainability of the product/programme your organisation is involved in. Interviews will be led by Mr Xandru Cassar, and will last no longer than 60 minutes. It will be recorded as long as you consent to this.

5. Benefits

By participating in this research, you are enabling livestock insurance and subsidy programmes to be improved.

6. Risks

Your information, anything which you say, or anything which you say about anyone else will be anonymised to avoid you or anyone you mentioned being identified. Nobody who is not part of this project is able to access your data. However, material may be shared with third parties for translation and/or transcription purposes (outsourcing). In this case, all those involved will be bound by the same standards as all those involved in the research, and will be obliged to not share the material or utilise it for any other purpose. They will also delete all material they were given access to once the assigned task/s is/are complete.
You are free to withdraw your consent at any point before, during, or after your participation. If you withdraw, your data and any information you provide will be deleted permanently.

8. Confidentiality

Your identity will remain confidential. Your name will not be published and will not be disclosed to anyone outside the study. This also applies to any individuals you mention.

9. Voluntary Participation

You have volunteered to participate in this study. You may quit at any time. If you decide not to participate, or if you quit, you will not be penalised.

10. Reimbursements

You will not receive any compensation for participating in this research.

11. Stopping the study

You understand that the researcher may stop your participation in the study at any time without your consent.

12. Permission

This study, and all processes conducted as part of it, have been approved by the School of Natural Sciences Research Ethics Committee at Trinity College Dublin and are aligned with Trócaire's research/ethical guidelines.

13. Access to data

As a participant in this study, you have the right to access your own data at any time under the 2014 Irish Freedom of Information Act. Please contact the lead researcher if you wish to do so. Trócaire is the data controller as defined in the EU General Data Protection Regulation.

15. Further information

You can get more information from Askale Aderaw reachable on AskaleA@cst-together.org.

Informed Consent Form

- This study and this consent form have been explained to me. I believe I understand what will happen if I agree to be part of this study.
- I have read, or had read to me, this consent form. I have had the opportunity to ask questions and all my questions have been answered to my satisfaction. I freely and voluntarily agree to be part of this research study, though without prejudice to my legal and ethical rights. I have received a copy of this agreement and understand that, if there is a sponsor, a signed copy will be sent to that sponsor.
- I understand that even if I agree to participate now, I can withdraw at any time or refuse to answer any question without any consequences of any kind.
- I understand that I can withdraw permission to use data, in which case the material will be deleted.
- I understand that I will not benefit directly from participating in this research.
- I agree to being audio-recorded. I also understand that material may be shared with third parties (outsourced) for purposes of transcription and/or translation.
- I understand that all information I provide for this study will be treated confidentially, and that in any report on the results of this research my identity will remain anonymous. This will be done by changing my name and disguising any details of my interview which may reveal my identity or the identity of people I speak about. I also understand that disguised extracts from what I say may be quote, but only when there is no risk of identification.
- I understand that if I inform the researcher that myself or someone else is at risk of harm they may have to report this to the relevant authorities - they will discuss this with me first but may be required to report with or without my permission.
- I understand that signed consent forms, original audio recordings, and transcripts will be retained in a secure location with access only to authorised individuals, and when stored digitally, on a password protected device, for a period of up to 10 years.
- I understand that under freedom of information legalisation I am entitled to access the information I have provided at any time while it is in storage as specified above.
- I understand that I am free to contact any of the people involved in the research to seek further clarification and information.

This research is being undertaken by Xandru Cassar (BSc) Hons, under the supervision of Dr. Tara Bedi (Trinity College Dublin), Dr. Nathan Jensen (The University of Edinburgh), Prof. Alan Duncan (The University of Edinburgh, ILRI), and Dr. Abera Wuletawu (CIAT, on behalf of the AWARD Fellowship) and is sponsored by Trócaire, the Jameel Observatory, the Government of Malta, and the AWARD One Planet Fellowship.

PARTICIPANT'S NAME:

PARTICIPANT'S SIGNATURE:

Date:

Date on which the participant was first furnished with this form:

Participants with literacy difficulties:

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely and understands that they have the right to refuse or withdraw from the study at any time.

Print name of witness:
Signature of witness:
Date:
Thumbprint of participant:

Statement of investigator's responsibility: I have explained the nature, purpose, procedures, benefits, risks of, or alternatives to, this research study. I have offered to answer any questions and fully answered such questions. I believe that the participant understands my explanation and has freely given informed consent.

Researcher's signature: **Date:**

Appendix 3

Annual Research Ethics Report Template

School of Natural Sciences, Trinity College Dublin

Name	
Staff/Student Number	
E-mail Address	
Title of Project	
Date DD/MM/YY	

Questions:	**YES/NO**	**Details:**
Is the study continuing? If YES, please provide the anticipated date of completion.		
Have there been any modifications to the study for which Ethical approval was granted? If YES, please provide details (only give details that are relevant to ethical approval)		
Have there been any adverse outcomes associated with the conduct of the research? If YES, please provide details.		
Are all data being stored in accordance with Trinity's data storage policy, in adherence to the Freedom of Information Act, and in compliance with the requirements of the Data Protection Commissioner? See https://www.tcd.ie/about/policies/data_protection.php		

Appendix 4

Research Ethics End of Project Report Template

School of Natural Sciences, Trinity College Dublin

Name	
Staff/Student Number	
E-mail Address	
Title of Project	
Date DD/MM/YY	

Questions:	**YES/NO**	**Details:**
Are the results of the study published? If YES, where (give details of thesis, paper, report etc.)		
Were there any modifications to the study for which Ethical approval was granted? If YES, please provide details (only give details that are relevant to ethical approval)		
Were there any adverse outcomes associated with the conduct of the research? If YES, please provide details.		
Are all data being stored in accordance with Trinity's data storage policy, in adherence to the Freedom of Information Act, and in compliance with the requirements of the Data Protection Commissioner? See https://www.tcd.ie/about/policies/data_protection.php		

Appendix 5

Key Informant Interviews

The table below lays out the interview guide to be used during Key Informant Interviews. As these will be semi-structured interviews, the topics discussed may digress slightly from those treated explicitly and directly by the questions below in order to allow for key points and comments of value to be probed further. Questions will also be adapted according to the individual being interviewed. Any changes to the questions to be asked will be reflected in an updated version of this Ethics Form, which will be communicated in due course.

Section	Questions/Prompts	Time
Greeting/logistics	1. Greeting, gratitude, rapport 2. Confirm engagement with participant information sheet 3. Reiterate recording and anonymity, reconfirm consent 4. Introduce the project and interview structure 5. Ask participant if they have any questions	5mins
Background on IBLI	1. Could you tell me about your and your organisation's role in programmes related to livestock insurance? 2. How would you describe IBLI to someone unfamiliar with it in one minute? 3. What would you say are the aims of IBLI? 4. What do you/your organisation regard as the main challenges of IBLI? 5. In spite of these challenges, what are the opportunities you see for IBLI?	10mins
IBLI beneficiaries	1. Who would you say are the beneficiaries of IBLI? (Do all pastoralists stand to benefit from it, or does it favour certain cohorts? If so, who?) 2. Why is this the case?	5mins
Background on Subsidies	1. Do you think that the cost of livestock insurance should be subsidised for pastoralists? 2. Have existing or planned subsidy programmes affected your entity, and if so how? 3. Have subsidy programmes implemented to date been effective? Why, why not?	10mins
Aim/s of subsidies	1. What would you say are the aim or aims of livestock insurance subsidies? (Are there any other aims?) 2. If there are multiple aims, how would you rank these? Which is most important? 3. Would you say that all pastoralists stand to benefit equally from insurance subsidies? Do certain cohorts stand to benefit more than others? Are female-headed households affected differently? Why?	10mins
Subsidies' impact on commercial viability	1. In your view, do subsidies affect the commercial viability and/or sustainability of IBLI, and if so how? 2. Are there any factors which mediate/influence the impact of subsidies on commercial viability? If so, what are they? (Should they be targeted, to what extent should they be subsidised, should there be an exit strategy?) 3. How do you envisage this interaction playing out in the long-term? Is the current set-up sustainable for different parties? (Do you regard subsidies as temporary, or are they part of the long-term setup?)	10mins
Interview close	1. Provide overview of next steps of research project 2. Request permission to contact for follow-up questioning. 3. Present opportunity to ask any questions 4. Reiterate contact details 5. Thanks and conclusion	5mins

Focus Group Discussions

As in the case of Key Informant Interviews, the discussion may digress slightly from those laid out below set in order to probe comments of interest to the research. The individuals moderating the discussions, who have experience conducting focus group discussions, will receive training with regards to the aim of the research and questions to be asked, in order to ensure that the discussion remains entirely within the scope of this research and that the privacy, respect of individuals participating is safeguarded at all times in line with the do no harm principle. Questions were developed in collaboration with community representative and NGO staff with extensive experience working with communities in the study areas.

Part 1 – Greetings, information, and consent

Duration: 10 minutes

Objective: To provide participants with information about this research project and ensure that they consent to participate.

Tasks:

1. Welcome participants and thank them for being present
2. Give each participant a participant information sheet
3. Read out the information sheet and consent form
4. Explain that the discussion will be recorded, and that all information will be anonymised so that it is not possible to identifying anyone who participates or is mentioned
5. Ask the participants if they have any questions
6. Ask participants to fill and support them in filling informed consent forms
7. Collect consent forms once filled

Part 2 – Participant introduction

Duration: 15 minutes

Objective: To provide context about participants' background. It is very important that the number of livestock they own is clear.

Questions:

1. Ask participants to introduce themselves
2. How many livestock do you control?
3. Who makes decisions about livestock in your household?
4. Do you have any other sources of food or income?
5. How were you affected by the recent drought?

Part 3 – Experience with livestock insurance

Duration: 20 minutes

Objective: To understand participants experience with and perspective on livestock insurance, and *whether livestock insurance's impact varies or is perceived to vary according to livestock wealth and pastoralist/decisionmaker gender*.

Tasks/questions:

1. Introduce livestock insurance, ask how many participants know about it, explain it briefly in terms familiar and accessible to those present
2. Have you ever had livestock insurance? How many livestock were insured? Why did you decide to acquire insurance coverage?
3. How did livestock insurance coverage affect you? Did anything change because of it? Were there any benefits?
4. Would you say that the impact/benefits of livestock insurance is/are the same for everybody?
    a. So, does the impact of livestock insurance change according to how many livestock one has?
    b. Do you think that livestock insurance affects men and women differently?
5. Do you still have insurance coverage? Why or why not?

Part 4 – Insurance subsidies

Duration: 25 minutes

Objective: To understand the impact that subsidies have on pastoralists, and how they perceive the benefits of these subsidies. It is *especially important to understand what the benefits of subsidies were for those present* – did they allow them to buy coverage where they otherwise would not have, did they allow them to cover more livestock, did they allow them to spend more money other items, etc. It is also import to understand how

Tasks/questions:

1. Briefly introduce the idea of subsidies, ask how many participants are familiar with it, briefly explain what subsidies are.
2. Have you ever received a subsidy for livestock insurance?
3. How did this subsidy affect you? What was the main benefit of it? Were there any other benefits?
   NOTE: If participants say that it lowered the cost of insurance, the interviewer should ask about what the impact/benefits of that lower price was.
4. How would you be affected if there were no subsidies for livestock insurance?
5. Who are subsidies most beneficial for? Or are the benefits of subsidies equal for everyone?
    a. Does the impact of subsidies vary according to how many livestock one has?
    b. Do subsidies affect men and women differently?
6. Do you think that everyone should receive the same subsidy for livestock insurance, or should different people receive different amounts of subsidies?

a. Other participants have mentioned that women are generally less able to undertake manual labour, and may be unable to travel due to household responsibilities. Their capacity to earn enough money to purchase insurance may thus be lower. Would you agree that this is the case? In light of this, do you think that subsidies for women/female-headed households and men/male-headed households should be different?
b. If people should receive different amounts of subsidies, how should this be done/decided in practice?
c. What are some of the benefits and challenges of this in your opinion?

Part 5 – Conclusion

Duration: 5 minutes

Objective: To thank participants and remind them that they can contact the researchers with any questions.

Tasks:

1. Thank everyone present for participating and sharing their views and experiences.
2. Remind them that they can contact the researchers listed on the information sheet with any questions or issues