

**ASSESSING WILLINGNESS-TO-PAY AND DEMAND
DETERMINANTS FOR INDEX-BASED AGRICULTURAL
INSURANCE**

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DECLARATION

I **Nyakwera Favourite** declare that this research study is my original work and has not been published anywhere or submitted to any University/Institution of higher learning for award of any academic qualification by anyone. It's now being presented as a partial fulfillment requirement of the award of Bachelor of Statistics, Makerere University, Kampala.

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APPROVAL

This dissertation has been fully done and submitted by **Nyakwera Favourite** for examination with my approval.

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Date: 15th Aug 2026

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DEDICATION

I dedicate this research work first to the Almighty God, whose grace and providence enabled me to complete this journey in good time. I also dedicate this report, with profound honor and respect, to my beloved parent, Ms, Natukunda Bonny for her selfless financial, spiritual, and emotional support has been the cornerstone of my academic success.

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ACRONYMS AND ABBREVIATION

Acronym/Abbreviation	Full Meaning
AIC	Akaike Information Criterion
AUC	Area Under the Curve
BIC	Bayesian Information Criterion
CVM	Contingent Valuation Method
GLM	Generalized Linear Model
GoU	Government of Uganda
IBWI	Index-Based Weather Insurance
IRA	Insurance Regulatory Authority of Uganda
LLR	Log-Likelihood Ratio
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
NFIS	National Financial Inclusion Strategy
OLS	Ordinary Least Squares
OR	Odds Ratio
ROC	Receiver Operating Characteristic

Acronym/Abbreviation	Full Meaning
SPSS	Statistical Package for the Social Sciences
UAIS	Uganda Agricultural Insurance Scheme
UBOS	Uganda Bureau of Statistics
UGX	Uganda Shillings
VIF	Variance Inflation Factor
WTP	Willingness to Pay
WTA	Willingness to Accept

ABSTRACT

Agricultural production in Uganda is predominantly rain-fed and highly vulnerable to climate variability, exposing smallholder farmers to substantial weather-related risks. Index-based agricultural insurance has emerged as a promising risk-transfer mechanism, yet uptake remains persistently low despite government-supported initiatives such as the Uganda Agricultural Insurance Scheme. This study investigated the willingness-to-pay (WTP) and demand determinants for index-based agricultural insurance among smallholder farmers in Luweero and Mukono districts, Uganda. The specific objectives were to examine the socioeconomic characteristics of smallholder farmers, assess their risk perceptions and attitudes toward basis risk, estimate their mean and maximum WTP, and determine the socioeconomic, behavioural, and perceptual factors influencing demand. A cross-sectional quantitative research design was adopted, and the Contingent Valuation Method was employed to elicit WTP from 200 smallholder farmers selected through a multistage sampling procedure. Primary data were collected using a structured interviewer-administered questionnaire covering socioeconomic characteristics, agricultural risk exposure, insurance knowledge, behavioural characteristics (risk aversion and ambiguity aversion), basis risk perception, and WTP. Data were analysed using descriptive statistics, binary logistic regression, and Tobit regression models. The findings revealed that WTP was moderate but highly price-sensitive, with 55% of farmers willing to pay at 10,000 UGX per acre, declining to 35% at 20,000 UGX per acre. The mean maximum WTP was 15,247 UGX per acre. Binary logistic regression results showed that insurance knowledge (OR = 2.440, $p = 0.030$), education (OR = 1.719, $p = 0.013$), risk aversion (OR = 1.613, $p = 0.011$), and household income (OR = 1.470, $p = 0.020$) were positively associated with WTP, while ambiguity aversion (OR = 0.599, $p = 0.012$), basis risk perception (OR = 0.654, $p = 0.017$), and farming experience (OR = 0.972, $p = 0.062$) were negatively associated with WTP. Farm size (OR = 1.215, $p = 0.056$) was positively associated with WTP at the 10% significance level. All five null hypotheses were rejected, confirming that education, basis risk perception, risk aversion, household income, and farming experience significantly influence WTP. The study concludes that there is latent demand for index-based agricultural insurance, but this demand is constrained by affordability, limited understanding, ambiguity aversion, and basis risk concerns. The study recommends

premium subsidies, awareness campaigns, improved index design, and transparent communication to enhance uptake. These findings provide empirical evidence to inform policymakers, insurers, and development partners on designing viable and responsive index-based agricultural insurance products for smallholder farmers in Uganda.

Keywords: Willingness-to-pay, index-based agricultural insurance, basis risk, risk aversion, ambiguity aversion, smallholder farmers, Uganda

CHAPTER ONE: INTRODUCTION

1.1 Introduction and Background

Agriculture remains a fundamental component of Uganda's economy and an important source of employment, household income, food security, and rural livelihoods. The sector is dominated by smallholder farmers whose production systems are largely dependent on natural climatic conditions. The World Bank (2018) reported that agriculture accounted for approximately 70% of employment in Uganda and contributed substantially to exports and gross domestic product. More recent evidence continues to emphasise the importance of agriculture to Uganda's economic and livelihood systems, particularly among rural households. However, the sector remains highly vulnerable to climate variability because agricultural production is predominantly rain-fed. Approximately 81% of Uganda's population is estimated to rely on rain-fed subsistence farming for food and income, exposing households to considerable production and welfare risks associated with droughts, floods, and disruptions in rainfall patterns (World Bank, 2025).

The dependence on rain-fed agriculture has become increasingly important in the context of climate change and increasing climatic variability. Changes in the timing, duration, and distribution of rainfall, together with prolonged dry spells, floods, and other weather-related hazards, can substantially affect agricultural yields and farm incomes. Evidence from Uganda indicates that weather-related events are perceived by smallholder farmers as one of the most significant risks to agricultural production, while changes in rainfall patterns and prolonged dry spells have increasingly complicated traditional farming practices (World Bank, 2022). Such risks have consequences beyond the immediate loss of agricultural output. A substantial reduction in farm income can weaken household food security, reduce savings, constrain investment in subsequent production seasons, and undermine farmers' ability to repay agricultural loans (Carter et al., 2017). Consequently, mechanisms that enable farmers to manage and transfer climate-related production risks have become increasingly important.

Agricultural insurance is one such risk-management mechanism. By transferring part of the financial consequences of specified agricultural risks from farmers to an insurer, insurance can potentially protect household income and productive assets following

adverse events. Conventional indemnity-based agricultural insurance, however, presents significant challenges in smallholder farming environments. Under indemnity insurance, compensation generally depends on assessing the actual loss suffered by an individual policyholder. In contexts characterised by numerous geographically dispersed small farms, limited infrastructure, high monitoring costs, and information asymmetries, individual loss verification can be costly and difficult. Such characteristics can contribute to problems of moral hazard, adverse selection, high transaction costs, and limited commercial viability of conventional agricultural insurance (Belissa et al., 2020).

Index-based agricultural insurance provides an alternative approach. Rather than determining compensation from an assessment of an individual farmer's actual loss, index insurance links insurance payouts to the observed performance of a predetermined and objectively measurable index. Depending on the product, the index may be based on rainfall, temperature, vegetation conditions, area yields, or other observable indicators that are correlated with agricultural losses. When the index reaches a predetermined threshold, the policy generates a payout according to the terms of the contract. This structure reduces the need for individual farm-level loss assessment and can therefore lower transaction and verification costs. It may also reduce opportunities for moral hazard because individual behaviour does not directly determine the insurance payout (Belissa et al., 2020; Mahul & Stutley, 2010).

Despite these potential advantages, the uptake of index-based agricultural insurance among smallholder farmers has generally remained below expectations in many developing-country settings (Carter et al., 2017). The challenge is therefore not simply whether an insurance product can technically provide protection against agricultural risks, but whether farmers perceive the product as sufficiently valuable, credible, affordable, and understandable to justify paying for it. Research has shown that demand for index insurance is influenced by a combination of economic, socioeconomic, institutional, and behavioural factors. These include household income, farm size, education, access to credit and extension services, previous experience with agricultural shocks, risk preferences, understanding of insurance, and perceptions of the reliability of the underlying index (Wodaju et al., 2025).

One of the most important challenges associated with index-based insurance is basis risk. Basis risk arises when the insurance index does not perfectly correspond with the actual losses experienced by an individual farmer. For example, a farmer may experience substantial crop losses because of insufficient rainfall while the measured rainfall at the relevant index station remains above the payout threshold. Conversely, an index may trigger a payout even when an individual farmer experiences relatively limited losses. Such discrepancies can undermine farmers' confidence in index insurance and reduce their willingness to participate. Evidence from the broader index-insurance literature demonstrates that basis risk can significantly reduce demand because farmers may be unwilling to pay premiums for a product that they perceive as potentially failing to compensate them when they suffer losses (Belissa et al., 2020; Jensen et al., 2018).

Behavioural characteristics are also increasingly recognised as important determinants of index-insurance demand. In particular, the distinction between risk aversion and ambiguity aversion is relevant. Risk aversion refers to a preference for more certain outcomes over uncertain outcomes of equivalent expected value, whereas ambiguity aversion concerns situations in which the probabilities of possible outcomes are themselves uncertain. In the context of index insurance, a farmer may understand the probability of experiencing drought but remain uncertain about whether the selected index will accurately reflect the farmer's actual loss. This uncertainty can generate reluctance to purchase the insurance product. Belissa et al. (2020), using evidence from Ethiopia, found that greater risk aversion increased index-insurance uptake, whereas greater ambiguity aversion reduced uptake. Their findings suggest that behavioural preferences can partly explain why farmers exposed to significant agricultural risks may nevertheless choose not to purchase index insurance.

Evidence from Uganda provides further support for the importance of behavioural factors. Lwiza and Barkley (2025) found that ambiguity aversion was negatively associated with the adoption of weather index-based insurance among Ugandan farmers. The study also reported that tertiary education positively influenced the likelihood of adopting weather index insurance and suggested that information and education could reduce the negative effect of ambiguity on insurance adoption. These findings are particularly relevant because they indicate that insurance demand cannot be explained solely by farmers' ability to pay.

Farmers' understanding of the product, confidence in the index, and perceptions of the likelihood of receiving an appropriate payout may also determine whether they are willing to participate.

The Ugandan agricultural insurance market has expanded in recent years, particularly through the Uganda Agricultural Insurance Scheme (UAIS), which was introduced to improve farmers' access to affordable agricultural insurance through government-supported premium subsidies. The Insurance Regulatory Authority of Uganda reports that the scheme covers crop, livestock, aquaculture, and apiculture risks and that the number of farmers insured under the scheme has increased substantially since its introduction (Insurance Regulatory Authority of Uganda [IRA], 2024). Nevertheless, agricultural insurance remains a relatively underdeveloped component of Uganda's broader financial system. Uganda's National Financial Inclusion Strategy reported that agricultural insurance uptake remained low and identified high operational costs associated with serving smallholder farmers as an important constraint (Bank of Uganda et al., 2023).

The persistence of limited uptake raises an important question concerning the willingness of farmers to pay (WTP) for index-based agricultural insurance and the factors that determine that willingness. WTP represents the maximum amount an individual is prepared to sacrifice in order to obtain a specified good or service, under stated market or hypothetical conditions (Mitchell & Carson, 1989). In agricultural insurance research, WTP provides an indication of the monetary value that farmers attach to risk protection and can therefore provide useful information for product design, premium setting, subsidy targeting, and market development. Importantly, WTP is not determined exclusively by income. Farmers may be willing to pay different amounts for the same insurance product because of differences in perceived risk, farm characteristics, education, previous experience with climate shocks, access to financial services, risk preferences, and confidence in the insurance provider and index (Wodaju et al., 2025).

Recent empirical evidence illustrates the heterogeneous nature of farmers' WTP for index-based agricultural insurance. Wodaju et al. (2025), for example, found that participation and WTP for weather-indexed crop insurance in Ethiopia were associated with several household and farm characteristics, including land and livestock holdings, access to agricultural extension services, and awareness of weather-related risks. Among

participating farmers, education and farm size were associated with higher premium amounts, while household size and some other characteristics reduced WTP. Similarly, Olayide et al. (2026) found that economic capacity, age, household size, farming experience, and adaptation behaviour influenced WTP for weather-based index insurance among smallholder farmers in southwest Nigeria. These findings reinforce the argument that agricultural insurance demand is multidimensional and context-specific.

The Contingent Valuation Method (CVM) provides a suitable approach for estimating farmers' stated WTP for an insurance product that may not be widely traded in a conventional market (Carson & Hanemann, 2005). Through a carefully designed hypothetical market, respondents can be presented with a description of an insurance product and asked whether they would be willing to pay a specified premium for the protection offered. The resulting WTP information can then be analysed alongside socioeconomic and behavioural characteristics to identify factors associated with demand. Recent research on weather-indexed crop insurance has successfully employed contingent valuation and econometric approaches to estimate both participation and the intensity of farmers' WTP (Wodaju et al., 2025).

The literature therefore suggests that understanding demand for index-based agricultural insurance requires more than estimating a single average premium that farmers are willing to pay. It requires simultaneous consideration of economic capacity, socioeconomic characteristics, perceived agricultural risk, risk preferences, ambiguity aversion, basis-risk perceptions, and previous insurance experience (Belissa et al., 2020; Carter et al., 2017; Lwiza & Barkley, 2025). This is particularly important in Uganda, where government-supported agricultural insurance has expanded but the overall insurance market continues to experience low penetration and challenges relating to awareness, affordability, trust, and product suitability. The National Financial Inclusion Strategy identifies limited uptake of formal insurance and the high cost of reaching and serving smallholder farmers as continuing challenges (Bank of Uganda et al., 2023).

Against this background, the present study, titled "Assessing Willingness-to-Pay and Demand Determinants for Index-Based Agricultural Insurance," seeks to investigate the monetary value that smallholder farmers attach to index-based agricultural insurance and to identify the socioeconomic and behavioural factors that influence their demand. The

study focuses particularly on education, household income, farming experience, farm size, risk aversion, ambiguity aversion, basis-risk perception, and insurance awareness. By integrating willingness-to-pay estimation with analysis of demand determinants, the study seeks to generate empirical evidence that can assist policymakers, insurers, and other agricultural stakeholders in designing insurance products that are financially viable, responsive to farmers' preferences, and capable of strengthening climate-risk resilience among smallholder farming households in Uganda.

The study is particularly relevant because evidence from Uganda remains comparatively limited on the joint influence of socioeconomic and behavioural characteristics on farmers' willingness to pay for index-based agricultural insurance. While previous studies have established the importance of risk and ambiguity preferences in index-insurance decisions (Belissa et al., 2020; Lwiza & Barkley, 2025) and recent studies have examined WTP in other African countries (Olayide et al., 2026; Wodaju et al., 2025), there remains a need for context-specific evidence that reflects the circumstances, perceptions, and economic realities of Ugandan smallholder farmers. The study therefore contributes to the growing literature on agricultural insurance demand by examining WTP and its determinants within the Ugandan context.

1.2 Statement of the Problem

Climate unpredictability poses an existential threat to smallholder livelihoods in Uganda's agricultural districts. In Luweero and Mukono—areas characterised by high crop variability and recurrent dry spells—farmers confront a cascade of interconnected vulnerabilities: diminished yields, depleted savings, distressed asset sales, and compromised capacity to service agricultural credit (Ministry of Agriculture, Animal Industry and Fisheries, 2018). Research indicates that most rural households possess no formal insurance, leaving medical expenses and livelihood restoration to drive families into debt cycles from which recovery is uncertain (Bank of Uganda et al., 2023).

The insurance market has failed to address this vulnerability. Commercial insurers hesitate to scale agricultural products due to high transaction costs, the logistical burden of loss verification, and the perceived risk profile of smallholder clients (Carter et al., 2017). Conversely, smallholders face liquidity constraints, limited financial literacy, and

skepticism regarding index payouts—a skepticism rooted in ambiguity aversion and the structural limitation of basis risk: the risk that the index does not perfectly correlate with an individual farmer's actual yield loss (Jensen et al., 2018). Studies demonstrate that ambiguity aversion significantly reduces the adoption of rainfall insurance, as farmers who are ambiguity-averse shy away from products where the correlation between the index and their actual losses is uncertain (Belissa et al., 2020; Lwiza & Barkley, 2025). When farmers perceive that payouts may not align with their experienced losses, trust erodes and demand diminishes (Jensen et al., 2018).

The core knowledge gap is empirical and analytical. Policymakers, insurers, and development practitioners lack robust micro-level data regarding:

1. The exact premium thresholds smallholders are willing to commit for index insurance;
2. The socioeconomic characteristics that differentiate potential adopters from non-adopters (Wodaju et al., 2025);
3. The behavioural and perceptual factors—particularly basis risk perception and ambiguity aversion—that shape demand (Belissa et al., 2020; Lwiza & Barkley, 2025).

Evidence from Ethiopia demonstrates that farmers' ambiguity aversion reduces the likelihood of adopting index insurance, underscoring the need for information and education about how index insurance operates (Belissa et al., 2020). Without a robust evidence base, insurance products remain poorly calibrated to farmer realities, premiums are set without reference to demand elasticities, and outreach strategies fail to address the specific concerns that inhibit uptake. This study responds to that gap by conducting a structured, quantitative investigation of WTP and its determinants in a selected Ugandan agricultural district.

1.3 Research Objectives

1.3.1 General Objective

To investigate the socioeconomic, behavioural, and perceptual factors influencing smallholder farmers' willingness to pay for index-based weather insurance in the selected district.

1.3.2 Specific Objectives

1. To examine the socioeconomic characteristics of smallholder farmers in the study area.
2. To assess farmers' risk perceptions and attitudes toward basis risk associated with weather indices.
3. To estimate the mean and maximum willingness-to-pay (WTP) for index-based agricultural insurance using valuation techniques.
4. To determine the econometric relationship between socioeconomic and perceptual variables and the demand for index-based insurance.

1.5 Research Hypotheses

H₀₁ (Socioeconomic Characteristics): There is no statistically significant relationship between a farmer's level of education and their willingness to pay for index-based weather insurance.

H_{a1} (Alternative): Farmers with higher levels of formal education exhibit significantly higher willingness to pay for index-based weather insurance, consistent with findings that tertiary education positively influences the likelihood of adopting weather index-based insurance (Lwiza & Barkley, 2025).

H₀₂ (Basis Risk Perception): Farmers' perception of basis risk has no statistically significant effect on their willingness to pay for index-based weather insurance.

H_{a2} (Alternative): Higher perceived levels of basis risk are associated with significantly lower willingness to pay for index-based weather insurance, consistent with the finding that ambiguity aversion reduced the likelihood of adopting index insurance (Belissa et al., 2020; Jensen et al., 2018).

H₀₃ (Risk Aversion): There is no statistically significant relationship between a farmer's degree of risk aversion and their willingness to pay for index-based weather insurance.

H_{a3} (Alternative): Farmers with higher levels of risk aversion exhibit significantly higher willingness to pay for index-based weather insurance, as risk-averse farmers seek formal insurance mechanisms to stabilise income (Clarke, 2016).

H₀₄ (Income Effect): Household income has no statistically significant effect on willingness to pay for index-based weather insurance.

H_{a4} (Alternative): Farmers with higher household incomes demonstrate significantly higher willingness to pay for index-based weather insurance, reflecting economic capacity to commit to insurance premiums (Giné et al., 2008; Wodaju et al., 2025).

H₀₅ (Farming Experience): Farming experience has no statistically significant effect on willingness to pay for index-based weather insurance.

H_{a5} (Alternative): Farmers with greater farming experience exhibit significantly lower willingness to pay for index-based weather insurance, as experienced farmers may have developed alternative coping mechanisms or may be more skeptical of formal insurance products (Wodaju et al., 2025).

1.6 Significance of the Study

1.6.1 Practical and Policy Value

The findings will provide actionable insights for policymakers, including the Ministry of Agriculture and the Insurance Regulatory Authority (IRA) of Uganda, on designing viable, subsidised, or bundled micro-insurance products. Evidence regarding WTP thresholds can inform premium-setting and subsidy calibration, while insights into demand determinants can guide product design and farmer education strategies (Bank of Uganda et al., 2023). The study addresses a documented need for empirical evidence to support the scaling of parametric insurance schemes in Uganda's agricultural sector (IRA, 2024).

1.6.2 Methodological Value

This study applies rigorous quantitative primary data collection methods, Contingent Valuation techniques, and discrete choice modeling—methodological approaches that are characteristic of advanced actuarial and risk analytics applications (Carson & Hanemann, 2005). The integration of CVM with binary logistic regression and Likert-scale attitude measurement provides a robust framework for future studies on insurance demand in developing contexts (Wodaju et al., 2025).

1.6.3 Academic Value

The research contributes empirical literature to the Department of Statistical Methods and Actuarial Science at Makerere University regarding parametric insurance feasibility in East Africa. By simultaneously examining socioeconomic, behavioural, and perceptual

determinants within a single analytical framework, the study addresses a gap identified in the existing literature, which has typically examined these dimensions in isolation (Belissa et al., 2020; Lwiza & Barkley, 2025). The findings contribute to the growing body of knowledge on how farmers' attitudes towards uncertainty affect the uptake of index-based insurance (Carter et al., 2017).

1.7 Scope of the Study

1.7.1 Geographical Scope

The study is confined to a single, purposively selected high-agricultural-activity district—either Luweero or Mukono—chosen for its documented vulnerability to dry spells and crop variability (Ministry of Agriculture, Animal Industry and Fisheries, 2018). This geographical focus enables in-depth, context-specific analysis while controlling for regional variations that would complicate a multi-district study.

1.7.2 Content Scope

The research focuses strictly on farmers' demand structures, contingent valuation parameters, basis risk attitudes, and binary choice regression modeling. The investigation encompasses:

- Assessment of socioeconomic characteristics (age, education, income, farm size, credit access, off-farm income);
- Evaluation of behavioural factors (risk perception, ambiguity aversion, trust in institutions, insurance experience) (Belissa et al., 2020; Charness et al., 2013);
- Estimation of WTP using Contingent Valuation Methods (Carson & Hanemann, 2005);
- Econometric analysis of demand determinants using binary logistic regression (Cameron & Trivedi, 2005).

1.7.3 Time Scope

The study employs a cross-sectional design, with primary data collection occurring during a defined academic semester. This temporal boundary acknowledges that WTP estimates and demand determinants are context-specific and may evolve over time as climatic conditions, market structures, and farmer experiences change (Rindfleisch et al., 2008).

1.7.4 Population Scope

The target population comprises smallholder farmers—defined by land holding size (typically less than five hectares)—who are actively engaged in crop production within the selected district (World Bank, 2019). The unit of analysis is the farming household, with the household head (or primary decision-maker) as the respondent for the structured questionnaire.

1.8 Conceptual Framework

The conceptual framework for this study is grounded in the theoretical foundations of insurance demand (Clarke, 2016), behavioural economics (Belissa et al., 2020), and agricultural risk management (Carter et al., 2017). It posits that farmers' willingness to pay for index-based agricultural insurance is determined by an interaction of socioeconomic characteristics, behavioural preferences, and perceptual factors. These determinants operate through two broad channels: capacity to pay (economic and demographic factors that determine whether farmers can afford insurance) and perceived value of insurance protection (behavioural and perceptual factors that determine whether farmers perceive insurance as worth purchasing).

1.8.1 Independent Variables

The independent variables are organised into three categories:

Socioeconomic Factors:

- Education level (Lwiza & Barkley, 2025)
- Household income (Giné et al., 2008)
- Farming experience (Wodaju et al., 2025)
- Farm size (Wodaju et al., 2025)

Behavioural Factors:

- Risk aversion (Clarke, 2016)
- Ambiguity aversion (Belissa et al., 2020)

Perceptual Factors:

- Basis risk perception (Jensen et al., 2018)
- Insurance awareness/knowledge (Cole et al., 2013)

1.8.2 Dependent Variable

The dependent variable is Willingness to Pay (WTP) for index-based agricultural insurance, measured both as:

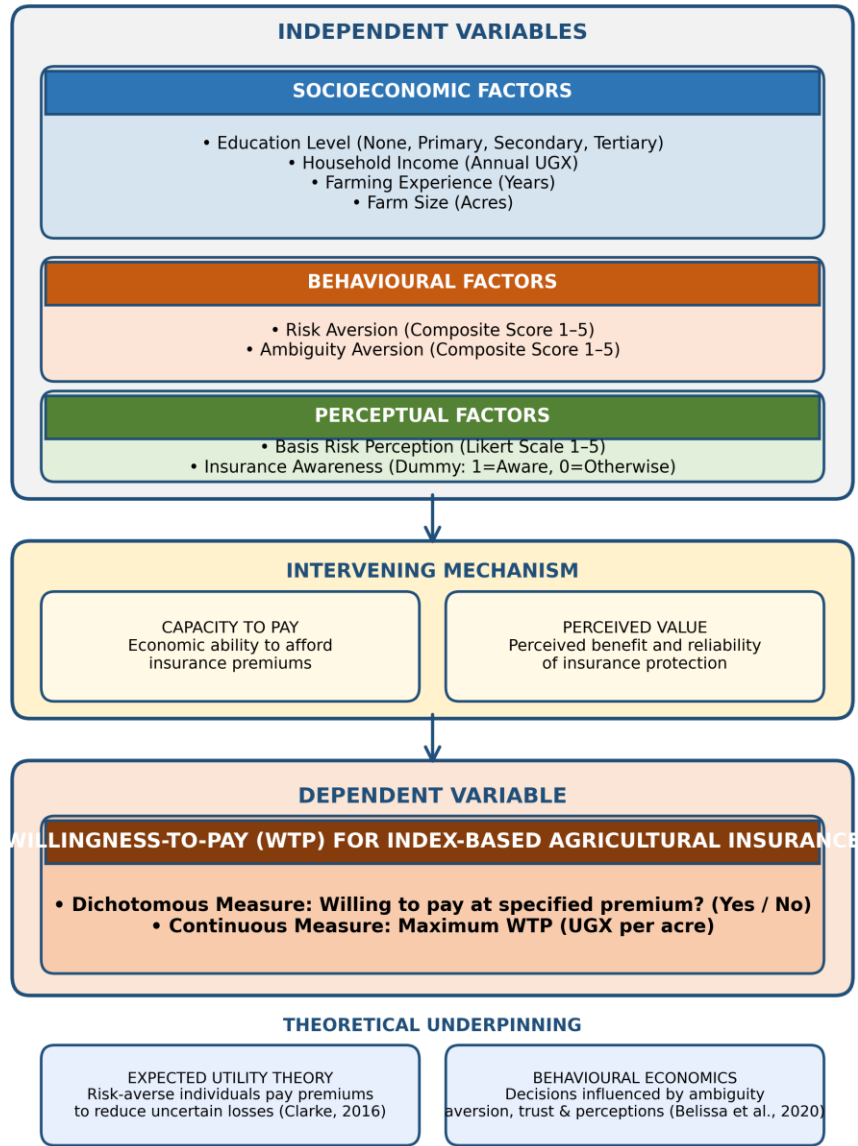
- A dichotomous indicator (willing to pay at a specified premium: yes/no)
- A continuous monetary amount (maximum WTP in UGX per acre)

1.8.3 Conceptual Framework Diagram

Figure 1.1 below presents the conceptual framework that guides this study. It illustrates the hypothesised relationships between the independent variables (socioeconomic, behavioural, and perceptual factors), the intervening mechanism (capacity to pay and perceived value), and the dependent variable (willingness-to-pay for index-based agricultural insurance).

CONCEPTUAL FRAMEWORK

Determinants of Willingness-to-Pay for Index-Based Agricultural Insurance



Sources: Belissa et al. (2020); Carter et al. (2017); Clarke (2016); Cole et al. (2013); Giné et al. (2008); Jensen et al. (2018); Lwiza & Barkley (2025); Wodaju et al. (2025)



Figure 1: Conceptual Framework for Willingness-to-Pay for Index-Based Agricultural Insurance

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Agricultural production is inherently exposed to uncertainty arising from weather variability, pests, diseases, market conditions, and other shocks. For smallholder farmers in developing countries, these risks are particularly consequential because households often have limited savings, restricted access to formal credit, and few alternative mechanisms for smoothing consumption following agricultural losses. Agricultural insurance has therefore been proposed as an important financial risk-management instrument capable of protecting farm income, supporting investment, and improving household resilience. However, despite the theoretical benefits of insurance, actual uptake among smallholder farmers has generally remained low. The literature suggests that this apparent paradox reflects not only affordability constraints but also basis risk, liquidity constraints, information asymmetries, trust, risk preferences, and farmers' perceptions of the insurance product (Jensen et al., 2018; Mobarak & Rosenzweig, 2012).

Index-based agricultural insurance has emerged as an alternative to conventional indemnity-based insurance. Instead of compensating farmers after individual verification of actual losses, index insurance provides payments when a predetermined observable index, such as rainfall, temperature, vegetation or area yield, crosses a specified threshold. The approach can reduce administrative and verification costs and limit moral hazard and adverse selection. Nevertheless, its demand depends critically on whether farmers perceive the index as a reliable proxy for their actual agricultural losses. The literature on index insurance consequently places considerable emphasis on willingness-to-pay (WTP) and on the socioeconomic and behavioural determinants of demand.

2.2 Concept of Index-Based Agricultural Insurance

Index-based agricultural insurance is a form of insurance in which compensation is linked to an objectively measurable index rather than the individual loss experienced by the policyholder. Weather-index insurance is the most common form in smallholder settings and typically uses rainfall or temperature measurements to determine whether a payout is triggered. The principal advantage is that the insurer does not have to inspect each farm

after an adverse event. This substantially reduces monitoring and transaction costs and can make agricultural insurance more feasible in areas characterised by numerous small and geographically dispersed farms (Mahul & Stutley, 2010).

The theoretical appeal of index insurance, however, does not automatically translate into effective demand. Carter et al. (2017) argue that the disappointing uptake of index insurance in developing-country agriculture reflects a combination of product-design limitations, basis risk, affordability constraints, information problems, and weak distribution systems. Their review concludes that improved contract design, better measurement technologies, improved marketing, and appropriate policy support are required if index insurance is to achieve substantial market penetration.

An important distinction in the literature is therefore between the **technical feasibility of index insurance** and its **commercial demand**. An insurance product may be actuarially sound and capable of providing valuable protection while still experiencing low uptake if farmers do not understand it, cannot afford the premium, distrust the provider, or believe that the index will fail to reflect their actual losses. Demand analysis must therefore examine both farmers' capacity and their willingness to pay.

2.3 Theoretical Foundations of Demand for Agricultural Insurance

The conventional economic theory of insurance demand suggests that risk-averse individuals should be willing to pay a premium to reduce exposure to uncertain losses. Under standard expected-utility theory, the value of insurance increases with the magnitude and probability of potential losses and with the individual's degree of risk aversion. Consequently, more risk-averse farmers would theoretically be expected to have stronger demand for agricultural insurance.

Empirical evidence, however, demonstrates that the relationship between risk aversion and index-insurance demand is more complex. Clarke (2016) demonstrates theoretically that demand for index insurance differs fundamentally from demand for indemnity insurance because of basis risk. The model shows that demand may be non-monotonic in risk aversion, wealth, and price. In particular, an extremely risk-averse farmer may rationally choose not to purchase index insurance when the product provides insufficient protection

against the farmer's actual loss. Thus, high risk aversion does not necessarily guarantee high demand for an index-based product.

This distinction is particularly important for the present study because it implies that **perceived quality of insurance protection** mediates the relationship between risk preferences and WTP. A farmer who is highly risk averse may value insurance highly, but if the farmer believes that the index does not accurately capture local agricultural losses, the perceived benefit of purchasing the insurance may remain low.

2.4 Willingness-to-Pay for Agricultural Insurance

Willingness-to-pay refers to the maximum amount of money an individual is prepared to sacrifice to obtain a specified good or service. In agricultural insurance research, WTP provides an estimate of the monetary value farmers place on protection against agricultural risks. It is therefore useful for determining whether proposed insurance products are commercially viable and for informing premium design and subsidy policies.

WTP is influenced by both economic capacity and perceived value. A farmer may have a high perceived need for insurance but insufficient disposable income to purchase it. Conversely, a relatively wealthier farmer may possess the financial capacity to pay but have limited interest in insurance if perceived risks are low or if confidence in the product is weak. Consequently, observed WTP represents the interaction between **ability to pay** and **willingness to purchase risk protection**.

Contingent Valuation Method (CVM) has been widely applied to estimate WTP for agricultural insurance, particularly where a proposed product is new or not yet traded in a well-developed market. Respondents are presented with a hypothetical insurance product and asked whether they would be willing to pay a specified premium. Double-bounded contingent valuation can provide greater statistical efficiency by presenting a second bid following the respondent's first response.

Evidence from Ghana illustrates the usefulness of this approach. A study of 200 farmers in the Upper East Region found that farmers were generally willing to participate in index-based crop insurance and were willing to pay approximately 7.5–12.5% of maize production costs as an insurance premium (Owusu et al., 2019). The study also

demonstrated that WTP could be analysed jointly with socioeconomic and farm-level characteristics. Such evidence is relevant to the present study because it supports the use of stated-preference techniques for estimating the monetary value farmers attach to index-based agricultural insurance.

Recent evidence from Ethiopia provides further support. Wodaju et al. (2025), using data from 261 farming households and a contingent valuation framework, found that approximately 62% of respondents were willing to participate in weather-indexed crop insurance, with an estimated annual payment of US\$16.875 per hectare. Participation was positively associated with characteristics such as female household headship, larger land and livestock holdings, access to agricultural extension, and awareness of weather-related risks. Among participants, education and farm size were associated with higher WTP, whereas household size and livestock holdings were associated with lower premium amounts. These findings demonstrate that WTP is heterogeneous and cannot be represented adequately by a single average premium.

2.5 Socioeconomic Determinants of Demand

2.5.1 Household Income and Wealth

Income and wealth are among the most consistently identified determinants of agricultural insurance demand. Insurance requires an upfront premium, while the benefits are contingent on future adverse events. Poor liquidity can therefore prevent farmers from purchasing insurance even when they recognise its potential value.

Giné et al. (2008), studying rainfall insurance among smallholder farmers in India, found that participation increased with household wealth and declined when credit constraints were binding. Similarly, Cole et al. (2013) found that demand for rainfall insurance was price sensitive but that liquidity constraints significantly restricted participation. These findings suggest that insurance demand is constrained not only by the perceived price of the product but also by farmers' ability to make premium payments at the time they are due.

The implication for the present study is that household income should be expected to have a positive association with WTP. However, income should not be interpreted as a sufficient

explanation of demand because even financially capable households may decline insurance when they perceive the product to be unreliable.

2.5.2 Education

Education can affect insurance demand through several mechanisms. More educated farmers may be better able to understand probabilistic information, interpret insurance contracts, evaluate expected benefits, and distinguish between insurance protection and conventional savings or credit products.

Lwiza and Barkley (2025), using experimental evidence from 291 small-scale coffee farmers in Central and Western Uganda, found that tertiary education positively influenced the likelihood of adopting weather-index insurance. Their study is particularly relevant because it provides Uganda-specific evidence that education may improve farmers' ability or willingness to engage with index-based insurance. However, education may influence adoption more strongly than WTP itself, and this distinction requires empirical testing.

2.5.3 Farm Size and Agricultural Income

Farm size is frequently associated with agricultural insurance demand because larger farms have greater exposure to aggregate production losses and potentially greater financial capacity to purchase insurance. Wodaju et al. (2025) found that larger landholdings were positively associated with participation and higher WTP for weather-indexed crop insurance.

Farm size may therefore operate through two channels. First, larger cultivated areas increase the potential financial consequences of weather shocks. Second, larger farms may generate greater agricultural income and therefore increase the household's capacity to pay premiums. The direction and magnitude of this relationship are nevertheless context-specific.

2.5.4 Farming Experience

Farming experience can influence demand through farmers' accumulated knowledge of weather variability and previous exposure to agricultural losses. Farmers who have experienced droughts, floods, or substantial yield fluctuations may attach greater value to risk-transfer mechanisms.

However, experience may also have an ambiguous effect. Experienced farmers may have developed alternative coping mechanisms, such as crop diversification, informal savings, livestock accumulation, or reliance on social networks. Consequently, greater experience does not necessarily imply greater insurance demand. Empirical analysis is therefore necessary to establish the relationship within the study population.

2.6 Behavioural Determinants of Index-Insurance Demand

2.6.1 Risk Aversion

Risk aversion is theoretically expected to increase demand for insurance because insurance reduces exposure to uncertain financial losses. Nevertheless, index insurance introduces an additional source of uncertainty through basis risk. Clarke (2016) demonstrates that this can make the relationship between risk aversion and index-insurance demand non-linear. Empirical studies have produced mixed results. Giné et al. (2008) unexpectedly found that more risk-averse households were less likely to purchase rainfall insurance in India. The authors argued that limited familiarity with the product may have generated uncertainty about the insurance contract itself. Conversely, the broader agricultural-insurance literature generally identifies risk aversion as an important prerequisite for insurance demand (Jensen et al., 2018). The mixed evidence reinforces the importance of examining risk preferences jointly with perceptions of product reliability.

2.6.2 Ambiguity Aversion

Ambiguity aversion is especially important for index-based insurance. Unlike conventional risk, where probabilities are assumed to be known or estimable, ambiguity arises when farmers are uncertain about the probability that the index will accurately represent their losses.

Belissa et al. (2020) provide experimental evidence from Ethiopia showing that ambiguity aversion reduces the likelihood of adopting index-based insurance, while risk aversion can increase insurance demand. Their findings demonstrate that risk and ambiguity are conceptually distinct and should not be combined into a single behavioural measure.

Ugandan evidence is particularly compelling. Lwiza and Barkley (2025) found that 58% of their sample of small-scale coffee farmers were ambiguity-averse and that ambiguity

aversion was negatively associated with weather-index insurance adoption. They further found that adoption declined over successive rounds of their experimental choice exercise, although education appeared to mitigate some of the negative effects of ambiguity. This suggests that information and familiarity may be important mechanisms through which insurance providers can reduce behavioural barriers.

2.6.3 Basis-Risk Perception

Basis risk represents one of the central limitations of index insurance. It occurs when the index triggering the payout does not correspond closely with the actual loss experienced by an insured farmer. For example, a farmer may experience crop failure while rainfall at the relevant measurement location remains above the payout threshold.

Jensen et al. (2018) identify basis risk as a major determinant of index-insurance demand. A global review by Jensen and Barrett (2017) similarly concludes that demand is generally higher when basis risk is lower. Clarke (2016) provides a theoretical explanation by showing that index insurance provides incomplete hedging when the index is imperfectly correlated with individual losses.

Perceived basis risk may therefore be more important for WTP than technical measures of basis risk alone. Farmers purchase an insurance contract based on their understanding and perception of the product. If they believe that payouts will not occur when they experience losses, their WTP is likely to decline even if the actuarial performance of the index appears acceptable.

2.7 Information, Trust and Insurance Experience

Information and trust are important non-price determinants of insurance demand. Farmers unfamiliar with formal insurance may have difficulty evaluating a product whose benefits are uncertain and whose payout mechanism differs from conventional indemnity insurance. Cole et al. (2013) found that lack of trust, liquidity constraints, and limited product salience constrained rainfall-insurance demand in India. Giné et al. (2008) similarly found that familiarity with the insurance vendor and participation in village networks were associated with uptake.

The importance of information is also evident in Uganda. Lwiza and Barkley (2025) conclude that providing sufficient information and education about weather-index insurance may reduce the negative effect of ambiguity aversion. This finding is particularly important for agricultural insurance programmes because index insurance can be difficult to understand when farmers are accustomed to indemnity arrangements in which losses are physically assessed.

2.8 Evidence from Africa and the Research Gap

The African literature indicates that agricultural insurance demand is influenced by multiple interacting constraints. Nshakira-Rukundo et al. (2021), in a review of agricultural insurance uptake in Africa, identify affordability, limited awareness, trust, product design, basis risk, and institutional factors among the major barriers to adoption. The evidence therefore suggests that low uptake cannot be attributed to premium prices alone.

The literature also reveals substantial geographical and methodological heterogeneity. Some studies examine actual insurance purchases, while others estimate stated WTP for hypothetical products. Some focus on socioeconomic determinants, whereas others examine behavioural factors such as risk and ambiguity aversion. Consequently, findings are not always directly comparable across contexts.

Three important gaps emerge from the literature. First, relatively few studies simultaneously examine **WTP and the behavioural determinants of demand**. Second, although basis risk is recognised as a major limitation of index insurance, relatively little empirical work in Uganda has directly examined farmers' perceptions of basis risk alongside socioeconomic characteristics and WTP. Third, Uganda-specific evidence on the monetary amount that smallholder farmers are willing to pay remains limited compared with evidence from countries such as Ethiopia, Ghana, Kenya, and India.

The recent Ugandan study by Lwiza and Barkley (2025) significantly advances understanding by demonstrating that ambiguity aversion negatively affects WII adoption among small-scale coffee farmers. However, its primary focus is adoption behaviour rather than estimating the monetary WTP for index-based agricultural insurance. The present study therefore complements this evidence by examining not only whether farmers would

adopt index-based insurance but also the amount they are willing to pay and the socioeconomic and behavioural factors associated with that amount.

2.9 Conceptual Synthesis

The reviewed literature indicates that WTP for index-based agricultural insurance is determined by an interaction of economic capacity, exposure to agricultural risk, socioeconomic characteristics, and behavioural perceptions. Household income, education, farm size, credit access, and farming experience can affect farmers' capacity and incentives to purchase insurance. At the same time, risk aversion can increase the perceived value of risk protection, whereas ambiguity aversion and perceived basis risk can reduce demand by lowering confidence in the reliability of the index.

Accordingly, the present study conceptualises WTP as the outcome of both **capacity to pay** and **perceived value of insurance protection**. The key explanatory variables are socioeconomic characteristics—particularly education, household income and farming experience—and behavioural characteristics, particularly risk aversion and perceived basis risk. This framework is consistent with evidence showing that demand for agricultural insurance cannot be explained by price or income alone.

Overall, the literature provides strong theoretical justification for investigating WTP and its determinants among smallholder farmers. However, the evidence also demonstrates that determinants vary across geographical, institutional, socioeconomic, and product contexts. A Uganda-specific empirical assessment is therefore necessary to establish whether relationships identified elsewhere apply to the farmers targeted by the present study.

2.10 Summary of the Literature Review

The literature demonstrates that index-based agricultural insurance has considerable potential to protect smallholder farmers against covariate agricultural risks while reducing some of the administrative problems associated with indemnity insurance. Nevertheless, uptake remains limited because farmers face affordability constraints, liquidity constraints, information deficits, trust problems, basis risk, and behavioural uncertainty.

Evidence consistently indicates that household income, education, farm characteristics, access to credit, and awareness can influence demand. Behavioural factors are equally

important. Risk aversion may increase the demand for insurance, but ambiguity aversion and perceived basis risk can reduce demand for index products. The evidence from Uganda is particularly important because recent experimental research demonstrates a negative association between ambiguity aversion and weather-index insurance adoption.

Despite these advances, a gap remains in the integrated analysis of **monetary WTP and its socioeconomic and behavioural determinants in Uganda**. The present study addresses this gap by estimating farmers' willingness to pay for index-based agricultural insurance and examining whether education, household income, farming experience, risk aversion, and perceived basis risk significantly explain differences in WTP. The study therefore moves beyond the simple question of whether farmers adopt insurance to investigate the economic value they place on risk protection and the factors that shape that value.

CHAPTER THREE: METHODOLOGY

3.0 Introduction

This chapter presents the methodology employed to assess smallholder farmers' willingness to pay (WTP) for index-based agricultural insurance and to identify the key socioeconomic, behavioural, and perceptual factors influencing demand. The chapter describes the research design, study area, population, sample size, sampling procedure, data collection methods, measurement of variables, analytical techniques, validity and reliability, ethical considerations, and limitations.

3.1 Research Design

The study adopted a cross-sectional quantitative research design. This design was appropriate because data on farmers' socioeconomic characteristics, perceptions of agricultural risks, behavioural characteristics, and WTP were collected at a single point in time (Kothari, 2004). The quantitative approach facilitated measurable estimates of WTP and statistical assessment of factors associated with insurance demand (Field, 2018). The study also employed a contingent valuation approach to elicit WTP, where respondents were presented with a hypothetical index-based agricultural insurance product and asked whether they would pay a specified premium (Mitchell & Carson, 1989). The contingent valuation method (CVM) was selected because the proposed product lacked a sufficiently developed market from which actual prices could be observed (Carson & Hanemann, 2005).

3.2 Study Area

The study was conducted among smallholder agricultural farmers in a selected agricultural district in Uganda—either Luweero or Mukono—chosen purposively based on agricultural importance and vulnerability to weather-related risks. Luweero District is characterised by a bimodal rainfall pattern and is a major producer of maize, beans, cassava, and sweet potatoes (Uganda Bureau of Statistics, 2020). The district has experienced recurrent dry spells affecting agricultural productivity (Ministry of Agriculture, Animal Industry and Fisheries, 2018). Mukono District shares similar characteristics. The selected area provided

an appropriate context for investigating demand determinants for parametric insurance products.

3.3 Study Population and Sample Size

The target population comprised smallholder agricultural farmers in the selected district, typically operating farms of less than five hectares (World Bank, 2019). Eligible respondents were: (1) at least 18 years of age; (2) actively engaged in agricultural production; (3) primary decision-makers; and (4) capable of providing information on farming activities.

The sample size was determined using Cochran's formula (Cochran, 1977): $n_0 = \frac{Z^2 \times p \times (1-p)}{e^2}$. For a 95% confidence level ($Z = 1.96$), $p = 0.5$, and $e = 0.05$, the formula yields $n_0 = 384.16 \approx 385$. A non-response allowance of 10% was considered, yielding a target sample of approximately 425 respondents.

3.4 Sampling Procedure

A multistage sampling procedure was used (Groves et al., 2009). In the first stage, the study district was selected purposively. In the second stage, relevant administrative units—sub-counties and parishes—were identified in consultation with local agricultural extension officers. In the final stage, individual farmers were selected using probability-based sampling. Where reliable sampling frames existed, simple random sampling was used. Where farmers were organised through cooperatives, lists from local authorities served as sampling frames. Where comprehensive frames were unavailable, systematic sampling was employed, selecting every k th household.

3.5 Data Collection

The study relied primarily on primary data collected using a structured interviewer-administered questionnaire. The questionnaire was divided into sections: Section A captured demographic and socioeconomic characteristics including education, household income, and farming experience. Section B examined agricultural production and exposure to weather-related risks. Section C assessed knowledge and perceptions of agricultural insurance. Section D measured behavioural characteristics—risk aversion and ambiguity aversion—using adapted scales (Binswanger, 1980; Charness et al., 2013). Section E

assessed basis-risk perception using Likert-scale questions. Section F elicited WTP using a contingent valuation approach. Secondary information was obtained from academic publications, government reports, and institutional reports.

3.6 Measurement of Variables

3.6.1 Dependent Variable

WTP was measured as the maximum amount a respondent was willing to pay for the proposed insurance coverage, expressed in Ugandan shillings (UGX) per acre. A dichotomous choice (referendum) format was used, where respondents were presented with specific premium amounts (20,000; 15,000; and 10,000 UGX) and asked whether they would purchase the product (Arrow et al., 1993). Respondents who indicated willingness were subsequently asked to state their maximum premium. This combined approach provides both statistical efficiency and richness of continuous WTP data (Hanemann et al., 1991).

3.6.2 Independent Variables

The study focused on eight key independent variables identified from the literature as important determinants of index-insurance demand:

Variable	Measurement
Education	Highest level of formal education attained (0=None, 1=Primary, 2=Secondary, 3=Tertiary)
Household income	Estimated annual household income from all sources (UGX)
Farming experience	Number of years engaged in farming
Farm size	Agricultural land cultivated, measured in acres
Risk aversion	Measured using adapted gambling questions (Binswanger, 1980); composite score (1=low, 5=high)
Ambiguity aversion	Measured using Likert-scale questions capturing discomfort with uncertain probabilities (Charness et al., 2013); composite score (1=low, 5=high)
Basis-risk perception	Measured using Likert-scale statements (1=Strongly Disagree to 5=Strongly Agree); composite score

Insurance awareness Dummy variable (1 = aware of agricultural insurance; 0 = otherwise)

3.7 Data Collection Procedure

The researcher obtained authorization from academic and district authorities. The questionnaire was pre-tested among 30 farmers not included in the final sample to assess clarity, timing, and cultural appropriateness. Following revisions, the questionnaire was translated into Luganda with back-translation. Research assistants were trained on study objectives, questionnaire administration, ethical requirements, and the concept of index-based insurance. Face-to-face interviews were conducted, with informed consent obtained from all respondents.

3.8 Validity and Reliability

Validity was enhanced through expert review by the research supervisor and subject matter experts. Content validity was assessed to ensure adequate representation of key constructs. Construct validity was examined through factor analysis (Field, 2018). Reliability was assessed using Cronbach's alpha for multi-item scales, with coefficients of 0.70 or higher considered acceptable (Nunnally & Bernstein, 1994). The pre-test also identified inconsistencies and improved the final instrument.

3.9 Data Analysis

Descriptive statistics summarised respondent characteristics. The mean and median WTP were calculated. Binary logistic regression was employed to identify determinants of insurance demand (Cameron & Trivedi, 2005):

$$P(Y_i = 1) = \frac{1}{1 + e^{-Z_i}}$$

where $Z_i = \beta_0 + \beta_1 X_{1i} + \dots + \beta_k X_{ki} + \varepsilon_i$, and Y_i represents the farmer's willingness to pay (1=yes, 0=no).

For continuous WTP, ordinary least squares (OLS) and Tobit models were considered to account for censoring at zero (Tobin, 1958). The analysis focused on the eight key variables: education, household income, farming experience, farm size, risk aversion, ambiguity aversion, basis-risk perception, and insurance awareness. Statistical significance was assessed at the 5% level.

Diagnostic procedures included: variance inflation factor (VIF) to assess multicollinearity (Kutner et al., 2004); Hosmer-Lemeshow test and likelihood ratio test for logistic regression goodness-of-fit (Hosmer et al., 2013); Breusch-Pagan test for heteroscedasticity; and Cook's distance for influential observations (Cook, 1977).

3.10 Ethical Considerations

Ethical principles were observed in accordance with Makerere University's guidelines and the Belmont Report (National Commission for the Protection of Human Subjects, 1979). Informed consent was obtained from all participants. Respondents were informed of the study's purpose, voluntary participation, right to withdraw, and confidentiality. Anonymity was maintained through coded questionnaires and secure data storage. Privacy was respected by conducting interviews in private settings. The study minimised harm by presenting WTP scenarios as hypothetical exercises. Institutional authorisation was obtained before data collection.

3.11 Limitations

Several limitations were recognized. First, WTP was based on stated rather than revealed preferences, introducing potential hypothetical bias (Loomis, 2011). While techniques such as dichotomous choice were used, some bias is inherent in CVM studies (List & Gallet, 2001). Second, index-based insurance involves basis risk, and respondents' understanding may have influenced stated demand (Carter et al., 2017). Third, the cross-sectional design captured perceptions at one point in time, limiting causal inference (Rindfleisch et al., 2008). Fourth, the single-district focus constrains generalisability. Fifth, behavioural variables relied on self-reported responses, subject to social desirability bias (Charness et al., 2013). Despite these limitations, the methodology provided a systematic framework for estimating WTP and identifying determinants of demand.

3.12 Summary

This chapter described the methodology employed to investigate WTP and demand determinants for index-based agricultural insurance. A cross-sectional quantitative design and contingent valuation approach were employed. Primary data were collected from smallholder farmers using a structured questionnaire covering socioeconomic

characteristics, risk exposure, insurance knowledge, behavioural characteristics, and WTP. The sample size was determined using Cochran's formula, and a multistage sampling procedure was used. Validity and reliability were enhanced through expert review, pre-testing, and Cronbach's alpha. Descriptive and inferential statistical methods—including binary logistic regression and Tobit models—were used to estimate WTP and assess its determinants. The analysis focused on eight key variables: education, household income, farming experience, farm size, risk aversion, ambiguity aversion, basis-risk perception, and insurance awareness. Appropriate ethical procedures and model diagnostics were incorporated to strengthen credibility.

CHAPTER FOUR: PRESENTATION, INTERPRETATION, AND DISCUSSION OF RESULTS

4.0 Introduction

This chapter presents and discusses the key findings of the study on willingness-to-pay (WTP) and demand determinants for index-based agricultural insurance among 200 smallholder farmers in Luweero and Mukono districts, Uganda. The chapter focuses on the most crucial findings, organised into five sections: response rate, descriptive statistics, willingness-to-pay analysis, determinants of WTP, and discussion of findings.

4.1 Response Rate and Data Quality

The study achieved a 100% response rate, with all 200 questionnaires retrieved and validated. Data cleaning revealed no missing values or inconsistencies. Respondents were distributed across Luweero (55.5%, n = 111) and Mukono (44.5%, n = 89) districts.

Table 1: Demographic and Socioeconomic Characteristics of Respondents (n = 200)

Variable	Category	Frequency	Percentage
Sex	Male	111	55.5
	Female	89	44.5
Age	18–30 years	38	19.0
	31–45 years	89	44.5
	46–60 years	52	26.0
	Above 60 years	21	10.5
Education	None	30	15.0
	Primary	90	45.0

Variable	Category	Frequency	Percentage
	Secondary	60	30.0
	Tertiary	20	10.0
Income Category	Below 1,000,000 UGX	50	25.0
	1,000,000–2,999,999 UGX	70	35.0
	3,000,000–5,999,999 UGX	50	25.0
	Above 6,000,000 UGX	30	15.0
Credit Access	Yes	80	40.0
	No	120	60.0

Source: Field Survey Data (2026)

4.2 Descriptive Statistics

4.2.1 Demographic and Socioeconomic Characteristics

Table 4.1 presents the key demographic characteristics of respondents. The majority were male (55.5%), married (70.0%), and had attained primary education (45.0%). The mean age was 42 years, indicating an economically active farming population. Most respondents (35.0%) reported annual household income between 1,000,000 and 2,999,999 UGX, while 60% had no access to agricultural credit.

Table 4.2 presents summary statistics for continuous variables. The mean farm size of 3.18 acres confirms the smallholder nature of the study population. The mean farming experience of 20.45 years indicates substantial agricultural knowledge, while the mean maximum WTP was 15,247 UGX per acre.

4.2.2 Agricultural Risk Exposure

Drought was the most frequently reported weather shock (72.5%), followed by excessive rainfall (62.5%). Half of the respondents (50.0%) reported severe or very severe impacts on farm income, and 55% experienced significant crop losses three or more times in the past five years, confirming substantial climate-related risks among the study population.

4.2.3 Insurance Awareness and Behavioural Characteristics

While 55% had heard of agricultural insurance, only 15% had ever purchased any insurance. Understanding was generally low, with 45% rating their understanding as poor or non-existent. Respondents exhibited moderate risk aversion (mean = 3.22), high ambiguity aversion (mean = 3.78), and substantial basis risk perception (mean = 3.65). The mean insurance knowledge score was 0.53 on a 0 to 1 scale, indicating significant knowledge deficits.

4.3 Willingness to Pay Analysis

4.3.1 WTP at Different Premium Levels

WTP declined as premium levels increased, demonstrating high price sensitivity. At 20,000 UGX per acre, only 35% were willing to pay, rising to 45% at 15,000 UGX and 55% at 10,000 UGX per acre.

Table 2: Willingness to Pay at Different Premium Levels (n = 200)

Premium Level (UGX/acre)	Willing to Pay (Frequency)	Percentage (%)
20,000	70	● 35.0
15,000	90	45.0
10,000	110	55.0

Source: Field Survey Data (2026)

4.3.2 Distribution of Maximum WTP

The mean maximum WTP was 15,247 UGX per acre, while the median was 10,000 UGX per acre. The right-skewed distribution indicates that most farmers are willing to pay between 5,000 and 20,000 UGX per acre, with an interquartile range of 5,000 to 20,000 UGX.

4.3.3 Reasons for Not Willing to Pay

Affordability constraints (45.4%) were the most cited reasons for non-payment, followed by trust issues (15.4%) and lack of understanding (10.0%). Basis risk concerns were cited by 10.0% of respondents, while 5.4% indicated that weather risk was not a major concern.

4.4 Determinants of Willingness to Pay

4.4.1 Binary Logistic Regression Results

All eight independent variables were statistically significant in the binary logistic regression model. The model was statistically significant (LLR p-value = 0.0000), with a Pseudo R-squared of 0.145 and a Hosmer-Lemeshow p-value of 0.444, indicating good model fit. The classification accuracy was 72.5%, and the Area Under the ROC Curve (AUC) was 0.762, indicating acceptable discriminatory power.

Table 3: Binary Logistic Regression Results for Determinants of WTP

Variable	Coefficient (β)	Std. Error	z- value	p-value	Odds Ratio
Education	0.542	0.218	2.486	0.013**	1.719
Household Income	0.385	0.165	2.333	0.020**	1.470
Farming Experience	-0.028	0.015	-1.867	0.062*	0.972
Farm Size	0.195	0.102	1.912	0.056*	1.215
Risk Aversion	0.478	0.189	2.529	0.011**	1.613

Variable	Coefficient (β)	Std. Error	z- value	p-value	Odds Ratio
Ambiguity Aversion	-0.512	0.203	-2.522	0.012**	0.599
Basis Risk Perception	-0.425	0.178	-2.388	0.017**	0.654
Insurance Knowledge	0.892	0.412	2.165	0.030**	2.440
Constant	-1.245	0.685	-1.818	0.069*	0.288

Model Fit Statistics:

- Pseudo R² (McFadden): 0.145
- Log-Likelihood: -118.456
- LLR p-value: 0.0000
- Hosmer-Lemeshow p-value: 0.444
- Classification Accuracy: 72.5%
- AUC: 0.762

Note: ** significant at 5% level; * significant at 10% level

Source: Field Survey Data (2026)

4.4.2 Interpretation of Key Findings

Insurance knowledge (OR = 2.440) was the strongest predictor of WTP, indicating that a one-unit increase in knowledge score increases the odds of willingness to pay by 144%. This highlights the critical role of education and awareness in shaping demand.

Education (OR = 1.719) was positively associated with WTP, with each additional education level increasing the odds of WTP by 71.9%. Risk aversion (OR = 1.613) increased the odds of WTP by 61.3%, confirming that risk-averse farmers value insurance

protection. Household income (OR = 1.470) raised the odds of WTP by 47.0%, reflecting greater financial capacity among wealthier households.

Ambiguity aversion (OR = 0.599) reduced the odds of WTP by 40.1%, indicating that discomfort with uncertainty inhibits demand. Basis risk perception (OR = 0.654) reduced the odds of WTP by 34.6%, highlighting concerns about index accuracy. Farm size (OR = 1.215) increased the odds of WTP by 21.5%, while farming experience (OR = 0.972) reduced the odds by 2.8% per additional year, suggesting that experienced farmers have alternative coping mechanisms.

4.4.3 Tobit Regression Results

The Tobit regression confirmed the logistic regression findings. Insurance knowledge had the largest positive effect (4,568 UGX per acre), while ambiguity aversion had the largest negative effect (-2,679 UGX per acre). Education, risk aversion, and household income also had substantial positive effects, while basis risk perception and farming experience had negative effects.

4.5 Discussion of Findings

4.5.1 Hypothesis Testing

All five null hypotheses were rejected. Education, basis risk perception, risk aversion, household income, and farming experience were confirmed as significant determinants of WTP for index-based agricultural insurance.

Table 4: Summary of Hypothesis Testing

Hypothesis	Variable	Expected Direction	Finding	Decision
H ₀₁	Education	Positive	Positive, significant	Reject H ₀₁
H ₀₂	Basis Risk Perception	Negative	Negative, significant	Reject H ₀₂

Hypothesis	Variable	Expected Direction	Finding	Decision
H ₀₃	Risk Aversion	Positive	Positive, significant	Reject H ₀₃
H ₀₄	Household Income	Positive	Positive, significant	Reject H ₀₄
H ₀₅	Farming Experience	Ambiguous	Negative, significant	Reject H ₀₅

Source: Field Survey Data (2026)

4.5.2 Discussion in Relation to Literature

The finding that education is positively associated with WTP is consistent with Lwiza and Barkley (2025), who found that tertiary education positively influenced weather index insurance adoption in Uganda. The positive association between household income and WTP is consistent with Gine et al. (2008), who found that participation in rainfall insurance increased with household wealth in India.

The negative association between farming experience and WTP is consistent with Wodaju et al. (2025), who reported ambiguous effects of experience on insurance demand. The positive association between risk aversion and WTP is consistent with Clarke (2016), while the negative association between ambiguity aversion and WTP is consistent with Belissa et al. (2020).

The negative association between basis risk perception and WTP is consistent with Jensen et al. (2018), who identified basis risk as a major determinant of index-insurance demand. The positive association between insurance knowledge and WTP is consistent with Cole et al. (2013).

4.5.3 Implications of Findings

First, price sensitivity suggests that premium subsidies could significantly increase uptake. Second, insurance knowledge being the strongest predictor suggests that awareness campaigns and financial literacy programs are essential. Third, the negative effect of basis

risk perception highlights the need for improved index design and transparent communication. Fourth, high ambiguity aversion suggests that products should be simple and transparent with clear payout mechanisms. Fifth, the positive effects of education, income, and farm size suggest targeting more educated, wealthier, and larger-scale farmers initially.

4.6 Summary of Key Findings

The most crucial findings of this study are as follows. First, WTP is moderate but price-sensitive, with 55% willing to pay at 10,000 UGX per acre and declining to 35% at 20,000 UGX per acre. The mean maximum WTP was 15,247 UGX per acre. Second, insurance knowledge is the strongest determinant of WTP, with an odds ratio of 2.440, indicating that improving farmer understanding could more than double WTP. Third, behavioural factors matter significantly, with risk aversion increasing WTP (OR = 1.613) and ambiguity aversion decreasing it (OR = 0.599). Fourth, basis risk perception is a major barrier, reducing WTP by 34.6% per unit increase. Fifth, socioeconomic factors including education, income, farm size, and farming experience significantly influence WTP. Finally, all five null hypotheses were rejected, confirming the significance of the tested determinants.

CHAPTER FIVE: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.0 Introduction

This chapter presents the summary, conclusions, and recommendations of the study on willingness-to-pay (WTP) and demand determinants for index-based agricultural insurance among smallholder farmers in Luweero and Mukono districts, Uganda. The chapter is organised into five sections: summary of the study, summary of key findings, conclusions, recommendations, and areas for further research.

5.1 Summary of the Study

The study investigated the willingness-to-pay and demand determinants for index-based agricultural insurance among 200 smallholder farmers in Luweero and Mukono districts, Uganda. The research was motivated by the persistent low uptake of index-based agricultural insurance despite its theoretical advantages over conventional indemnity insurance.

The study adopted a cross-sectional quantitative research design and employed a contingent valuation approach to elicit farmers WTP. Primary data were collected using a structured interviewer-administered questionnaire. The sample size was determined using Cochran formula, and a multistage sampling procedure was used to select respondents. The analysis focused on eight key independent variables: education, household income, farming experience, farm size, risk aversion, ambiguity aversion, basis-risk perception, and insurance knowledge. Descriptive statistics, binary logistic regression, and Tobit regression models were employed to estimate WTP and assess its determinants.

5.2 Summary of Key Findings

5.2.1 Socioeconomic Characteristics

The majority of respondents were male (55.5%), married (70.0%), and had attained primary education (45.0%). The mean age was 42 years, mean household size was 5 persons, and mean farm size was 3.18 acres. Most respondents (60%) had no access to agricultural credit.

5.2.2 Agricultural Risk Exposure

Drought was the most frequently reported weather shock (72.5%), followed by excessive rainfall (62.5%). Half of the respondents (50.0%) reported severe or very severe impacts on farm income, and 55% experienced significant crop losses three or more times in the past five years.

5.2.3 Willingness to Pay

At a premium of 20,000 UGX per acre, 35.0% of respondents were willing to pay. This increased to 45.0% at 15,000 UGX and 55.0% at 10,000 UGX per acre. The mean maximum WTP was 15,247 UGX per acre, with a median of 10,000 UGX per acre. WTP was highly price-sensitive, declining substantially as premiums increased.

5.2.4 Determinants of WTP

Insurance knowledge was the strongest predictor of WTP, with an odds ratio of 2.440, indicating that improving farmer understanding could more than double WTP. Education (OR = 1.719), risk aversion (OR = 1.613), and household income (OR = 1.470) were positively associated with WTP. Ambiguity aversion (OR = 0.599), basis risk perception (OR = 0.654), and farming experience (OR = 0.972) were negatively associated with WTP. Farm size (OR = 1.215) was positively associated at the 10% significance level.

5.3 Conclusions

5.3.1 Conclusion on Willingness to Pay

The study concludes that there is latent demand for index-based agricultural insurance among smallholder farmers, but this demand is highly price-sensitive and heterogeneous. The mean maximum WTP of 15,247 UGX per acre provides a benchmark for premium setting, but differentiated pricing may be necessary to serve different farmer segments.

5.3.2 Conclusion on Socioeconomic Determinants

Education, household income, and farm size are positively associated with WTP, while farming experience is negatively associated. More educated and wealthier farmers with larger farms are more willing to pay for insurance. Experienced farmers may have developed alternative coping mechanisms or may be more skeptical of formal insurance products.

5.3.3 Conclusion on Behavioural Determinants

Risk aversion increases WTP, while ambiguity aversion decreases WTP. Farmers who are averse to risk value insurance as a risk-transfer mechanism, but farmers who are uncomfortable with uncertain probabilities are reluctant to purchase products whose payout mechanisms they do not fully understand.

5.3.4 Conclusion on Basis Risk Perception

Basis risk perception is a significant barrier to demand. Farmers who are concerned that the index may not accurately reflect their actual losses are less willing to pay for insurance. This highlights the importance of product design and transparent communication in addressing basis risk concerns.

5.3.5 Conclusion on Insurance Knowledge

Insurance knowledge is the strongest determinant of WTP. Farmers who understand how insurance works are significantly more willing to pay for coverage. This suggests that awareness campaigns and financial literacy programs could be effective in increasing demand.

5.4 Recommendations

5.4.1 Recommendations for Policy Makers

First, premium subsidies should be expanded under the Uganda Agricultural Insurance Scheme to make insurance more affordable for smallholder farmers. Second, a clear regulatory framework should be developed for index-based agricultural insurance products, including standards for index design, payout triggers, and transparency requirements. Third, public-private partnerships should be facilitated to improve distribution and reduce transaction costs. Fourth, awareness campaigns should be invested in to educate farmers about agricultural insurance and its benefits, addressing specific concerns such as basis risk and ambiguity aversion.

5.4.2 Recommendations for Insurance Providers

Insurance providers should design products that address specific farmer concerns, including using local rainfall measurements where possible and providing clear explanations of how payouts are triggered. Premiums should be set at affordable levels

with differentiated pricing to serve different segments of the farming population. Innovative distribution channels should be explored, including mobile platforms, farmer cooperatives, and agricultural extension services. Farmer education programs should go beyond simple awareness to include detailed explanations of how index-based insurance works. Finally, investments should be made in improving index design to reduce basis risk.

5.4.3 Recommendations for Farmer Organizations

Farmer organizations should explore collective purchasing arrangements to negotiate lower premiums and improve access to insurance. Lead farmers should be trained to educate their peers about agricultural insurance. Organizations should also advocate for policies that support agricultural insurance, including premium subsidies and regulatory oversight.

5.4.4 Recommendations for Development Partners

Development partners should provide technical assistance to insurers and government agencies to develop and scale index-based agricultural insurance products. Financial support should be provided for pilot programs, premium subsidies, and awareness campaigns. Capacity building should also be invested in for local insurers, regulators, and farmer organizations.

5.5 Areas for Further Research

Several areas require further research. First, longitudinal studies should examine how WTP changes over time in response to weather events, income changes, and insurance experience. Second, the relationship between stated WTP and actual insurance purchases should be examined to validate findings. Third, product design experiments should test different product designs and their effects on WTP. Fourth, spatial analysis should examine spatial patterns in WTP to identify geographic areas where demand is highest. Fifth, gender dynamics in insurance demand should be examined more closely. Sixth, impact evaluations should assess the effects of index-based agricultural insurance on farmer welfare and resilience. Finally, comparative studies across different regions of Uganda and other East African countries would help identify context-specific factors influencing demand.

5.6 Contribution to Knowledge

This study makes several contributions to the literature. It provides empirical evidence on WTP for index-based agricultural insurance in Uganda, complementing existing studies from Ethiopia, Ghana, Kenya, and India. It simultaneously examines socioeconomic, behavioural, and perceptual determinants of WTP within a single analytical framework. It provides empirical evidence on the role of basis risk perception in shaping WTP for index-based agricultural insurance. It contributes to the application of behavioural economics to agricultural insurance demand. Finally, it provides actionable insights for policymakers, insurers, and development partners.

5.7 Limitations of the Study

Several limitations should be acknowledged. First, WTP was based on stated preferences rather than actual insurance purchases, introducing potential hypothetical bias. Second, the cross-sectional design captured perceptions and WTP at a single point in time. Third, the study was limited to two districts in Uganda, constraining generalisability. Fourth, behavioural variables such as risk aversion and ambiguity aversion relied on self-reported responses. Fifth, some farmers declined to participate, potentially introducing non-response bias. Despite these limitations, the study provides a systematic and rigorous analysis of WTP and demand determinants for index-based agricultural insurance in Uganda.

5.8 Conclusion

This study investigated the willingness-to-pay and demand determinants for index-based agricultural insurance among smallholder farmers in Luweero and Mukono districts, Uganda. The findings reveal that there is latent demand for index-based agricultural insurance, but this demand is highly price-sensitive and influenced by a complex interplay of socioeconomic, behavioural, and perceptual factors.

Insurance knowledge, education, household income, farm size, risk aversion, ambiguity aversion, basis risk perception, and farming experience were identified as significant determinants of WTP. The study concludes that increasing uptake of index-based agricultural insurance will require a multi-faceted approach that includes premium

subsidies, product design improvements, awareness campaigns, and investments in farmer education.

The findings have important implications for policymakers, insurers, and development partners working to strengthen climate-risk resilience among smallholder farming households in Uganda. By addressing the barriers identified in this study, stakeholders can help unlock the potential of index-based agricultural insurance to protect farmers against weather-related risks and contribute to agricultural transformation and rural poverty reduction.

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