Heterogeneous Demand and Supply for an Insurance-Linked Credit Product in Kenya: A Stated Choice Experiment Approach

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Abstract

Bundling insurance with credit has emerged as a promising market-based tool for both managing agricultural weather risks and providing access to credit to farmers. However, to develop a suitable bundled credit product it is essential to tailor the product to the needs and preferences of both smallholder farmers and insurance and credit providers. We employ a discrete choice experiment to elicit demand and supply side preferences for insurance-linked credit and explore heterogeneity in these preferences using primary data from smallholder farmers and managers of financial institutions combined with household socio-economic survey data in Kenya. We analyse the choice data using multinomial logit and Hierarchical Bayes estimation of mixed logit model. We find that farmers prefer credit for both seasons, credit term to be one year or longer, no or partial collateral for loan, lower risk premium, and loans to be used for any purpose. Supply side results suggest that managers of financial institutions prefer the risk premium to be added with loan amount, loans to be repaid after harvest, credit available for both seasons, credit term to be shorter than one year, loans to be used only for agricultural purpose, and loans to be fully or partially collateralised. We also analyse willingness to purchase and willingness to offer for farmers and suppliers, respectively for risk premium at different attributes and their levels. Identifying the preferred attributes and levels for both farmers and financial institutions can guide optimal packaging of insurance and credit providing market participation and adoption motivation for insurance-bundled credit product.

Keywords: Insurance-linked credit, choice experiment, Kenya, random parameter logit, willingness to pay, Bayesian estimation

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1. Introduction

Uninsured agricultural risk and limited access to credit are two important issues in agricultural development, and they are considered major sources of poverty among smallholder farmers in Sub-Saharan Africa. Agricultural production is affected by drought related climate risks which is increasing in frequency and severity in the region (Lesk et al. 2016 and Daryanto et al. 2016). The impacts drought-related climate risks are particularly acute in Kenya. According to the Government of Kenya, four consecutive years (2008-2011) of drought amounted to US $12.1 billion in losses, including losses in assets and from disruptions in the economy flow across all sectors (GOK 2014). Such severe shocks cannot be financed by the government and donor communities alone.

Limited access to capital is another major challenge inhibiting smallholder farmers' ability to purchase agricultural inputs contributing to low agricultural productivity. Kenyan banks are usually unwilling to offer credit to farmers because of the issue of asymmetric information caused by uninsured risk. Farmers can receive loans only with high collateral, but many farmers voluntarily withdraw themselves from credit market because of their exposure to the high risk of collateral loss that may result due to uninsured risks. The lack of access to credit coupled with uninsured risk are considered drivers of poverty trap (Barrett et al. 2006; Marr et al 2016; Santos and Barrett 2006). We conducted a household survey with a credit module to elicit farmers' credit constraint status in Kenya following the methodology developed by Boucher et al. (2008 and 2009). We find that half of the sample did not borrow because of fear of losing collateral (also called risk rationing). This result is consistent with recent studies in microfinance that showed limited demand for microcredit (Johnston and Morduch 2008; Banerjee et al. 2015). Since the risk rationing comes from uninsured risk it is important to mitigate the risk of credit default to make the credit market work in Kenya.

There have been efforts from private sector financial institutions to expand credit access to farmers, but drought-related adverse weather conditions severely affect agricultural productivity and ultimately increase farmers' loan default risk. The risk of loan default discourages banks to offer credit to the farmers. So, the issue with practitioners is how to provide farmers with greater access to credit while at the same time minimizing weather related risks and loan default risks.

One of the recent innovations is agricultural index-insurance that has gained some success around the world for managing climate risks faced by farmers (for recent review, see Miranda and Farrin 2012 and Jensen and Barrett 2017). However, index insurance does not solve the problem of limited access to credit in agriculture. Some hypothesize that index insurance would crowd in credit but so far there is no empirical evidence on that. Moreover, demand and uptake of index insurance has been stagnant. On the other hand, literature such as Karlan et al. (2014) find that relaxing credit constraint without mitigating uninsured risk is not effective for agricultural development. Hence, a pragmatic solution is bundling insurance with credit where insurance and credit complement each other. Insurance bundling with credit cannot only provide benefits for farmers but also for insurers and banks. Farmers obtain easier access to credit for investment in agriculture including ease of payment of premiums if they are added to loan. Insurers can leverage banks' distribution channel to increase outreach and market penetration including reduction of distribution cost. Banks also receive benefit of embedded insurance that help minimize risk of loan default that can expand banks' business.

Several applied research were undertaken to investigate design and impact of bundling insurance with credit products and suggest that embedding insurance with credit products can improve demand and supply situation of agricultural credit (Skees et al. 2007, Gine and Yang 2009, Carter 2011, Shee and Turvey 2012, and Shee et al. 2015). However, to date no research analysed farmers' and finance providers' preferences for attributes of an insurance-linked credit product. Such knowledge can guide optimal packaging of insurance and credit attributes that are preferred by both demand and supply side. The paper addresses this knowledge gap. Even in index insurance literature, although a limited number of studies have investigated farmers' preferences for index insurance products (Hill et al. 2013, Tadesse et al. 2017) they are only limited to demand side preferences. To our knowledge no studies have investigated the preferences of insurance and credit providers for both index insurance and credit literature. This research will provide empirical evidence on supply side preference. We will use stated preference discrete choice experiment approach to analyse how farmers and finance providers respond to certain changes in attributes of an insurance-linked credit. Since observational data with any variation in contractual design are usually not available, we exploit choice experiment approach to elicit preferences for hypothetical attributes that is hard to observe in the market.

The objective of this paper is to analyse preferences including willingness to pay for farmers and willingness to offer for finance providers using data from household survey combined with a discrete choice experiment data. We elicit demand and supply side preferences for different attributes and their levels of an insurance-linked credit product. We will also explore the extent and effects of heterogeneity in both demand and supply side preferences. This research will provide substantial insights into farmers participation and adoption motivation for insurance-bundled credit product. The extent of heterogeneity among the farmers and financial institutions may have implications for implementation strategy and policy because it implies that individuals will not respond uniformly to economic incentives.

The paper unfolds in the following way. Next section provides a brief review of literature and background of risk-contingent credit (RCC). Section 3 presents a conceptual underpinning of demand and supply market for RCC. Section 4 describes our methodology of designing a discrete choice experiment and econometric framework for estimating demand and supply side preferences and heterogeneity in these preferences for RCC. Primary data collected in this study and results of empirical analysis including interpretations are then presented in section 5. Section 6 concludes with some economic implications.

2. Bundling insurance with credit - literature and study background

Unlike traditional credit products, insurance-linked credit structure facilitates risk management by layering hedging protection into loan payment obligations. In a bundled credit an index-insurance is embedded with the repayment structure of the credit so that when the insurance triggers farmers repayment obligation is reduced. When a weather index such as rainfall level worsens and crosses a predetermined trigger the insurance pays out that reduces farmers repayment burden. The payout from the insurance is applied to the underlying debt obligation or debt service, thereby reducing the probability of default on loans by farmers. Managing credit default not only increases farmers willingness to take up credit but it also mitigates portfolio risk for lenders. This is designed with an actuarially fair pricing that is interlinked with the underlying weather index.

There has been an emerging literature on insurance-linked credit in developing countries. Giné and Yang (2009) investigated adoption of an operating loan in Malawi where the payoff was determined by rainfall and found low take-up. Karlan et al. (2011) investigated the adoption of price-contingent credit in Ghana and found limited impact on uptake. Carter (2011) examined the impacts of RCC on financial market deepening and its impacts on farm households, concluding that RCC capitalized the adoption of new technology. Shee and Turvey (2012) showed how risk-contingent instrument can be priced in practice and using simulated field data they concluded that an imbedded price option for pulse crops in India provided downside risk protection for the pulse farmers. Shee et al. (2015) conducted a field-based feasibility of RCC with Kenyan pastoralists and dairy farmers. Casaburi and Willis (2015) implemented insurance linked contract farming found 71.6% take-up rate. These papers investigate linking risk to loans directly made to farmers or agribusiness. Miranda and Gonzalez-Vega (2011) and Collier et al. (2011) provide conceptual frameworks in which financial institutions themselves link their loan portfolios to El Niño risks in Central America.

Because the insurance component of bundled credit substitutes for collateral (Bester 1985, Shee and Turvey 2012), it is more financially inclusive than conventional credit products. By design, bundled credit mitigates business risks faced by the farmer (failure of rainfall, for example) and financial (credit) risks faced by the lender. This form of risk balancing can not only encourage supply but also encourages credit use targeted towards more economically efficient input use at the intensive margin. The removal of critical liquidity constraints, combined with the inter-temporal transfer of climate risk, bundling insurance with credit mechanism can achieve better targeting of poorer farmers, increase economic efficiency, provide climate resilience, reduce income inequality, and eliminate climate-based poverty traps. Finally, it also can eliminate the drawbacks of standalone index insurance products by not requiring the farmers to pay a premium upfront and out of pocket. Questions remain as to whether the attributes of this innovative bundled product can meet the demand by smallholder farmers and whether financial institutions will be able to offer them.

Although literature has completely ignored the analysis of consumers' preferences and willingness to pay for attributes of insurance-linked credit products, several recent studies have estimated farmers' preferences and willingness to pay for attributes of an insurance. Farmers' preference or willingness to pay for insurance in the literature have followed mainly three approaches. First, literature such as Fraser (1992) and Wang et al. (1998) used expected utility-based approach to estimate farmers' willingness to pay for crop insurance premium. Second, survey-based contingent valuation methods were used by Hill et al. (2013) to estimate willingness to pay for weather-index insurance in Ethiopia and by Akter et al. (2009) to estimate farmers preferences for crop insurance in Bangladesh. And finally, stated preference choice experiments were used by Liesivaara and Myyra (2014) to examine farmers attitude for crop insurance in Finland and by Akter et al. (2016) to estimate heterogeneity in farmers preferences to crop insurance in Bangladesh. In terms of the use of choice experiment approaches to estimating consumer preferences, they are used widely in non-insurance literature, Lusk et al. (2003, 2006), Ortega et al. (2012), and Ward et al. (2014, 2016) etc. are to name a few. This research adds to the choice experiment approach to investigate preference heterogeneity in both demand and supply side of bundling insurance with credit.

Our study is based on an existing project that implements an insurance linked credit product in Kenya where farmers have already experienced with an insurance linked credit product called risk-contingent credit (RCC). In recent years there have been several such projects being implemented in developing countries. Some examples of such projects are agricultural insurance schemes in India where weather-based crop insurance is bundled with agricultural loans taken from commercial banks and Planet Guarantee project in Burkina Faso where index insurance is bundled with credit for maize and cotton farmers. In the fall of 2017 our research group piloted RCC for the first time in Machakos County in Kenya, with loan indemnities linked to long and short rains. The implementation design was a randomized control experiment including no-loan, traditional loan, and Risk Contingent Credit, with a sub-experiment, also randomized, on RCC premium subsidization. Uptake of offered traditional and RCC loans were about 40%. In time, our group will evaluate the impact on agricultural productivity, household income, consumption smoothing, savings and investment, household nutrition and so on using traditional credit vs RCC against the no-credit counterfactual. Below map shows our study area in Machakos consisting of five Sub-

Counties in Machakos where RCC operation is ongoing in 13 locations as specified in Figure 1. This is a semi-arid and hilly terrain area that receives very low annual rainfall of around 700 mm per year with average rainfall in long and short rain seasons being 315 and 266 mm, respectively (Situation Analysis-GOK 2014). Due to this semi-arid climate, agriculture is practiced by smallholder farmers whereby maize is the main food crop.

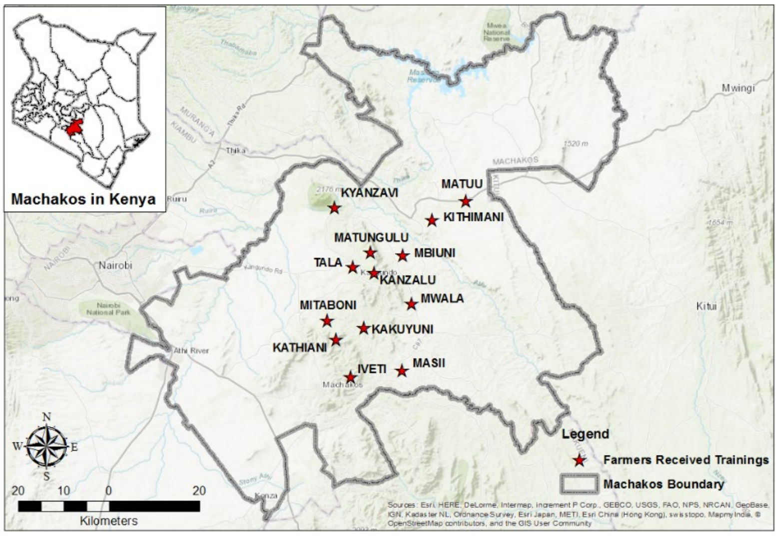


Figure 1 RCC study area- Machakos county, Kenya

3. Conceptual understanding of demand and supply of insurance-linked credit

To place RCC in a broader context, we develop here a simplified structure of supply and demand in the credit market. We assume that an isoelastic structure of demand and supply function for consumer credit can be written as functions of interest rate and the underlying risk (e.g. weather and economic shocks) where the risk is represented as power function of the shock variable.

$$Q_d = as^{-\delta} r^{-\alpha(s)} \tag{1}$$

$$Q_s = bs^{-\gamma} r^{\psi(s)} \tag{2}$$

Where Q_d and Q_s are the quantity of consumer credit demand and supply respectively, a and b are positive constants, r is interest rate, $\alpha(s) > 0$ and $\psi(s) > 0$ are elasticities of demand and supply respectively for consumer credit. $\delta > 0$ is the sensitivity of the borrowers to the underlying shock or called 'risk rationing' where borrowers voluntarily withdraw from the credit market because of increased collateral requirement by the lenders as a result of uninsured risks. Risk rationing is a demand side effect. $\gamma > 0$ is the sensitivity of the lenders to the underlying shock referred to as 'credit rationing' a situation where lenders limit the supply of credit to borrowers because of the issue of asymmetric information caused by uninsured risk.

At market equilibrium,

$$as^{-\delta} r^{-\alpha(s)} = bs^{-\gamma} r^{\psi(s)}$$

Or

$$r = \left(\tfrac{a}{b} s^{-(\delta-\gamma)} \right)^{\frac{1}{\psi(s)+\alpha(s)}} \tag{3}$$

a) If $\gamma = 0$ and $\delta = 0$ or $\delta - \gamma$ (spread between risk rationing and credit rationing) =0, equilibrium interest rate becomes $r = (a/b)^{1/\psi(s)+\alpha(s)}$.

b) If we consider consumers are more risk rationed than credit rationed (fact from focus group discussions), we obtain $\frac{\partial \psi(s)}{\partial s} < 0$ meaning credit supply is more inelastic with the underlying shock.

c) We also obtain $\frac{\partial \alpha(s)}{\partial s} < 0$ that shows credit demand is more inelastic with the underlying shock.

It is interesting to note that change in elasticity is related to change in consumer's risk aversion whereas risk rationing implies prudence that the consumers take action to offset the effects of the risk. As mentioned before, RCC, as a financial innovation, is designed to balance business and financial risks. By reducing losses on the downside, risk rationing behavior should be reduced, at least normatively as credit demand becomes more elastic. Likewise by ensuring repayment through the indemnification of loans so, too, would we expect the lender supply function to become more elastic, while shifting to the right, decreasing interest rates.

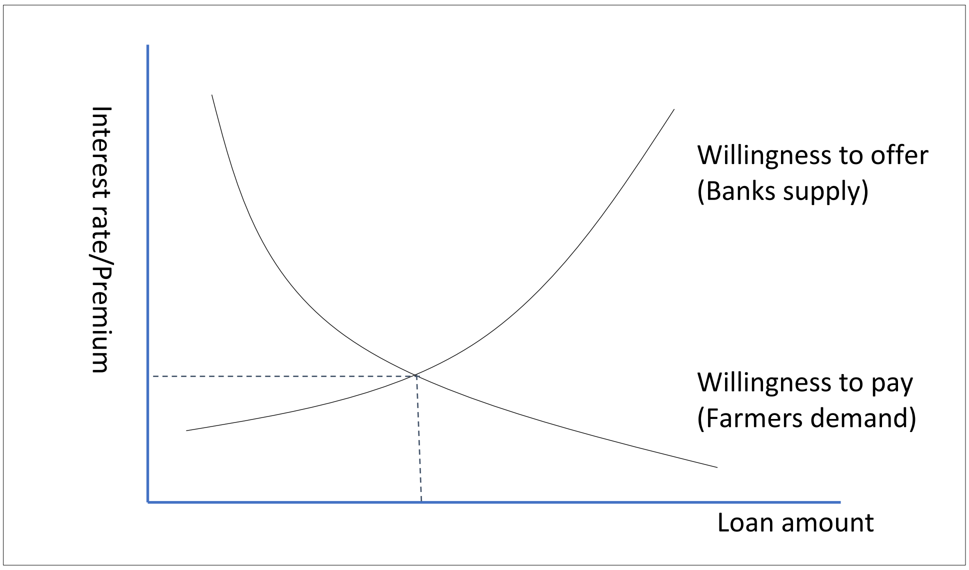


Figure 2 Willingness to pay and offer for RCC

4. Empirical methodology

The empirical methodology of this study is based on stated preference discrete choice experiments (CE) to estimate demand and supply side preferences for different components of an insurance-linked credit product. Stated preference CEs are a form of a discrete choice model, where preferences are elicited from responses to hypothetical alternatives rather than observed market decision. In a CE, individuals are asked to choose one alternative from among several alternatives containing different attributes, each of which takes one of a few pre-defined levels. The theoretical underpinning of CE is rooted in the Lancastrian approach to utility that proposes that individuals derive their utilities from a good through each of its attributes (Lancaster 1966). In our context, the good of interest is the insurance-linked credit product, which can be viewed as a collection of its attributes such as cost and coverage of risk, credit term, collateral requirement, loan repayment flexibility, etc.

Stated CEs are consistent with choice decisions in actual market in which individuals typically choose one product from a store of several products. Such experiments have become an increasingly important mode of studying individual demand and supply behaviour, since they allow researchers to estimate individual preference for attributes including non-market goods for which such preference estimations are impossible to measure by revealed preference approaches. Literature such as Adamowicz et al. (1998), Carlsson and Martinsson (2001) and Lusk and Schroeder (2004) have documented the advantages of using stated CE over revealed preference methods and found no statistically significant difference between results from both the approaches. Since the objective of this paper is to estimate marginal values for various attributes of bundled credit product from both demand and supply side where attributes such as collateral requirement, preferred season, rainfall measurement etc. exhibit non-monetary effects, stated CE is most suited method.

4.1 Design of discrete choice experiment

Important attributes of an insurance-bundled credit product were identified by careful review of related literature, farmers opinion in focus group discussions, meetings with bank and insurance company managers, and consulting the scientific design team. The team came up with nine attributes for our choice experiment that are thought to be the most important characteristics that a consumer and a supplier would look for. The attributes are insurance cost, insurance payment, insured risk coverage, credit term, collateral requirement, loan repayment flexibility, loan use flexibility, preferred season for loan, and rainfall measurement. A summary of the choice experiment attributes and their corresponding levels are presented in Table 1, and in Figure 3 as a cause effect diagram of choice experiment.

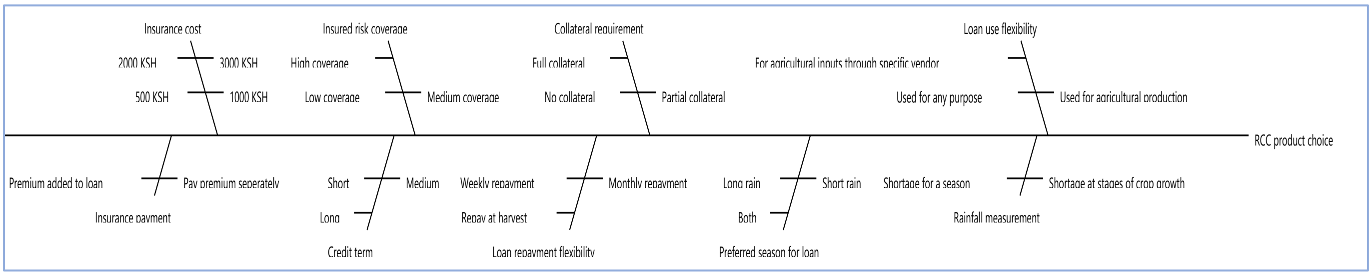


Figure 3 Cause and Effect Diagram of the choice experiment

Insurance cost or risk premium was included to allow for estimation of money metric measure of willingness to purchase for farmers and willingness to offer for finance providers. We specified four premium levels in our choice sets based on actuarially fair premium pricing. Regarding insurance payment attribute, actuarial design team and bank and insurance company representatives highlighted the option of premium to be added to loan amount and paying premium separately. Insurance risk coverage is directly related to cost of insurance, we define low coverage as insurance providing payout once in every 20 years, medium coverage as providing payout in every 10 years, and high coverage as covering frequent risk allowing payout in every 4 years. Credit terms are defined as six months (maize being a six-month crop in the area), one year and more than one year. As collateral is very important component of any credit lending in Kenya, we included partial, full and no collateral options. Loan repayment option of monthly and after harvest came clearly during our focus group discussions. Regarding loan use term, two options were included, loans can be used for any purpose versus loans can only be used for agricultural production. Since the area have two distinct seasons with bimodal rainfall pattern we included long, short and both seasons options. Finally, we included an option to elicit opinions about rainfall measurement for pricing and payout decisions. The rainfall calculation should be based on total rainfall shortage in season or shortage at each growth cycle of maize crop. This variable indirectly captures spatial basis risk option where rainfall shortage at crop growth cycle will have much lower basis risk compared to rainfall shortage in a season.

Table 1 Choice experiment attributes and corresponding levels

Attributes	**Levels**
Insurance cost for borrowing 10,000 KSH loan	500 KSH (5%), 1000 KSH (10%), 2000 KSH (20%), 3000 KSH (30%)
Insurance payment	Premium added to loan, Pay premium separately
Insured risk coverage	**Low coverage** (covering rare risk, 1 in 20 years), **Medium coverage** (covering medium risk, 1 in 10 years), **High coverage** (covering frequent risk,1 in 4 years)
Credit term (length of loan)	**Short** (up to 6 months, e.g. until harvest), **Medium** (6 months to 1 year), **Long** (more than 1 year)
Collateral Requirements	No collateral required, Partial collateral required, Full collateral required
Flexibility in loan repayment	Make monthly repayments, Repay at time of harvest only
Flexibility in loan use	Loan can be used for any purpose, Loan can only be used in agricultural production
Preferred season for loan	Long rain, Short rain, Both
Rainfall measurement based on	Total rainfall shortage for a season, Rainfall shortage measured at various stages of crop growth cycle (vegetative, reproductive, and ripening stages)

To construct choice sets, we specified D-Optimality criterion using Federov search algorithm which is based on calculating the determinant of variance-covariance matrix of the parameters from non-linear logit model. Choice sets were constructed with three alternatives available for respondents to choose.

For the main effect model the number of parameters we need to estimate,

$$\#Parameter = \#Levels - \#Attributes + 1,$$

where $\#Levels = \sum_{i=1}^{A} L_i$, A is number of attributes and L_i is number of levels of attribute *i*.

We need at least 24-9+1= 16 parameters to estimate. Also, we would want to take into consideration some interaction effects in addition to the main effects. This increases the number of parameters that we will want to efficiently estimate, which has implications for the number of runs as well as our sample size. A common rule of thumb is that the minimum sample size should be $N \geq 500(\frac{l^*}{S*J})$,where S is the number of choice tasks presented to each respondent (9, in our case), J is the number of alternatives per choice task (3 in our case), and l^* is the largest number of levels of any of the attributes (4, for insurance cost). Therefore, based on this, we should have at least 75 individuals in our sample.

The values of S and J can be determined exogenously but should satisfy the rank condition S(J-1)>K, where K is the number of parameters to be estimated. Estimating only main effects can buy us lower values for S and J, but this precludes any consideration of correlated or heterogeneous preferences. With the full set of interactions, the rank condition would be violated. In addition to problems with estimability, it also becomes increasingly difficult to get a suitable experimental design. We are certainly better off with three alternatives per choice set with each respondent replying to nine choice sets to satisfy rank condition.

In order to ensure data reliability, we placed special emphasis on increasing farmers' understanding of and involvement in tasks. Thus, we included pictorial illustrations of the product attributes and levels in the choice cards to facilitate respondents' choice task (see Figure 4). Also, to reduce participants' possible fatigue, we grouped the choice sets into six groups of nine choice sets each. The participants were then randomly assigned to the choice sets presented in one of the six groups, with equal proportion of respondents allocated to each of the groups.

Additionally, we used partial profile designs as opposed to full profiles. In other words, we asked participants to respond to half the attributes (partial profile) at the time, instead of the complete nine attributes (full profile) all at once. The purpose for this was to reduce possible participants' cognitive burden and response fatigue.

BLOCK1-CHOICE SET 6 OF 9			
ASSUME THAT THE FOLLOWING THREE RCC PRODUCTS WERE THE ONLY CHOICE YOU HAVE, WHICH ONE WOULD YOU PREFER TO CHOOSE?			
RCC CHARACTERISTICS	**RCC 1**	**RCC 2**	**RCC 3**
INSURANCE COST	3000 KSH (30%)	2000 KSH (20%)	500 KSH (5%)
INSURANCE PAYMENT	Pay premium separately	Premium added to loan	Pay premium separately
INSURED RISK COVERAGE	Medium coverage	Medium coverage	Medium coverage
CREDIT TERM	12 months Medium	6 months Short	More than 12 months Long
COLLATERAL REQUIREMENT	Partial collateral	Partial collateral	Partial collateral
LOAN REPAYMENT FLEXIBILITY	Jan . Feb . Mar . Apr Monthly repayment	Jan . Feb . Mar . Apr Monthly repayment	Jan . Feb . Mar . Apr Monthly repayment
LOAN USE FLEXIBILITY	For any purpose	For agricultural production	For any purpose
PREFERRED SEASON	Long rain	Both	Short rain
RAINFALL MEASUREMENT	Shortage at crop cycle	Shortage at crop cycle	Shortage at crop cycle

Figure 4 Example of choice set to be presented to survey respondent

4.2 Econometric framework

Since the data from stated preference CEs are discrete choice decisions they can be analysed within the framework of random utility theory (McFadden 1974). Suppose that individual n faces J alternatives contained in a choice set. We define an underlying latent variable u_{nj} that denotes the indirect utility associated with individual n choosing alternative $j \in J$. Random utility maximization implies that individual n will choose alternative j if and only if $u_{nj} > u_{nk}\ \forall k \neq j$. Following standard practice, we assume that indirect utility is linear and can be written as

$$u_{nj} = x_{nj}^{'}\beta + \varepsilon_{nj} \tag{1}$$

where $x_{nj}^{'}$ is a vector of attributes for the jth alternative, β is a vector of preference parameters, and ε_{nj} is a stochastic component of utility that is independently and identically distributed across individuals and alternatives. Assuming ε_{nj} follows a Gumbel (extreme value type I) distribution, the probability that the individual n will choose alternative j from among J alternatives can be derived as

$$P_{nj} = \frac{\exp(x_{nj}^{'}\beta)}{\sum_{k=1}^{J}\exp(x_{nj}^{'}\beta)} \tag{2}$$

which is called conditional or multinomial logit model and can be estimated using maximum likelihood. However, the main limitations of multinomial logit model are its imposition of proportionate substitution pattern (also called as independence from irrelevant alternatives or IIA) and its inability to handle random test variations. To overcome these limitations literature uses a generalized model called random parameter logit model or mixed logit model. Mixed logit is regarded as a highly flexible model that can approximate any random utility model and overcomes the limitations of multinomial logit by allowing random test variation and observing substitution pattern from the data (McFadden and Train 2000). In our context, since smallholder farmers and managers from financial institutions are heterogeneous, their preferences for RCC attributes may also be heterogeneous.

To estimate the individual level heterogeneity, we follow Train (2009) and use Hierarchical Bayes estimation procedure to estimate mixed logit model (Bayesian mixed logit). We use Bayesian procedures to overcome two prominent difficulties associated with classical procedures: a) Bayesian procedure do not require maximization of likelihood function which is difficult numerically as it may sometime fail to converge, and 2) more desirable estimation properties, such as consistency and efficiency can be attained under more relaxed conditions (Train 2009). The indirect utility in (1) can be written in mixed logit specification as follows

$$u_{nj} = x_{nj}^{'}\beta_n + \varepsilon_{nj} \tag{3}$$

where, individual parameter, $\beta_n \sim N(b,S)$, b being the parameters and S being its covariance matrix. We specify our prior beliefs about b and S are the following. $b \sim N(0,v),\ v \text{ is large}$, and $S \sim IG(v,1) \text{ for } v \to 1$, where IG stands for inverted Gamma distribution. β_n are the individual-level parameters for person n, which describe the preference of that person. The β_n s are distributed in the population with mean b and variance S. The parameters b and S are called population level parameters. We use Gibbs sampling to estimate three sets of parameters $b,\ S,\ \text{and}\ \beta_n\ \forall n$. The posterior for $b,\ S,\ \text{and}\ \beta_n\ \forall n$ is

$$K(b,S,\beta_n \mid Y) \propto \prod_n \frac{\exp(\beta_n^{'}x_{nj})}{\sum_{k=1}^{J}\exp(\beta_n^{'}x_{nj})}\phi(\beta_n \mid b,S)k(b,S) \tag{4}$$

Draws from this posterior are obtained through conditional posteriors using Gibbs sampling. The steps are as follows: (1) we take a draw of b conditional on values of S and β_n, (2) we take draw of S conditional on values of b and β_n, and (3) we take draw of β_n conditional on values of b and S. Finally, these steps are repeated for many iterations. In step 3, since we do not know the shape of the conditional posterior, the Metropolis-Hastings algorithm is used to draw from distribution. In steps 1 and 2, Gibbs sampling is used to draw from these posteriors. Such Gibbs sampling for this model is fast for the following reasons. There are no layers that require numerical integration. In fact, the first layer utilizes a product of logit formulas for a given value of β_n. Steps 1 and 2 do not utilize the data at all, because they depend only on the draws of β_n.

The parameter estimates from both the multinomial logit and Bayesian mixed logit models provide little economic information given the non-cardinal nature of utility. We use the estimated parameters to obtain willingness to pay (WTP) measures. WTP is calculated as the change in price or premium in order to keep the same level of utility after an attribute (nominal) changes. WTP for the kth attribute can be written as follows.

$$WTP_k = \frac{2\beta_k}{\beta_p} \tag{5}$$

where β_k is the estimated parameter of kth attribute, and β_p is the estimated coefficient of price or premium in our context. In our analysis, the WTP measure is multiplied by two due to our use of effects coding (Lusk et al. 2003).

5. Data and results

The data for this study was collected from 13 locations in Machakos county in eastern province of Kenya (see study area in Figure 1) where our project, promoting an insurance-linked credit called risk-contingent credit (RCC), was implemented. The interviewed households in our choice experiment took part in a long household survey a year before the choice experiment. Household survey was conducted through computer-assisted personal interviewing (CAPI) under a multi-year impact evaluation of RCC managed by the International Food Policy Research Institute (IFPRI) and its partners. Although the project impact evaluation plan is not germane to this study we used the household survey data to obtain socio-economic data of the households. The sample for household survey were randomly selected from 13 locations in 5 Sub-Counties (Matungulu, Kangundo, Kathiani, Mwala, Yatta). In each location 6 villages were randomly selected and ultimately 15 households from a list of families in a village were selected. The household survey collected information on various socioeconomic variables such as demography, agricultural land characteristics, production and inputs, livestock ownership, and credit. The household survey data was collected from 1170 households, all of them received training on RCC in September 2017. The choice experiment data was collected from 330 households randomly selected from these 1170 households.

Table 2 Socio-economic characteristics of sample households

Household characteristics	HH received loan	HH with no loan	Total
Yield of maize(kg/acre)	317.61***	224.52***	245.78
Crop revenue (KES/acre)	11185.07*	9214.70*	9664.68
Household size	5.47	5.42	5.43
Female headed household	0.17**	0.23**	0.21
Age of the head	55.79	56.71	56.5
Max years of education in the household	11.24	11.03	11.08
No. of working age labor	3.43**	3.20**	3.26
Total land size (Acre)	3.98	4.02	4.01

Tropical Livestock Units: total	4.12	11.55	9.85
Distance from the hh to the closest plot	1.07	1.05	1.06
Average travel time to seed supplier (minute & one way)	29.46	30.75	30.45

* significant at 10%, ** significant at 5%, and *** significant at 1% indicate difference in means between sub-samples

We present a summary statistic of key socio-economic variables of the sample in Table 2, before presenting results from our choice experiments. Summary statistics in Table 2 are presented for full sample as well as households that received any loan through the project last year. Compared to household with no loan and the households who received loan last year exhibit higher maize yield and crop revenue per acre, and higher number of working age labourer in the household but lower percent of households that are headed by female. Average household size of the sample is 5.4 whereas average number of working age laborers in a household is 3.2. About 21% households in the sample are female headed. The maximum adult years of education in a household is 11 years. Average land holding of a household is about 4 acres. We will use some of these variables as interaction terms in the estimation of choice models.

The choice data were collected from 330 farmers and 39 managers from key insurance companies and banks in Kenya. Farmers were randomly assigned to a block of choice sets and shown each choice set in that block, one set at a time. A choice set is presented in Figure 4. For each choice set, farmers were asked to select the alternative they prefer. The sample size for insurance and credit providers was lower (may seem to be underpowered) because there are only a finite number of managers to choose from. Because each manager had to choose from nine different choice cards with three alternatives to choose form in each card, the total number of observation points was 39*9*3 or 1,053. Respondents household ID, random block number, and the choice indicator for the choice they made for each choice set were recorded. All responses were collected using CAPI. We treat Price as a continuous variable in the regression. This reduces the number of parameters needed to be estimated and allow for calculation of willingness to pay.

Table 3 presents estimation results from multinomial logit model (presented in Eqn. (2)), without interaction terms, for both demand and supply sides. For demand side, except insured risk coverage and rainfall measurement all other parameters are statistically significant with expected signs. Although the coefficient for premium is very low it is negative, meaning farmers are price sensitive and prefer lower premium price, holding other attributes constant, but the preferences are highly inelastic. Farmers have high negative preference for full collateral over partial collateral, and they mostly prefer no collateral. In terms of loan repayment farmers prefer to repay after harvest. Farmers also prefer to use the loan for any purpose rather than using only for agricultural production. On the other hand, supply side preference stories are different. Premium does not seem to be a relevant attribute for managers of financial institutions. Managers do not seem to prefer zero collateral at all, they also do not prefer the credit to be long term. Manager strongly prefer the loans to be used only for agricultural production purpose. All in all, there is conflicting demand and supply side preferences for credit term, collateral requirement, and loan use flexibility. Both seasons are preferred for both demand and supply side.

Table 3 Parameter estimates of multinomial logit without interaction

Variables	Demand side		Supply side	
	Estimate	Std Error	Estimate	Std Error
Insurance payment[Pay premium separately]	-0.074***	0.028	-0.362***	0.089
Insured risk coverage[High coverage]	0.060	0.038	0.266**	0.111
Insured risk coverage[Low coverage]	-0.048	0.038	-0.327**	0.122
Credit term[Long]	0.355***	0.037	-0.445***	0.125
Credit term[Medium]	0.180***	0.039	0.165	0.111
Collateral requirement[Full collateral]	-0.299***	0.042	0.143	0.112
Collateral requirement[No collateral]	0.328***	0.038	-0.344**	0.123
Loan repayment flexibility[Monthly repayment]	-0.153***	0.028	-0.157	0.088
Loan use flexibility[For agricultural production]	-0.181***	0.029	0.266***	0.088

Preferred season[Both]	0.441***	0.036	0.395***	0.104
Preferred season[Long rain]	0.025***	0.040	0.003	0.113
Rainfall measurement[Shortage at stages of crop growth]	0.048	0.029	0.182**	0.086
Premium	-0.0002***	0.000	-0.000	0.000
AICc	5891.814		698.415	
BIC	5969.643		747.158	
-2*LogLikelihood	5865.691		671.306	
-2*Firth LogLikelihood	5762.910		596.793	

Table 4 presents estimation results from multinomial logit model with interaction terms, for both demand and supply sides. From this we can observe the changes in estimation when we add interaction terms as additional covariates. We notice that farmers who received loans in previous season prefer the loan to be used only for agricultural production purpose. So, these sections of farmers' preferences are aligned with suppliers' preferences. Male farmers do not like monthly repayment compared to female farmers. Managers from banks like monthly repayment although managers in polled data do not prefer monthly repayment. Compared to managers from insurance companies, bank managers do not prefer credit disbursement in both the seasons, they prefer credit to be provided in long rain. Thus, clearly there is some heterogeneity about the preference on RCC attributes among male and female-headed households. Similarly, we notice some heterogeneity among insurance and bank company managers on their preference on RCC attributes.

The results of Hierarchical Bayes estimation of mixed logit model represented by Eqn. (4) are reported in Table 5 (we do not report insignificant interaction terms in the table). For analysing choice experiment in agricultural economics Hierarchical Bayes estimation is rarely used. For both demand and supply side we report posterior mean, posterior standard deviation, and subject level standard deviation. The standard deviation of the posterior distribution in Bayesian estimation is analogous to the standard error in frequentist concept, and accordingly the level of significance was determined. The posterior mean values represent marginal utility parameters, that provide relative value associated with each attribute levels. While long-term credits are preferred by farmers, they are not preferred by finance providers. Farmers prefer medium term credit over short term credit although suppliers do not prefer both. No collateral loans are preferred by farmers whereas they are strongly not preferred by suppliers. Farmers prefer loans to be used for any purpose, but the managers prefer loans to be used only for agricultural production purpose. This is because financial institutions think if farmers use the loans for production purpose their loan repayment rate will be higher.

Table 4 Parameter estimates multinomial logit with interaction terms

Variables	Demand side		Supply side	
	Estimate	Std Error	Estimate	Std Error
Insurance payment[Pay premium separately]	-0.045	0.043	-0.366***	0.093
Insured risk coverage[High coverage]	0.027	0.058	0.225	0.120
Insured risk coverage[Low coverage]	-0.044	0.059	-0.279	0.128
Credit term[Long]	0.339***	0.056	-0.444***	0.129
Credit term[Medium]	0.173***	0.058	0.210	0.120
Collateral requirement[Full collateral]	-0.295***	0.065	0.123	0.122
Collateral requirement[No collateral]	0.360***	0.057	-0.309**	0.131
Loan repayment flexibility[Monthly repayment]	-0.001	0.043	-0.196**	0.093
Loan use flexibility[For agricultural production]	-0.181***	0.043	0.282***	0.095
Preferred season[Both]	0.515***	0.054	0.459***	0.112
Preferred season[Long rain]	-0.006	0.061	-0.095	0.131
Rainfall measurement[Shortage at stages of crop growth]	0.045	0.044	0.177**	0.093
Premium	-0.0002***	0.000	0.000	0.000
loan category[Loan]*Loan use flexibility[For agricultural production]	0.094***	0.032		
loan category[Loan]*Preferred season[Both]	0.093*	0.041		
hh_female[0]*Collateral requirement[No collateral]	-0.102*	0.053		
hh_female[0]*Loan repayment flexibility[Monthly repayment]	-0.221***	0.040		
Institution type[Bank]*Collateral requirement[No collateral]			-0.441***	0.131
Institution type[Bank]*Loan repayment flexibility[Monthly repayment]			0.172**	0.093
Institution type[Bank]*Preferred season[Both]			-0.265**	0.112
Institution type[Bank]*Preferred season[Long rain]			0.247*	0.131
AICc	5727.3417		692.37126	
BIC	5959.1493		787.6192	
-2*LogLikelihood	5648.2501		635.91412	
-2*Firth LogLikelihood	5353.0385		489.37169	

Table 5 Hierarchical Bayes estimation results of mixed logit model

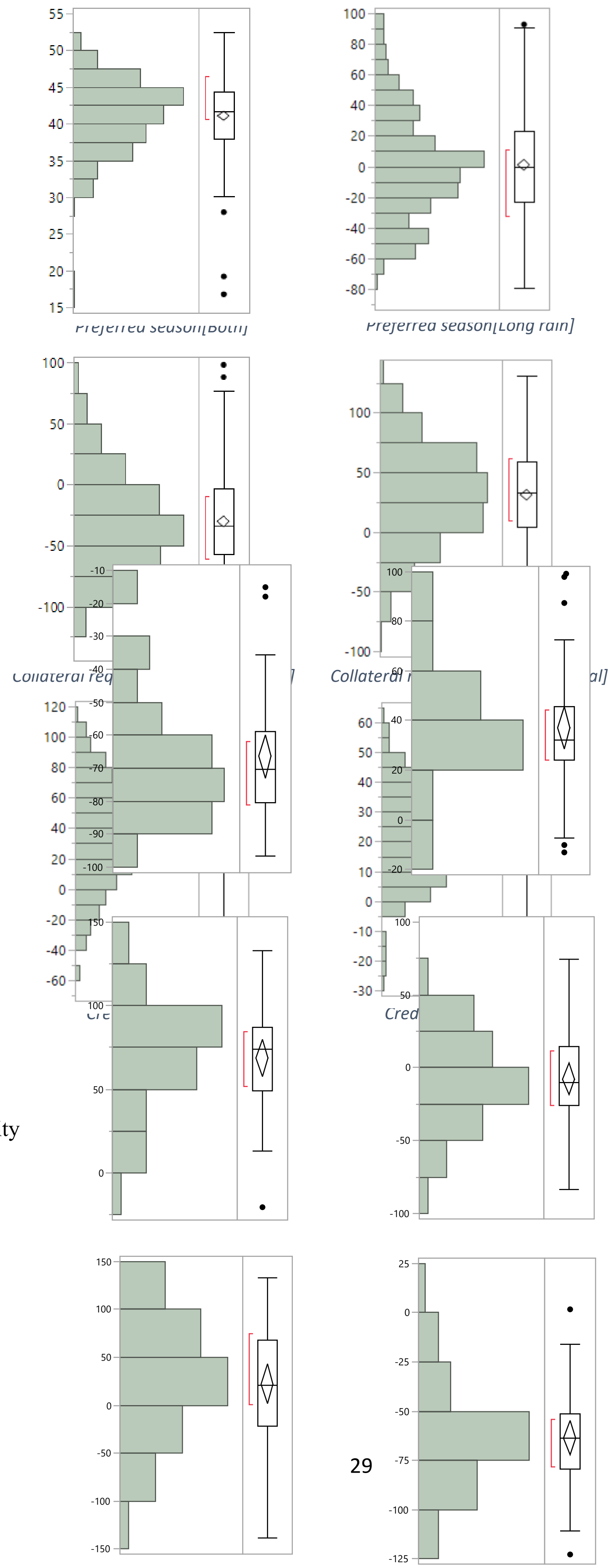
Variables	Demand side			Supply side		
	Posterior Mean	Posterior Std Dev	Subject Std Dev	Posterior Mean	Posterior Std Dev	Subject Std Dev
Insurance payment[Pay premium separately]	-2.513	3.274	23.274	-85.408***	22.902	57.307
Insured risk coverage[High coverage]	7.909	5.766	3.501	20.328	19.066	32.345
Insured risk coverage[Low coverage]	-2.278	3.608	27.010	-28.580	15.392	30.288
Credit term[Long]	28.089***	13.516	3.486	-66.374***	17.261	19.829
Credit term[Medium]	17.414***	10.844	32.409	36.950	20.087	25.767
Collateral requirement[Full collateral]	-17.218***	5.263	7.842	24.937	23.022	43.682
Collateral requirement[No collateral]	23.852***	8.409	33.484	-56.229***	23.330	75.190
Loan repayment flexibility[Monthly repayment]	-1.499	2.621	1.455	-40.484***	19.072	63.383
Loan use flexibility[For agricultural production]	-19.639***	5.783	44.142	67.674***	23.675	22.568
Preferred season[Both]	50.532***	16.462	38.836	68.723***	20.852	33.855
Preferred season[Long rain]	1.019	3.574	28.710	-7.811	16.002	33.025
Rainfall measurement[Shortage at stages of crop growth]	13.947***	6.103	4.149	17.012	16.972	46.412
Premium	-0.034***	0.014	0.033	-0.062	0.038	0.096
hh_female[0]*Loan repayment flexibility[Monthly repayment]	-20.381***	7.357	49.522			
loan category 2[Loan]*Insured risk coverage[High coverage]	-9.772***	3.208	0.466			
loan category 2[Loan]*Insured risk coverage[Low coverage]	8.425***	2.601	1.247			
loan category 2[Loan]*Loan repayment flexibility[Monthly repayment]	5.083***	1.949	0.306			
loan category 2[Loan]*Preferred season[Both]	9.521*	5.216	0.610			
Institution type[Bank]*Collateral requirement[No collateral]				-63.644***	28.897	26.491
Institution type[Bank]*Preferred season[Both]				-37.134***	16.960	43.291
Institution type[Bank]*Preferred season[Long rain]				34.928*	18.879	30.782
Total Iterations		5000			5000	
Burn-In Iterations		2500			2500	
Number of Respondents		322			38	
Avg Log Likelihood After Burn-In		-52.574			-3.373708	

Looking at the interaction terms, male farmers strongly dislike monthly repayment. People who received loans last year prefer low coverage. Interestingly people who received loans last year prefer loans to be repaid monthly compared to farmers who did not receive loans last year. Compared to insurance companies, banks do not like offering loans in both the seasons.

Table 6 Willingness to pay and willingness to offer for RCC attributes

Factor	Feature Setting	Demand side (WTP)		Supply side (WTO)	
		Price Change (KSH)	New Price (KSH)	Price Change (KSH)	New Price (KSH)
Insurance payment	Pay premium separately	0	500	0	500
Insurance payment	Premium added to loan	312.03	812.03	2600	3091.59
Insured risk coverage	High coverage	0	500	0	500
Insured risk coverage	Low coverage	206.21	706.21	-2000	-1125.94
Insured risk coverage	Medium coverage	-300	166.42	-400	138.16
Credit term	Long	0	500	0	500
Credit term	Medium	-200	308.61	2100	2605.51
Credit term	Short	-2000	-1171.21	2900	3387.23
Collateral requirement	Full collateral	0	500	0	500
Collateral requirement	No collateral	806.75	1306.75	-3000	-2291.34
Collateral requirement	Partial collateral	671.04	1171.04	427.25	927.25
Loan repayment flexibility	Monthly repayment	0	500	0	500
Loan repayment flexibility	Repay at harvest	846.48	1346.48	970.77	1470.77
Loan use flexibility	For agricultural production	0	500	0	500
Loan use flexibility	For any purpose	725.97	1225.97	-2000	-1406.77
Preferred season	Both	0	500	0	500
Preferred season	Long rain	-2000	-1134.51	-74.73	425.27
Preferred season	Short rain	-3000	-2463.91	-2000	-1009.01
Rainfall measurement	Shortage at stages of growth	0	500	0	500
Rainfall measurement	Shortage for a season	-600	-70.42	-700	-242.58

To keep the consumer just as well off, a trade-off between increasing one discrete attribute from 0 to 1 and increasing the price, gives the Willingness to Pay (WTP) for that attribute. Table 6 summarizes the calculated willingness to purchase and willingness to offer for changes in particular attributes of a bundled product. You can see that the farmers are willing to pay amount 312 KSH more for premium added to loan option compared to pay premium separately, which has a base price of 500 KSH. The new price for the change in this attribute would be 812 KSH. Farmers' WTP decreases by 2000 KSH if the credit is for short term (6 months) compared to long term credit, whereas finance providers WTO (willingness to offer) increases by 2900 KSH if the credit is for short term compared to long term. From table 6 we see that WTP-WTO figures are most conflicting between demand and supply sides for credit term, collateral requirement, and loan use flexibility. The table clearly shows WTP-WTO for both farmers and suppliers reduce significantly if RCC is available only for short rain or long rain compared to its implementation in both seasons. This finding is consistent with historical drought occurrence that happened almost evenly in both the seasons; also farmers require credit in both seasons. In terms of collateral requirement, farmers' WTP increases whereas suppliers WTO decreases if the credit is collateral free compared to a full collateral loan. Since WTP-WTO for partial collateral increases for both farmers and finance providers compared to full collateral loans, it will be important policy recommendation to develop a partial collateral contract.



of demand heterogeneity

Figure 5 Examples side preference

Credit term[Long] *Credit term[Medium]*

Preferred season[Both] *Preferred season[Long rain]*

*Institution type[Bank]*Collateral requirement[Full collateral]* *Institution type[Bank]*Collateral requirement[No collateral]*

Figure 6 Examples of supply side preference heterogeneity

Figures 5 and 6 plot histograms of the empirical distributions of the posterior mean marginal utilities for different attribute levels. The plots show high level of heterogeneity of the mean posterior estimations.

Probability profiler for Premium for all other attribute at baseline condition

From the probability profiler graphs below it can be seen that the demand and supply probabilities are price sensitive, but highly price inelastic. This means that subsidies may not be an effective tool for influencing preferences.

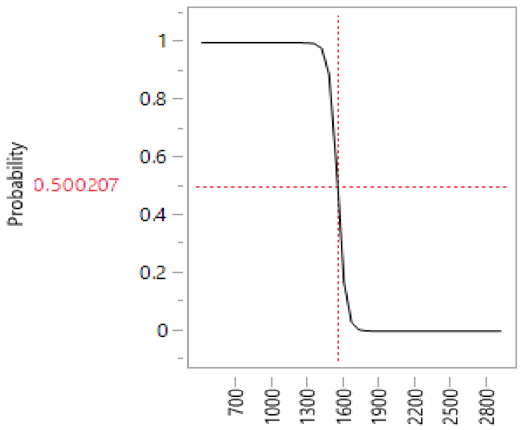


Figure 7 Probability profiler for farmers' WTP premium

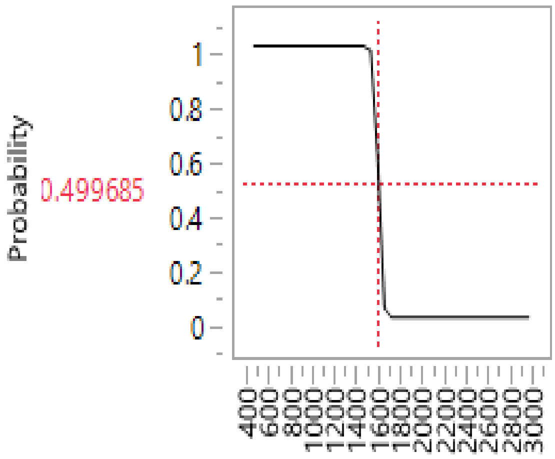


Figure 8 Probability profiler for farmers' WTP premium

5. Concluding comments

Efforts to address weather-related risks and limited access to credit in smallholder agriculture have resulted in promotion of index insurance linked credit products in developing countries. Although bundling insurance with credit is a win-win proposition, questions remain as to whether the attributes of this innovative bundled product can meet the demand for smallholder farmers and whether financial institutions will be able to offer them and what will be optimal packaging of insurance and credit components that will be preferred by both demand and supply side.

We use discrete choice experiments to examine demand and supply side preferences for attributes of insurance-linked credit and model heterogeneity in these preferences using primary data from smallholder farmers and managers of financial institutions combined with household socio-economic survey data in Kenya. We analyse the choice data using multinomial logit and Hierarchical Bayes estimation of mixed logit model. This research provides a novel approach of comparing demand and supply side preferences to examine if there is gap in expectations from both sides of a market.

We find that farmers prefer credit for both seasons, credit term to be one year or longer, no or partial collateral for loan, lower risk premium, and loans to be used for any purpose. Supply side results suggest that managers of financial institutions prefer the risk premium to be added with loan amount, loans to be repaid after harvest, credit available for both seasons, credit term to be shorter than one year, loans to be used only for agricultural purpose, and loans to be fully or partially collateralised. While long-term credits are preferred by farmers, they are not preferred by finance providers. Farmers prefer medium term credit over short term credit although suppliers do not prefer both. No collateral loans are preferred by farmers whereas they are strongly not preferred by suppliers. Farmers prefer loans to be used for any purpose, but the managers prefer loans to be used only for agricultural production purpose, as investment in productive activities is perceived to enhance the probability of loan repayment.

We also analyse willingness to pay (WTP) and willingness to offer (WTO) for farmers and suppliers, respectively for risk premium at different attributes and their levels. WTP-WTO figures are most conflicting between demand and supply sides for credit term, collateral requirement, and loan use flexibility. In terms of collateral requirement, farmers' WTP increases whereas suppliers' WTO decreases if the credit is collateral free compared to a full collateral loan. Since WTP-WTO for partial collateral increases for both farmers and finance providers compared to full collateral loans, it will be important policy recommendation to develop a partial collateral contract.

Identifying the preferred attributes and levels for both farmers and financial institutions can guide optimal packaging of insurance and credit providing market participation and adoption motivation for insurance-bundled credit product. The findings of the paper can complement actuarial design and ratemaking. Heterogeneity of preferences confirms that it is important for marketing and extension strategies that are tailored to the diversity of farming population. At the end we would highlight that it is very important that choice experiments are free of respondent burden and fatigue. It is recommended not to conduct household survey and CE together. Since respondents' understanding is key for making an informed choice it is recommended to use simple explanation of the product including use of pictorial illustrations.

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Appendix

Demand side multinomial logit (with no interaction)

Effect Summary

Source	LogWorth	PValue
Preferred season	40.599	0.00000
Credit term	36.840	0.00000
Collateral requirement	18.680	0.00000
Premium	14.636	0.00000
Loan use flexibility	9.680	0.00000
Loan repayment flexibility	7.512	0.00000
Insurance payment	2.062	0.00867
Rainfall measurement	1.041	0.09101
Insured risk coverage	0.599	0.25197

The above is the effect summary report that shows the significance of each attribute. The p-value for each effect is in the last column. The p-value is transformed into logWorth, which is $-\log_{10}(pvalue)$. From the table we see that Preferred season has the most significant effect.

Likelihood Ratio Tests

Source	L-R ChiSquare	DF	Prob>ChiSq
Insurance payment	6.889	1	0.0087*
Insured risk coverage	2.757	2	0.2520
Credit term	169.657	2	<.0001*
Collateral requirement	86.026	2	<.0001*
Loan repayment flexibility	30.658	1	<.0001*
Loan use flexibility	40.382	1	<.0001*
Preferred season	186.965	2	<.0001*
Rainfall measurement	2.856	1	0.0910
Premium	62.778	1	<.0001*

Demand side multinomial logit (with female headed HH and loan farmer interaction)

Choice Model

Effect Summary

Source	LogWorth	PValue
Preferred season	23.595	0.00000
Credit term	15.662	0.00000
Collateral requirement	9.321	0.00000
hh_female*Loan repayment flexibility	7.836	0.00000
Premium	5.783	0.00000
Loan use flexibility	4.731	0.00002
loan category 2*Loan use flexibility	2.550	0.00282
loan category 2*Preferred season	1.230	0.05885
hh_female*Collateral requirement	1.085	0.08225
loan category 2*Insured risk coverage	0.803	0.15742
loan category 2*Collateral requirement	0.781	0.16565

Source	LogWorth	PValue
loan category 2*Credit term	0.682	0.20783
hh_female*Loan use flexibility	0.670	0.21371
hh_female*Insurance payment	0.585	0.25992
Rainfall measurement	0.532	0.29352
Insurance payment	0.523	0.29984
loan category 2*Premium	0.441	0.36185
hh_female*Insured risk coverage	0.398	0.39984
loan category 2*Insurance payment	0.165	0.68376
Insured risk coverage	0.122	0.75424
hh_female*Preferred season	0.115	0.76773
hh_female*Credit term	0.033	0.92784
loan category 2*Rainfall measurement	0.030	0.93292
hh_female*Rainfall measurement	0.029	0.93433
Loan repayment flexibility	0.000	1.00000
loan category 2*Loan repayment flexibility	0.000	1.00000
hh_female*Premium	0.000	1.00000

Likelihood Ratio Tests

Source	L-R ChiSquare	DF	Prob>ChiSq
Insurance payment	1.075	1	0.2998
Insured risk coverage	0.564	2	0.7542
Credit term	72.127	2	<.0001*
Collateral requirement	42.925	2	<.0001*
Loan repayment flexibility	0.000	1	1.0000
Loan use flexibility	18.330	1	<.0001*
Preferred season	108.660	2	<.0001*
Rainfall measurement	1.103	1	0.2935
Premium	22.968	1	<.0001*
loan category 2*Insurance payment	0.166	1	0.6838
loan category 2*Insured risk coverage	3.698	2	0.1574
loan category 2*Credit term	3.142	2	0.2078
loan category 2*Collateral requirement	3.596	2	0.1657
loan category 2*Loan repayment flexibility	0.000	1	1.0000
loan category 2*Loan use flexibility	8.923	1	0.0028*
loan category 2*Preferred season	5.666	2	0.0588
loan category 2*Rainfall measurement	0.007	1	0.9329
loan category 2*Premium	0.831	1	0.3618
hh_female*Insurance payment	1.269	1	0.2599
hh_female*Insured risk coverage	1.833	2	0.3998
hh_female*Credit term	0.150	2	0.9278
hh_female*Collateral requirement	4.996	2	0.0822
hh_female*Loan repayment flexibility	32.109	1	<.0001*
hh_female*Loan use flexibility	1.546	1	0.2137
hh_female*Preferred season	0.529	2	0.7677
hh_female*Rainfall measurement	0.007	1	0.9343
hh_female*Premium	0.000	1	1.0000

Supply side multinomial logit (with no interaction)

Effect Summary

Source	LogWorth	PValue
Insurance payment	4.658	0.00002

Source	LogWorth	PValue
Preferred season	4.015	0.00010
Credit term	3.217	0.00061
Loan use flexibility	2.788	0.00163
Insured risk coverage	1.972	0.01067
Collateral requirement	1.878	0.01324
Rainfall measurement	1.573	0.02671
Loan repayment flexibility	1.191	0.06447
Price	0.340	0.45718

Likelihood Ratio Tests

Source	L-R ChiSquare	DF	Prob>ChiSq
Insurance payment	18.008	1	<.0001*
Insured risk coverage	9.080	2	0.0107*
Credit term	14.814	2	0.0006*
Collateral requirement	8.650	2	0.0132*
Loan repayment flexibility	3.419	1	0.0645
Loan use flexibility	9.926	1	0.0016*
Preferred season	18.488	2	<.0001*
Rainfall measurement	4.909	1	0.0267*
Price	0.553	1	0.4572

Supply side multinomial logit (with institution type interaction)

Effect Summary

Source	LogWorth	PValue
Insurance payment	4.529	0.00003
Preferred season	4.475	0.00003
Credit term	3.030	0.00093
Loan use flexibility	2.845	0.00143
Institution type*Collateral requirement	2.738	0.00183
Institution type*Preferred season	1.704	0.01978
Loan repayment flexibility	1.647	0.02255
Rainfall measurement	1.374	0.04227
Institution type*Loan repayment flexibility	1.333	0.04640
Collateral requirement	1.322	0.04764
Insured risk coverage	1.295	0.05068
Institution type*Price	0.805	0.15665
Price	0.598	0.25258
Institution type*Credit term	0.519	0.30298
Institution type*Rainfall measurement	0.362	0.43450
Institution type*Insured risk coverage	0.327	0.47083
Institution type*Loan use flexibility	0.147	0.71227
Institution type*Insurance payment	0.090	0.81320

Likelihood Ratio Tests

Source	L-R ChiSquare	DF	Prob>ChiSq
Insurance payment	17.447	1	<.0001*
Insured risk coverage	5.965	2	0.0507
Credit term	13.952	2	0.0009*
Collateral requirement	6.088	2	0.0476*
Loan repayment flexibility	5.203	1	0.0225*
Loan use flexibility	10.166	1	0.0014*
Preferred season	20.606	2	<.0001*
Rainfall measurement	4.125	1	0.0423*
Price	1.309	1	0.2526
Institution type*Insurance payment	0.056	1	0.8132
Institution type*Insured risk coverage	1.506	2	0.4708
Institution type*Credit term	2.388	2	0.3030
Institution type*Collateral requirement	12.609	2	0.0018*
Institution type*Loan repayment flexibility	3.967	1	0.0464*
Institution type*Loan use flexibility	0.136	1	0.7123
Institution type*Preferred season	7.846	2	0.0198*
Institution type*Rainfall measurement	0.611	1	0.4345
Institution type*Price	2.006	1	0.1567