AN ASSESSMENT OF MAIZE FARMERS' PREFERENCES FOR CROP INSURANCE FEATURES IN TRANS-NZOIA COUNTY, KENYA

OLILA Dennis Opiyo[1], Nyikal Rose Adhiambo, Otieno David Jakinda

Thesis Brief Prepared for the African Economic Research Consortium (AERC) Workshop held in Egerton University, 24th – 25th June 2014

ABSTRACT

Agricultural risk management is very important in protecting farmers against the vagaries of weather. The initial stage in risk management is the identification of the perceived risk followed by application of various agricultural mitigation strategies. The risk mitigation strategies available to farmers fall under three categories, focusing on financial, production and marketing aspects. While production risk management involves enterprise diversification and appropriate farm management practices, the marketing aspect involves forward contracting, hedging on futures markets, and selling price and minimum price contract. The financial facet of risk management comprises off-farm employment and crop insurance. Besides these, other alternatives including diversification of enterprises such as relying on public assistance or dependence on income outside agriculture are used.In Kenya, agricultural insurance is still at a pilot stage after an unsustainable effort in the 1970's. Despite the noble intervention to develop the crop insurance industry in Kenya, there exists an empirical gap in knowledge on farmers' preferences for the service. In order to address the aforementioned knowledge gap, the study employed the Choice Experiment (CE) method to assess farmers' preferences for crop insurance design features. The application of CE facilitated the estimation of willingness to pay (WTP) and policy scenarios that represent a useful method to inform policy design in a developing country context. The study site was Trans-Nzoia County, a major maize producing region in Kenya. The analysis employed a random parameter logit model (RPL). The results show that farmers are willing to pay for various features of crop insurance. Some of the important attributes were level of coverage, compensation, content design, risk cover, nature of coverage and price. Further, small scale farmers had higher WTP values than those of their large scale counterparts. This was a plausible expectation considering that small scale farmers are relatively more prone to vagaries of nature and resource constraints that hinder their diversification efforts compared to the large scale farmers. The insights on farmers' preferences are important in informing ex-ante design and improvement of crop insurance programmes in Kenya and other countries that face climate-related challenges and other agricultural risks.

1.0 Introduction

Like any other developing country, agricultural sector plays a significant role in economic development in Kenya. Odhiambo *et al*. (2004) posits that agricultural sector performance directly mirrors that of the economy. According to GoK (2014), the sector currently contributes 24.5 percent to the Gross Domestic Product (GDP). Moreover, the sector contributes approximately 27 percent to the GDP through linkages with manufacturing, distribution and other service related sectors. It further accounts for 65 percent of Kenya's' total exports, 18 percent and 60 percent of the formal and total employment respectively. Most importantly, agriculture falls under one of the three key pillars of Kenya's vision 2030 aimed at delivering 10 percent economic growth.

However, despite its ability to transform the economy from primary to tertiary level, the sector faces a myriad on inherent risks and uncertainty such as weather variability and climate change. Hardaker et al. (1997) explains that risk is the uncertainty of outcomes resulting in losses that negatively affect an individual's welfare. Normally the major risks that impacts negatively on the producer are both price and production. Empirical evidence show that one major contributor of price risk is liberalization of trade while climate change is the key driver of production risk (Ramiro, 2009). However, according to Chmielewski and Kohn (1999), weather plays a direct role in crop income volatility.

Risk and uncertainty are ubiquitous and varied in the Kenyan agricultural sector. Generally, they stem from uncertain weather, pests, diseases, and volatile market conditions. According to the Ministry of Water and Irrigation (MOWI, 2005), only 16 percent of Kenyan landmass is considered to be an area of high agricultural potential while the rest fall under arid and semi-arid areas. Moreover, Kenya experiences episodes of adverse weather conditions every five years and severe drought once every ten years (Nyamwange, 1995). These result in uncertain economic performance of the agricultural sector (Korir *et al*., 2011). Furthermore, exposure to risk hinders farmers from better planning and willingness to invest in agriculture. Even though agricultural risk is inevitable, opportunities exist in improving risk management strategies such as crop insurance in Kenya. World Bank (2005) opines that improved risk management in agriculture has significant potential in enhancing productivity.

Problem statement

Considering that maize is a staple food in Kenya, its availability and accessibility is a useful indicator of food security in the country (GoK, 2011). However, maize production and marketing face frequent risks and uncertainties including failed rains and unpredictable market prices that result in losses to farmers.Various humble reactions to the risk element, which include

diversification, have not been impressive, and crop insurance approach has emerged over the past decade or so, and not without challenges. Although various attempts to address crop insurance challenges in Kenya have been made, previous initiatives were based on a top-down approach, thus lacking local stakeholder, particularly farmers involvement in the programme design processes. The main challenge is that farmers fail to be engaged in the design of programmes they pay for. As such, their priorities, needs, and constraints facing them on the ground are not considered. Some of the main consequences of stakeholder omission are low levels of programme acceptance by the target group and reduced chances of success for such development programmes (Feder *et al.*, 1981). Moreover, Howlett and Ramesh (2003) report that stakeholder engagement in the design of policy programmes enhances acceptance and implementation. Prior identification of farmers' preferences can help design development interventions that are more acceptable and cost effective. Moreover, prior knowledge of farmers' priority problems and predisposition with respect to the usefulness of a development intervention can also help align the interventions with the needs of the different regions and categories of farmers (Bekele, 2004).

Objectives

The main objective of this study was to evaluate farmers' preferences for crop insurance features/attributes in Trans-Nzoia County, Kenya. The specific objectives included:

i. To analyze maize farmers' willingness to pay for crop insurance features.
ii. To assess factors influencing maize farmers' willingness to pay for crop insurance features.

Research hypotheses

The study hypothesized that:

i. Maize farmers in Trans-Nzoia County are not willing to pay any amount of money for crop insurance features.
ii. There are no known factors affecting farmers' willingness to pay for crop insurance features.

2.0 Methodology

Sampling method

Primary data were collected in the three districts of Trans-Nzoia County namely Trans-Nzoia West, Trans-Nzoia East, and Kwanza. The County was selected purposively because it is one of the main maize producing regions in the country. The study employed a multistage sampling procedure. This sampling procedure has the advantage in that it facilitates sequential sampling across two or more hierarchical levels (Cochran, 1977). The initial step began by listing all the divisions within the

three districts followed by a random selection of four divisions. This same procedure repeated by narrowing down to smaller administrative units (sub-locations). Finally, 15 sub-locations gave the primary sampling units.

In order to narrow down to respondents, a systematic random sampling was applied through a face-to-face interview. In order to ensure unbiased selection of respondents, a random route procedure was used where enumerators first interviewed farmers on one side of the road (left) before moving to the other side (right). Thus the third, sixth, and ninth farmer were sequentially interviewed in the various 15 sub-locations. The final sample size was 300 maize farmers. The sample size was justified by both budget constraint and by past studies using the CE method. Examples of some of these CE studies are Otieno (2011) with a sample size of 313; Espinosa-Godded *et al.* (2010) with a sample size of 300 respondents and Hanley *et al.* (2001) with a sample size of 267; among others.

The Data

The rural household survey was carried out in the months of April and May 2013. A pre-tested questionnaire was administered through face-to-face interview. The face-to-face interviews were given priority over other survey modes such as mail and telephone interviews, among others, because of the inconsistent and unpredictable use of mobile phones and internet among farmers in the region. Furthermore, face-to-face interviews have the merit of enabling further clarification of the questions by the interviewers besides facilitating collection of more data (Bateman *et al*., 2002). The larger questionnaire comprised of the CE profiles and questions concerning farm characteristics and socio-demographic factors. The survey targeted maize farmers only irrespective of their scale of operation. Six enumerators trained by the researcher and the supervisory team collected primary data. The survey employed a random route procedure (mentioned in section 3.5). Only household heads, who take part in key decision making in the household were interviewed. This was important in obtaining reliable information.

The household survey questionnaire had an introductory part of which enumerators were well acquainted. Such was important in gauging the ability of the respondent to answer the questions. This was followed by requesting permission to commence the survey given the estimated time to complete the interview was about 30 minutes per respondent. In order to ensure that all questions were attempted, the researcher on a daily basis checked the completed questionnaires. Table 1 below presents the variables used in the choice set.

Table 1: Description of variables used in the choice set

Variable	Description
LEVCOVME	Medium level of coverage [60%]
LEVCOVHI	High level of coverage [70%]
COMPENME	Medium compensation of the current price of a 90 kg bag of maize [60%]
COMPENHI	High compensation of the current price of 90 kg bag of maize [70%]
CONTJOIN	Content design [1 = joint, 0 = provider only]
MULTPRSK	Risk cover [1= Single, 0 = Multiple peril]
CROPMKT	Nature of coverage [1 = crop only, 0 = otherwise]
CROPMED	Nature of coverage [1 = crop and medical, 0 = otherwise]
PRICE	Annual insurance cost (Ksh/acre) [110, 170, 280]

Model specification

The CE approach is consistent with the Lancasterian theory of consumer choice (Lancaster, 1966), which postulates that consumers derive utility from the various features of the good as opposed to the good as a whole. The econometric basis of the approach rests on the behavioral framework of random utility theory (McFadden, 1974). The discrete choices follows utility maximization framework. The study employed a random parameter logit model (RPL) to estimate the marginal willingness to pay (WTP).

Data analysis

Estimation of willingness to pay

The CE data was analysed in NLOGIT 4 software. This began with the estimation of the standard MNL model. Due to the limitations of MNL, the RPL model resulted in parametric estimated β*'s* showing preference heterogeneity among individuals. The estimates of β represent taste (utility preference) parameters since they relate to the intensity with which the associated attribute contributes to utility. The most important application of β lies in the valuation of attributes. The ratio of an attribute coefficient and the price coefficient represents the implicit price (WTP or part-worth). This represents the trade-offs between crop insurance attributes and money, which is the marginal WTP. The Computation of WTP is as follows:

$$WTP = -1 * \left(\frac{\beta_k}{\beta_p} \right) \quad \text{.....} \quad (1)$$

Where β_k is the estimated coefficient for an attribute level in the choice set and β_p is the marginal utility of income given by the coefficient of the price attribute (Hanemann, 1984).The part-worth (implicit price) for the discrete change in an attribute or attribute level provides a measure of the relative importance that respondents attach to attribute within the crop insurance design.

Estimation of compensating surplus

Finally, the overall WTP or compensating surplus (CS) was calculated. This was based on the two categories of farmers namely small and large scale farmers. The CS estimates for the two groups of farmers are important in informing policy on an *ex-ante* crop insurance design; more so at this time when crop insurance is still at a pilot stage. Moreover, the CS provides a measure of crop insurance change based on substitutability between other attributes and price attribute.

The overall CS is estimated as (Hanemann, 1984):

$$CS = \frac{-1}{\beta_p}\left(V_1 - V_0\right) \quad \text{..... (13)}$$

Where V_1represents the value of the indirect utility associated with the attributes of the crop insurance scenario whereas $V_0$is the indirect utility of the baseline scenario of no crop insurance. Therefore the CS is the difference between the value of indirect utility before the change and the value of the same after the change converted into monetary units using the coefficient on the cost attribute, β_P. Thus, CS measure provides useful *ex-ante* information on the potential acceptability of the new crop insurance policy.

3.0 Results and Discussion

Farmer preferences for crop insurance

Table 2 on the next page presents RPL estimates on preference for crop insurance.The model results shown in table 2 above indicate that all the mean coefficients of the six attributes investigated are statistically significant. Furthermore, the estimated model has a good explanatory power (McFadden Pseudo-R^2 = 0.496). This offers an estimate of how much variation the model accounts in the CE data. The results indicate that indeed farmers prefer a crop insurance that includes the features crop and medical, high level of coverage, joint programme development among others. The positive coefficients indicate that if the levels are increased, so is the probability of purchasing a crop insurance premium as an agricultural risk mitigation strategy.

Table 2: RPL estimates on Preferences for crop insurance

Variable	Mean coefficient	Standard error	P-values

LEVCOVME	1.757	0.619	0.005***
LEVCOVHI	3.249	0.925	0.000***
COMPENME	3.401	1.119	0.002***
COMPENHI	4.726	1.266	0.000***
CONTJOIN	1.190	0.456	0.011***
MULTPRSK	4.420	1.201	0.000***
CROPMKT	5.965	1.712	0.001***
CROPMED	9.068	2.629	0.001***
PRICE	-0.021	0.006	0.001***
Standard deviations of parameter distributions			
$_{NS}$LEVCOVME	2.214	0.823	0.007***
$_{NS}$LEVCOVHI	2.210	0.823	0.007***
$_{NS}$COMPENME	2.164	0.798	0.007***
$_{NS}$COMPENHI	2.164	0.798	0.007***
$_{NS}$CONTJOIN	1.946	0.824	0.018**
$_{NS}$MULTRSK	3.141	1.007	0.002***
$_{NS}$CROPMKT	1.701	0.652	0.009***
$_{NS}$CROPMED	4.640	0.652	0.003***
Log-likelihood	-664.556		
Pseudo-R^2	0.496		
N respondents	300.000		
N choices	1200.000		

Notes: Statistical significance levels: ***1%, **5% and *10% respectively.

Table 3 below presents the results of the marginal WTP for crop insurance attributes. The ratio of an attribute coefficient and the price cost. This gives the mean WTP (Part-worth). The results of WTP confirm that farmers have heterogeneous preferences for all the crop insurance features. The WTP values were high for a crop insurance programme that is inclusive of medical, multiple risk cover, and both high compensation and coverage levels. Moreover, a scheme that covers market price volatility risks is also preferred.

Table 3: Marginal WTP estimates for Crop Insurance attributes (Ksh)

Variable	Marginal WTP (95% confidence	P-value	H_0:

	interval)		testing
LEVCOVME	85.689	0.00370***	H_0 rejected
	(27.892 to 143.487)		
LEVCOVHI	158.482	0.00000***	H_0 rejected
	(117.312 to 199.652)		
COMPENME	165.897	0.00000***	H_0 rejected
	(101.143 to 230.653)		
COMPENHI	230.484	0.00000***	H_0 rejected
	(180.237 to 280.732)		
CONTJOIN	56.527	0.00000***	H_0 rejected
	(29.505 to 83.548)		
MULPRSK	215.584	0.00000***	H_0 rejected
	(174.761 to 256.408)		
CROPMKT	290.916	0.00000***	H_0 rejected
	(243.689 to 338.144)		
CROPMED	442.272	0.00000***	H_0 rejected
	(364.474 to 520.071)		

Notes: Statistical significance levels: ***1%, **5% and *10% respectively.

Compensating surplus

For a successful implementation of the proposed crop insurance programme, a combination of the various attributes was vital. In order to illustrate how both small and large scale farmers might respond to different attribute combinations, the CS estimates for two possible policy scenarios were determined from the RPL models as presented in Table 4 (see next page). The rationale underlying CS was to inform policy on the design of crop insurance programme that is best suited for the small and large scale farmers. These outcomes are representing different crop insurance programmes.

Table 4: Attribute levels and Compensating Surplus for Crop Insurance Policy Scenarios (Kshs).

Attributes													
	Level of coverage		Compensation	Content design		Risk cover		Nature of coverage		Compensating Surplus	Standard error	P-value
Scenario	Low	High	70%	Joint	Provider alone	Single peril	Multiple peril	Crop and market	Crop and medical			
1			✓		✓		✓		✓	16,791.70	1,836.10	0.0000
2		✓	✓	✓		✓		✓		16,639.80	1,825.00	0.0000

Notes: ✓Indicates that the attribute is present in a scenario at the non-zero level.

The CS estimates for the two scenarios are both positive and significant at the 1 percent level. This shows that maize farmers are generally willing to move from the base-line of no crop insurance. Scenarios 1 and 2 are the CS estimates for small and large scale farmers respectively.The CS results indicate that small scale farmers have a higher overall WTP for crop insurance as compared to their large scale counterparts. This was a plausible expectation considering that small scale farmers are relatively more prone to vagaries of nature and resource constraints that hinder their diversification efforts compared to the large scale farmers.

Farmers preferences for specific features

Figure 1 below presents graphical representation farmers' preferences for the various crop insurance features as a percentage of the sample population. Generally, over 90 percent of the farmers had a positive preference for each of the attributes included in the CE. A majority of the farmers clearly preferred the crop insurance features included in the CE, suggesting that collectively these features fully captured farmers' range of crop insurance.

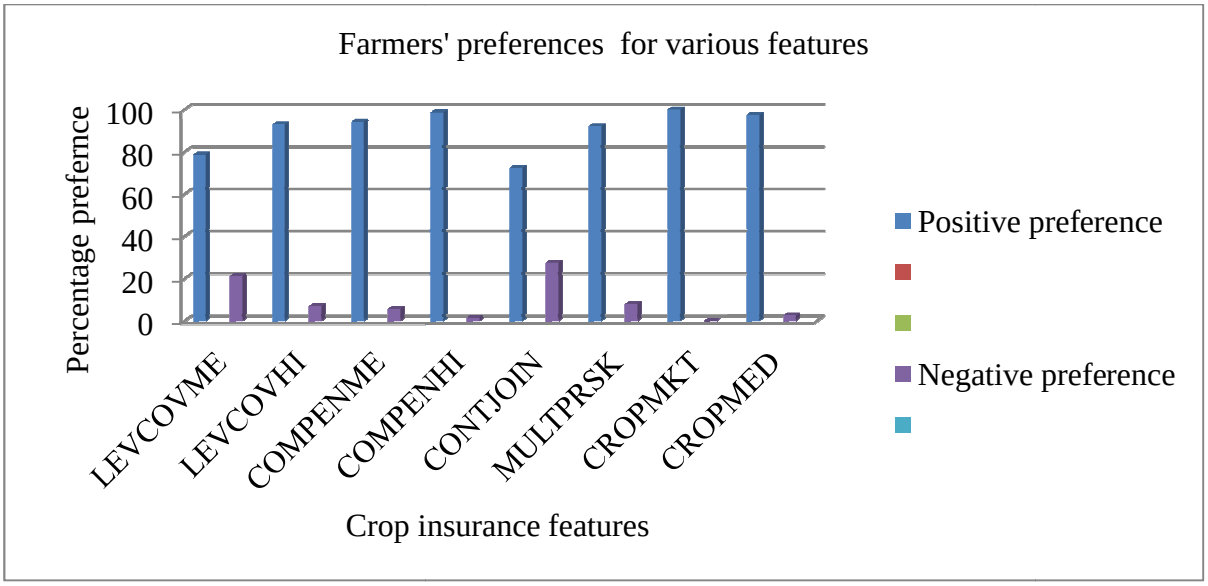

Figure 1: Farmer preferences for crop insurance features.

Source: Authors survey

5.0Summary, Conclusions and Policy Recommendations

Summary

The objective of this study was to evaluate farmers' preferences for crop insurance in Kenya. A CE method was used to elicit farmers WTP for various attributes of the crop insurance. After the review of literature and FGD attribute validation, a pre-test study and actual data collection among 300 respondents followed. Among the attributes used were level of coverage, compensation, content design, risk cover, nature of coverage and price. The descriptive results indicate that large scale farmers had a higher level education and income as compared to the small scale farmers.

The two farmer categories also exhibited statistically significant differences with respect to awareness about crop insurance, membership to development groups, and access to loans. Indeed, a majority of large scale farmers were aware of crop insurance, accessed loan besides being members of development groups.

The RPL results showed that farmers had a high preference for the various crop insurance features. This suggests that collectively, the features used in the CE design fully captured farmers' preference range for crop insurance. For example, farmers preferred a crop insurance scheme that can insulate them against both production and market risks besides offering them an opportunity to afford medical insurance. Moreover, the WTP values were positive and statistically significant at 1 percent level. The implication of positive WTP is that crop insurance with these features would increase the probability of farmers choosing the proposed insurance scheme.

Heterogeneity in farmer preferences existed among the various crop insurance features. Finally, the CS estimates for the two scenarios were positive and statistically significant. This has an implication that farmers prefer a change from the baseline of no crop insurance to the current proposed crop insurance scheme. Agriculture remains an important economic sector and primary source of livelihood in Kenya. Despite this, climate and weather related risks remain a major challenge to financially constrained farmers. This calls for a comprehensive financial risk management approach. Even though agricultural insurance is not a panacea to risk management, the findings offer important policy insights required for the development of crop insurance based on stated farmers' preferences.

Conclusions and policy recommendations

The results have demonstrated that CE has greater prospects of applications in developing country context to inform policy on the design of crop insurance in Kenya.The findings showed a high WTP for nature of coverage (crop and market risks, crop, and medical risks). Moreover, high WTP for a holistic crop and medical insurance implies that farmers would readily accept the programme with an element of medical cover. This would stimulate farmers towards the uptake of agricultural insurance as a risk mitigation strategy. This calls for Policies that target the development of a crop insurance comprising of these features.

Further, the findings reveal that in general farmers were willing to be engaged in the design of programmes they pay for. This is justified by their WTP for stakeholder consultation regarding policy formulation. Reviews of empirical literatures indicate that stakeholder consultation plays a major role in acceptance and implementation of an intervention programme. In order to ensure acceptance of the programme among farmers, it appears important to emphasize on a bottom-up policy formulation approach, a phenomenon recommended by development experts world over, but only practiced sparingly. This will instil confidence in development programmes such as crop insurance.

The results indicated that farmers prefer a MPCI cover. Further, results showed preference for higher coverage levels. The positive and significant coefficient signifies that as coverage level is increased, so did the probability of choosing the product. The policy implication of this result is that government should develop a crop insurance programme that takes care of multiple risk cover besides advocating for a higher coverage level. Nevertheless, the results of the CS estimates (policy scenarios) derived for the two farmer categories show that farmers were willing to move from the baseline (status quo) of no crop insurance to the current proposed crop insurance scheme. The CS values are relative values that farmers would pay should they use crop insurance as a risk mitigation strategy. The ability to pay would be a consequence of high incomes that would result due to increment in production output. Therefore, in designing and implementing an appropriate crop insurance scheme, policies geared towards the design of crop insurance suitable for the two farmer category based on the scale of production are imperative.

Two distinct differences between the proposed and the existing crop insurances exist. First, the existing crop insurance was formulated through a top-bottom approach i.e., farmers were never consulted while designing the programme. Second, the existing crop insurance values the product as whole while the proposed one values the various components after stakeholder consultation on what components they desire in a crop insurance.

Proper implementation of policy scenarios will require both farmer representation and government intervention as proposed in a two prong approach below. First, a cooperative union formed by the committee members will offer a plausible vehicle for the provision of the programme. This has several advantages such as the ability of members who are shareholders at the same time to act in a manner that serves the interest of the cooperative.

Moreover, members become observers of the functioning organization besides the possibility of enhancing transparency. In addition, a cooperative would be more sensitive to the needs of the clients particularly in respect of settling claims. Furthermore, better control of risks would be possible and by virtue of having links with other cooperatives, it would lead to better risk management. Finally, public confidence enhanced resulting from legal registration under the Insurance Act (Cap 487) Laws of Kenya, which came into force in 1987 to regulate insurance services.

Second, public intervention will play an important role in providing an enabling environment to operate. This can be done by enacting an appropriate institutional framework i.e., systems of formal laws, regulations and procedures guiding provision of crop insurance scheme in the country. Moreover, the government should enact suitable policies to facilitate the implementation of the proposed crop insurance scheme besides offering premium subsidy.

Contributions to knowledge

The study applied CE method to elicit farmers' preferences for crop insurance programme. It thus contributes to the existing body of knowledge in various ways. First, the information on farmers' preferences provides policy insights on the development of crop insurance as a financial facet of risk mitigation strategy in Kenya and other emerging economies facing similar conditions. Despite the fact that quite a number of policies currently touch on the issue of agricultural insurance, none of them propose concrete and result-oriented strategies on how to improve the agricultural insurance (Kerer, 2013). Therefore, the estimated CS values for crop insurance policy scenarios offer important policy insights on an *ex-ante* design of crop insurance in the country. Second, the study designed a crop insurance programme specific to the two farmer categories. This takes care of heterogenic structures in crop production sector (small and large scale farmers) in the country. As a result, it offers insights on what is desirable for both small and large scale farmers as far as provision of crop insurance is concerned. Finally, the application of CE contributes to the thin body of literature, owing to the fact that empirical applications of this method in a developing country context are still limited.

References

Bateman, I. J., R. T. Carson, M. Hanemann, N.Hanley, T.Hett, M. Jones-Lee, G. Loomes,

E. Ozdemiroglu, D. W. Pearce, R. Sugden, and Swanson, J. (2002), Economic Valuation with Stated Preference Techniques*, A manual, Department for Transport, ISBN 1-84376-852-6, Edward Elgar, Cheltenham.*

Bekele, W. (2004), 'Analysis of Farmers' Preferences for Development Intervention Programs',*A Case Study of Subsistence Farmers from Eastern Ethiopian Highlands. African Development and Poverty Reduction: The Macro-Micro Linkage Forum Paper.*

Cochran, W. G. (1977). Sampling techniques (3rd ed.). New York: Wiley. Available at: http://www.gobookee.net/cochran-sampling-techniques/ [Last accessed: 28th, August 2013].

Chmielewski, F.M. and Kohn, W. (1999), 'Impact of weather on yield components of spring cereals over 30 years', *Agricultural and Forest Meteorology*, *96(1-3):49-58.*

Espinosa-Goded, M., Barreiro-Hurle´, J., and Ruto, E. (2009), 'What Do Farmers' want from Agri-environmental Scheme Design: A Choice Experiment Approach', *Journal of Agricultural Economics, doi: 10.1111/j.1477-9552.2010.00244.x*

Feder G., Just, R., and Sibeman, D. (1981).'Adoption of agricultural innovations in developing countries'.*World Bank: Staff Working Paper No. 444, Washington, D.C., USA.*

GoK (Government of Kenya) (2011), 'National Food and Nutrition Policy', *Government Printers, Nairobi*

Hanemann, W. M. (1984), 'Welfare evaluations in contingent valuation experiments with Discrete responses', *American Journal of Agricultural Economics*, *66(3): 332-341*.

Hanley, N., Maurato, S. and Wright, R.E. (2001), Choice Modelling Approaches: A Superiour Alternative for Environmental Valuation. Journal of Economic Survey, 15(3)

Hardaker, J. B., Huirne, R.B.M, and Anderson, J.R. (1997), 'Coping with risk in agriculture', *Cab International, Wallingford, United Kingdom.*

Howlett, M., and Ramesh, M., (2003), 'Studying Public Policy: Policy Cycles and Policy Subsystem', *Oxford University Press, New York.*

Kerer, J. (2013), 'Adaptation to Climate Change and Insurance', Available at: http://www.acci.co.ke/accio/wp/wp-content/uploads/2013/06/ACCI_Insurance-Background-Kenya_6-2013.pdf. [Last accessed: 13th, December 2013].

Korir, L.K., Lagat, J.K., Njehia, B.K. (2011), Risk Management among Agricultural households and the role of off-farm investments in Uasin Gishu County, Kenya.*A Thesis*

Submitted to the Graduate School in Partial fulfillment for the Requirements of the Master of Science Degree in Agricultural and Applied Economics of Egerton University.

Lancaster, K. (1966), 'A new approach to consumer theory', *Journal of Political Economy, 74(2): 132-157.*

MOWI (2005), 'Overview of Irrigation Development in Kenya and Water Sector Reforms: Achievements and challenges', *Ministry of Water and Irrigation, Government printers, Nairobi.*

McFadden, D. (1974), 'Conditional Logit Analysis of Qualitative Choice Behavior',

in P. Zarembka (Ed.), *Frontiers of Econometrics, Academic Press.*

Nyamwange, M. (1995), 'Famine mitigation in Kenya: Some practices, impact, and lessons. *Middle States Geographer', 28(2):37-44.*

Otieno (2011), 'Economic analysis of beef cattle famers' technical efficiency and willingness to comply with Disease Free Zones in Kenya', *Thesis Submitted for the degree of Doctor of Philosophy School of Agriculture, Food and Rural Development, Newcastle University, Newcastle Upon Tyne, NE1 7RU, United Kingdom*

Ramiro, I. (2009), 'Agricultural insurance', 'In *Primer Series on Insurance. World Bank.*

Walter Odhiambo, Hezron O. Nyangito ,JonathanNzuma (2004), Sources and Determinants of Agricultural Growth and Productivity in Kenya. *KIPPRA Discussion Paper No. 34 March 2004.*

World Bank (2005), 'Managing Agricultural Production Risk: Innovations in Developing Countries', *World Bank Washington D.C*