Determinants of Farmers' Awareness about Crop Insurance: Evidence from Trans-Nzoia County, Kenya

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Abstract

Kenya has a long history in applying risk management mechanisms in agriculture. The initial agricultural insurance scheme was initiated by the colonial government in the 1930's under the Guaranteed Minimum Returns (GMR); a form of crop insurance that guaranteed farmers a minimum price for their produce besides insuring their production against unavoidable crop failure. However, due to its abuse by stakeholders, the government made a decision to discontinue the programme in 1978. For many years after the discontinuation, agricultural insurance was virtually not available in the country. In order to revive the crop insurance industry, the private sector launched '*Kilimo salama'*, meaning safe farming in 2009. However, despite the noble intention to revive the crop insurance industry, a dearth of empirical knowledge exists on factors affecting farmer awareness about crop insurance product. In order to address the aforementioned knowledge gap, a binomial logit model was employed to assess the factors affecting awareness. The core findings of the study were that gender, education, and income of the household were the main determinants of awareness. These findings provide policy insights on key areas of intervention with respect to uptake of crop insurance in the country.

Key words: Awareness, crop insurance, logit model, farmers, Kenya

1. Introduction

1.1 Background information

Kenyan economy still battles with agriculture as the key driver to the long-term economic transformation. The sector accounts for 24 percent of Gross Domestic Product (GDP) and 60 percent of foreign exchange earnings (GoK, 2014). However, the sector mainly depends on rain-fed agriculture that faces challenges of risk and uncertainty. 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 (ASALS). Moreover, Nyamwange (1995) posits that the country experiences episodes of adverse weather conditions every five years and severe drought once every decade.

The country's food sustainability lies in the availability and accessibility of maize, a central indicator of food security (NFNP, 2011). According to Muchena *et al*. (1988), maize crop can grow in a wide range of soils that enables maize cultivation in almost all agro-ecological zones. Empirical evidence reveals that two out of every three farmers grow maize (Kibaara, 2005). One of the major challenges facing the maize subsector is weather variability resulting from climate change. This has prompted the government to enact grain market reforms mainly because the commodity plays a major role as a key staple food and a source of income for the majority of the population (Nzuma and Sarker, 2010). Even as the country grapples with importation of maize to off-set the deficit, constraints on the supply side resulting from increased weather variability, high incidences of diseases and pests, and declining soil fertility among others are inevitable.

1.2 Research Problem statement

Climate change is perhaps the most complex and challenging impediment to agricultural transformation in developing countries. Kenya's maize production sector is wholly dependent on rain-fed agriculture characterised by risk and uncertainity. According to Ojwang' *et al*. (2010), almost 57 percent of the population lives in poverty largely reliant on climate-sensitive economic activity. As a result, agricultural risk management plays a fundamental role in insulating farmers against the effect of weather vagaries. Kenya has had a long history of agricultural risk management ranging from production, marketing, and crop insurance among others. However, there exists an empirical gap in knowledge on factors affecting farmer awareness about crop insurance.

It is therefore imperative assess these factors with an aim of coming up with evidence-based policies relevant in terms of agricultural risk management.

2. Literature Review

2.1 Historical review of agricultural insurance in Kenya

Kenya has a long history in applying risk management mechanisms in agriculture. During the 1930's, an economic depression forced the colonial government to introduce a number of reforms to compensate for the slow-down in agricultural lending and the worsening food security situation (Kerer, 2013). In order to insulate farmers against agricultural risks, government introduced GMR scheme; a form of crop insurance aimed at addressing the main challenges that faced agricultural production through guaranteed market and accessibility to credit. Its main aim was to benefit farmers who were obligated to purchase crop insurance (Makau, 1984). However, GMR collapsed in 1978 mainly due to collusion between farmers and implementing officials who had their crop declared a failure and in return had their production loans written off (Kerer, 2013). For many years after the discontinuation of GMR, agricultural insurance was virtually not available in Kenya but until the year 2009 when '*Kilimo salama'* was launched on a pilot basis.

2.2 Review of empirical studies on crop insurance

A plethora of literature exists in the area of agricultural insurance. According to Mahul and Stutley (2010), crop insurance refers to insurance that provides financial compensation for production or revenue losses. A review of empirical literature show that several studies fall within the developed world context. For example, Fraser (1992) analyzed producer willingness to Pay (WTP) for crop insurance in Australia. The findings of the study indicated that WTP was relatively sensitive to levels of coverage and yield variability. Second, Martinson *et al*. (2004) evaluated farmers' preferences for crop and health insurance products. The results showed that 64 percent of the farmers prefer to hold any type of health insurance perceived affordable to them. Patrick (1988) studied the demand for crop insurance in the Australia. Findings showed that non-participation is higher (about 57 percent) for single risk cover as opposed to about 25 percent in multiple peril cover.

Furthermore, Shaik *et al.* (2008) estimated WTP for potential insurance policy among 268 trout producers using the contingent valuation (CV) method. The finding showed that producers were willing to pay premium rates of 2 to 11 percent for coverage levels. In a developing country context, Sarris *et al*. (2006) used a probit regression model to estimate two types of rainfall index contract. The study results showed that many farmers in Tanzania were not able to afford crop insurance premium before harvest due to financial constraint. McCarthy (2003) used a cross-section data for farm households in Morocco to estimate WTP for crop insurance contracts. Findings showed that farmers with relatively high income were more willing to pay for crop insurance compared to those whose income fell below average.

Finally, various studies have looked at consumer awareness in various aspects of agriculture. For example, Kumar (2011) analyzed farmers' perceptions and awareness towards crop insurance as a tool for risk management using Tobit and Probit models. The results of the survey showed that 65 percent of the farmers were aware of risk mitigation measures. Pambo (2013) studied consumer awareness of fortified sugar in Kenya. The core finding was that 55 percent of the households were aware of fortified sugar most of whom were urban consumers. Finally, Shim *et al.* (2011) carried out a study on consumer knowledge and safety perceptions of food additives on 430 consumers. It was revealed that respondents were concerned about preservatives, colorants, and artificial sweetness of foods.

3. Methodology

3.1 Sampling and data collection

The study employed a multistage sampling procedure. This sampling procedure has the advantage of facilitating 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 was repeated by narrowing down to smaller administrative units (sub-locations). A Systematic random sampling was then used to reach 300 farmers. In order to ensure unbiased selection of respondents, a random route procedure was applied where enumerators first interviewed farmers on one side of the road (left) before moving to the other side (right). This was used to get to select the third or sixth farmer in the various 15 sub-locations.

The household survey was carried out from April to May 2013. A pre-tested questionnaire was administered through face-to-face interview. The face to face interviews were given priority to other survey modes such as mail and telephone interviews among others because of inconsistent use of mobile phones and internet among farmers in the region. Moreover, face-to-face interview has the merit of enabling further clarification of the questions by the interviewers (Bateman *et al*., 2002). Only household heads that are key in decision making were interviewed.

3.3 Description of the Variables

Table I presents six variables that were used to determine level of awareness. Among the variables used were size of land (LANDSIZE), gender of the household (GENDER), education level of the farmer (EDUC), income of the farmer (INCOME), membership to development group (DEVPTGP), and type of the farmer (FARMTYPE). Gender refers to the roles played by both men and women in the society. It was therefore expected that gender could have a significant effect in terms on knowledge about crop insurance. Further, education level of the household was thought to influence on awareness. Finally, average monthly income was included because it was expected that it could explain awareness and alternative risk mitigation strategies. Table I presented indicates the expected signs in the variables.

In order to ensure that explanatory variables included in the model were not in any way correlated with each other, a multicollinearity test was done through a variance inflation factor (VIF) computation. A simple ordinary least square (OLS) regression was estimated with awareness as the dependent variable with the rest as explanatory variables. The VIF quantifies the severity of multicollinearity in an ordinary least squares regression. According to Gujarati (2004), VIF shows how the variance of an estimator is inflated by the presence of multicollinearity. The calculation of VIF follows the following formula:

$$VIF = \frac{1}{1 - Ri^2} \quad \text{..... (1)}$$

Where Ri^2 is the R^2 of the regression with the i^{th} independent variable as a dependent variable. Table II presents the results of the VIF.

The mean VIF is 1.31 with explanatory variables having a VIF ranging from 1.05 to 1.59. The VIF for the independent variables are less than five (<5) implying zero multicollinearity. This justifies the inclusion of these variables in the binary logit model (Maddala, 2000).

3.4 Model specification

A binary logit model was employed in assessing determinants of farmer awareness about crop insurance. The logit model was preferred owing to the fact that the dependent variable is discrete in nature. According to Hensher and Green (2009), the logistic distribution is better in applied research over the probit model because of computational complexity arising from lack of a closed form for the normal cumulative density function on which the probit model is based. With awareness as the dependent variable, farmers who were aware were and assigned the value of Y = 1 and 0 otherwise. The logit model is specified as:

$$Y = a_0 + \beta_1 \text{LANDSIZE} + \beta_2 \text{GENDER} + \beta_3 \text{EDUC} + \beta_4 \text{INCOME} + \beta_5 \text{DEVLPGP} + \beta_6 \text{TYPEFARM} \quad \ldots\ldots (2)$$

Following Greene (1993), the probability that individual *i* is aware can be modelled as:

$$\text{Prob} = [Y_{ij} = 1] = \frac{\exp(\beta' xi)}{1 + \exp \beta' xi)} = \Lambda(\beta' xi) \quad \ldots\ldots (3)$$

The subscripts *i* and *j* denote consumer awareness where those who are aware are assigned a value of 1 and 0 for otherwise. It should be noted that equation (1) above represents the reduced form of the binomial logit model, where the x_i row vector of explanatory variables for the ith farmer and the non-observed $\varepsilon i' s$ are assumed to follow a distribution of logistic probability with a density function:

$$F' (\beta' xi) = \Lambda(\beta' xi)[1 - \Lambda(\beta' xi)] \quad \ldots\ldots (4)$$

The probability that individual *i* is aware of crop insurance is empirically estimated by the model as:

$$\Pr [Yi = 1] = Xi\beta i + \varepsilon i \quad \ldots\ldots (5)$$

Where *X* represents a vector of socio-demographic characteristics that influence farmers awareness of crop insurance, βi is a vector of parameters to be estimated while εi stochastic random term. The study also estimated marginal effects. According to Otieno (2013), marginal

effects measures instantaneous effects change in explanatory variable on the predicted probability under the assumption that all other explanatory variables are held constant. Thus, marginal effects are computed as follows:

$$\beta m = \left[\frac{\partial(\beta iXi + \varepsilon i)}{\partial \beta iXi} \right] \beta i \text{ for continuous explanatory variables}\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

In terms of dummy variables, equation (4) becomes $\beta m = \Pr[Yi = 1] - \Pr[Yi = 0]$ …..…… (7)

4. Results and Discussion

4.1 Farmer Characteristics

Table III presents a summary of socio-demographic characteristics of farmers. Results show that large scale farmers had higher income level compared to their small scale counterparts. This could be attributed to higher level of education that enabled farmers' to acquire larger parcels of land. Further, focusing on farmer access to loan, results indicate that within the farmer category, 23, and 44 percent of small and large scale farmers had applied for a loan respectively. Therefore, credit accessibility among large scale farmers could explain the consequent higher incomes. Membership to social and development group like Merry-go-round, farmers' savings and credit cooperative organization (SACCO) were relatively higher among large scale farmers.

A total of 46 and 53 percent of small and large scale farmers were members of development group respectively. The pooled sample indicates that only 49 percent of farmers belonged to a development group. In terms of awareness about crop insurance, only 32 percent of the small scale farmers were aware as opposed to 43 percent of large scale farmers. In the pooled sample, only 36 percent of both small and large scale farmers were aware of crop insurance.

Land ownership varied between farmers. Small scale farmers i.e., farmers having less than 5 acres of land were dominant at 64 percent compared to 36 percent of large scale farmers. Empirical literature show that small scale farmers contribute up to 70 percent of the global food (UNEP, 2012). The yield of maize per acre ranged from a minimum of 15 to 45 per acre while the average yield (90kg bags) for the whole sample per acre was 23. This implies that farmers are not getting the optimal expected yield. Weather variability, price risks, pests, and diseases were some of the factors alluded by farmers to affect maize yield. Surprisingly, none of the farmers used crop insurance as a financial facet of risk mitigation strategy despite the aforementioned challenges.

According to Just *et al*. (1999), there are usually three motivations for purchasing crop insurance namely, subsidy effect from the government, motivation in risk aversion and adverse selection among farmers. The risk aversion aspect is key to indemnifying farmers against climate related risks.

4.2 Determinants of farmer awareness

Table IV presents the results of the binary logit model. The coefficient values explain the influence of each explanatory variable on the probability of being aware about crop insurance. Furthermore, the marginal effects give what would happen immediately if farmers become aware about crop insurance. The independent variables that significantly influenced farmer awareness were gender, education, and income of the household. Female headed households were more aware of crop insurance as compared to male headed households. This could be attributed to the fact that women usually spend more time on the farms as compared to men. According to Karaya *et al.* (2013), women play a major role in primary food production and are therefore the main custodians of food security. The result is consistent with that of Adesope *et al.* (2010) that female consumers in Northan Nigeria were more likely to be aware of safety labels of sugar. The number of years of schooling had a positive effect on awareness. It was revealed that educated farmers are more aware about crop insurance scheme as compared to those who have less education. Specifically, the marginal effect indicates that an increase in education by one year instantly increases the probability of being aware by 13 percent. The study findings corroborates with that of Kumar (2011) that years of education influenced farmer awareness about crop insurance.

The level of household income positively influenced awareness. This could be explained perhaps by the fact that farmers with higher income have a possibility of getting information on risk management strategies as they interact with various financial institutions. A change in income level to above average has the probability of instantly raising awareness level by 15 percent. Contrary to study expectation, membership to a development group did not significantly influence farmer awareness. This finding is contrary to that of Kumar (2011) that farmer's participation in social and community-based organization increased the probability of being aware about crop insurance scheme.

5. Conclusions and policy recommendation

A binomial logit model was employed in empirical analysis of the primary data. The key findings of the study were that gender, education and income of the farmer significantly affected awareness. These findings provide policy insights on financial intervention among the rural poor with the rationale of enhancing agricultural productivity. Perhaps, policies that promote accessibility to credit may offer prospects for agricultural transformation. Second, knowledge dissemination to farmers in form of extension services offers great opportunities of increasing both farmer awareness and uptake of crop insurance. The findings thus provide policy insights on key areas of intervention in terms of use of crop insurance as an agricultural risk mitigation strategy in Kenya and other developing countries facing similar conditions.

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Table I: Variables, Description and expected signs

Variable	Description	Expected sign
LANDSIZE	Size of land in acres [1 = large scale, 0 = small scale]]	±
GENDER	Household gender [1 = male, 0 = female]	+
EDUC	Education level of the household [1 = high educ, 0 = low educ]	+
INCOME	Monthy income of the household [1 = High income, 0 = low income]	+
DEVPGP	Membership to a development group [1 = Yes, 0 = otherwise]	+
TYPEFARM	Type of farmer either small oer large scale [1 = large scale, 0 = otherwise]	±

Table II: VIF for explanatory variables

Variable	VIF	1/VIF
FARMSIZE	1.59	0.631
INCOME	1.54	0.6474
LANDSIZE	1.53	0.6540
EDUC	1.08	0.9302
GENDER	1.06	0.9457
DEVPTGP	1.05	0.9521
Mean VIF	1.31	

Table III: Socio-demographic characteristics of farmers

		Small scale farmers	Large scale farmers	Pooled
Characteristics		(N = 191)	(N = 109)	(N = 300)
Education (mean years)		10.36	11.39	10.73
Awareness (%)		31.90	43,10	36.00
Development group (%)		46.10	53.20	48.70
Monthly income (mean)		16174.00	81860.00	40040.00
Access to credit (%)		22.50	44.00	30.30
Mean age (years)		42.71	48.94	44.98
Average farm size (acres)		2.53	22.19	9.67
Average maize yield (90 bags/acre)				22.60
Gender:	Male			43.30
	Female			56.70
Education (%):	None			3.30
	Primary			37.70
	Secondary			33.70
	College			20.30
	University			3.30
	Masters			1.70
Household income (Ksh/month)				
< 10,000				27.67
10,000 - 25,000				39.67
25,001 - 35,000				6.67
35,001 - 45,000				7.67
More than > 45,000				18.33

Table IV: Logit model estimates of the determinants of farmers' awareness

Variable	Coefficient	p-value	Marginal effect	p-value
CONSTANT	-0.684**	0.010	-	-
	(0.266)			
LANDSIZE	0.012	0.208	0.003	0.029
	(0.001)		(0.002)	
GENDER	-1.018***	0.000	-0.222	0.000
	(0.273)		(0.056)	
EDUC	0.595**	0.03	0.131	0.025
	(0.274)		(0.058)	
INCOME	0.658**	0.068	0.154	0.074
	(0.360)		(0.086)	
DEVELPGP	-0.108	0.682	-0.024	0.682
	(0.263)		(0.059)	
TYPEFARM	-0.262	0.438	-0.058	0.432
	(0.338)		(0.074)	

Notes: Standard errors shown in parentheses. Statistical significance levels: ***1%, **5% and *10%. McFadden Pseudo-R^2 = 0.0878.