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FINANCIAL INNOVATION AND POVERTY REDUCTION: EVIDENCE FROM RURAL NORTHERN NIGERIA

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Financial Innovation and Poverty Reduction: Evidence from Rural Northern Nigeria[1]

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Executive Summary

This paper examines the effect of financial innovation on poverty reduction in rural northern Nigeria. Households from this part of the world are farmers hence, exposed to the vagaries of Climate Change. Therefore, assessing whether or not, the poorest income quintile (the poorest of the poor) benefit from existing financial inclusive strategies, would inform policy makers and direct the attention of microfinance entrepreneurs to better innovate products that would increase financial inclusiveness and reduce poverty in developing countries. The findings of the paper include:

- First, females constitute the majority of farmers in the poorest income quintile while men are mostly in the 4th and richest quintile

- Secondly, smaller size households are more likely to be in the poorest income quintile than large households as family size matters for farm labour due to traditional farm practice.

- Thirdly, traditional crop insurance benefits mostly rich farmers and poor farmers do not utilize microfinance institutions meant to accelerate formal access to credit. Lending to rural farm households organized into savings clubs, however, benefits the poorest income quintile farmers.

- Fourthly, government programmes put forward to help rural farm households cope with agricultural shocks have, unfortunately, benefited mostly those in the richest income quintile.

- Lastly, to eradicate poverty for all in a post 2015 sustainable development framework, looking into how rural farm households are organized in developing countries and designing financial inclusive products that would be consistent with their values and community life, would be needful.

Financial Innovation and Poverty Reduction: Evidence from Rural Northern Nigeria[2]

By

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ABSTRACT
In a post 2015 sustainable development agenda where the eradication of poverty for all is a target, empirical evidence on how traditional financial coping strategies (access to formal credit and crop insurance) affect rural farm households and what kind of innovation would bring them out of poverty, remains critical. This paper examines the effect of financial innovative strategies on poverty reduction in rural northern Nigeria and whether or not, the poorest income quintile benefits the most from such strategies in different scenarios. Empirical findings showed that traditional crop insurance benefits mostly rich farmers, and microfinance institutions meant to accelerate formal access to credit are underutilized by poor farmers. Lending to rural farm households organized into savings clubs, however, would benefit the poorest of the poor. To eradicate poverty for all in a post 2015 sustainable development framework, perhaps it is time to look into how rural farm households are organized in developing countries and design financial inclusive products that would be consistent with their values and community life. Furthermore, moving away from traditional crop insurance to alternative insurance would help poor farmers cope or adapt to covariate and idiosyncratic agricultural shocks in developing countries.

1.   INTRODUCTION

A more equal distribution of the gains from economic growth emerged as an increasingly prominent development objective during the 1970s (Malton 1979). Interest in the distribution reflected the growing awareness that the income gap separating the rich and poor had widened substantially in all but a few developing countries during the past two decades. While recent evidence have shown widen income gap between the rich and poor in developing countries, how income is distributed among rural farm households, how climate change is driving that process and how a set of financial innovative strategies can help in ensuring equitable distribution of income, have remained vague in the literature.

There is strong evidence that access to financial services would strengthen the resilience of households to climate change (Dabla-Norris et al 2013, Collier 2013, IMF 2014 etc). Whether such services would benefit the poorest income quintile in typical agricultural household-type communities that are vulnerable to climate change in developing countries, however, is not clearly established. This paper examines the effect of financial innovation (formal access to finance, rural household savings clubs and traditional crop insurance) as a climate change adaptation strategy on horizontal inequality in Nigeria. This thinking is rooted in the typical agricultural household model (see Siegel and Alwang 2005, Schneider and Gugerty 2011, Sanfo and Gérard 2012) and the monotonicity axiom of robust poverty measures (see Ravallion and Chen 2001, and Haughton and Khandker 2009) which suggests that, in situations where poor rural households are farmers (producers) as well as consumers, any income gain should reduce poverty. The poverty-growth-inequality triangle hypothesis (see Grammy and Assane, 2006; Biosca, Mosley and Lenton, 2011) also provides a theoretical link as the extent and magnitude of poverty is argued to depend on the growth of mean level of per capita income and the degree of

inequality in the distribution of income. Thus, income gain for the poor should reduce poverty. The reasoning is that while farmer innovation can be used to cope with some aspects of the negative impact of climate change in developing countries (see Tambo and Wünscher 2014), financial innovation could do well in other cases.

Farmers had always found ways to adapt to the impact of changing weather and climate conditions. Global climate and environmental change (with its local effects) however, increases the scale for which they need to build and implement resilient strategies (see IISD 1995, von Braun 2002, Hess 2003; Ayers and Huq 2009, Aiello 2009, Akter and Fatema 2011, World Bank 2012, Kim 2013, Collier 2013, IFAD 2014). The literature on climate change and risk management strategies identifies several approaches to helping farmers adapt to the impact of climate change. Weather Insurance and access to credit are two of such (Botzen and van den Bergh 2008; Akter and Fatema, 2011; WFP and IFAD, 2011). While evidence of the effectiveness of access to credit as a poverty reduction strategy has been favorable and some point and at other times not favorable (see Diagne and Zeller 2001 and Zeller and Sharma, 2002), others (e.g Sorensen 2000, Pettengell 2010, World Bank 2012, Collier 2013) suggests that access to finance could have some effect as a climate change adaptation strategy. Thus, the need for researching into this debate to see what lessons can be learnt from rural household experience with access to credit and crop insurance. These issues are critical not only for helping rural households adapt to the impact of climate change but also, fits into the first goal of the Post 2015 Sustainable Development Agenda that seeks to eradicate extreme poverty and overcome inequality for all.

Nigeria's population is about 174.51 million (2013estimate) and has a population growth rate of 2.6 %. Available statistics for Nigeria shows that 46.3 % of adult population are excluded from financial services with women accounting for 54.4 % of the excluded population (CBN, 2012). About 80.4 % of the financially excluded population however, resides in rural areas with over 70 %, practicing land use agriculture. Yet, the sector, which accounts for 44% of the GDP, only 2% receives total lending by commercial. The MDG target to half poverty in Nigeria (21.4% by 2015 from 1992), was not achieved: 42.7% against 72% in 2013) (NBS, 2013). Hence, with the impact of climate change on rural livelihood and land use activities, rural farm households are more likely further into poverty. This paper addresses two research questions:

- How does financial innovative strategies affect farm households distributed along horizontal income quintiles in a typical agricultural household community and,

- Would households that constitute the poorest income quintile benefit the most from such innovations?

The objective of the paper therefore is to examine the effect of financial innovative strategies on horizontal income distribution in rural northern Nigeria. Whether or not, the poorest income quintile would benefit the most from such strategies in different scenarios, would also be examined.

2.   LITERATURE REVIEW

Financial innovations have been recognised as having great potential for building social and climate resilience (World Bank, 2012). There are, however, a number of challenges that need to be addressed before they can contribute to climate change adaptation and poverty reduction. The World Bank (2012) in collaboration with partners examined the challenges affecting index insurance in order to find ways of advancing the development of sustainable climate risk management models that would reach the poorest and strengthen climate resilience. The study argued that consumption smoothing as an alternative for little access to formal insurance mechanisms and other coping strategies, such as taking emergency loans from microcredit institutions or moneylenders, or relying on family or community support could however be ineffective. It also noted that reliance on government or donor assistance is often inadequate, as it could be ad hoc, poorly targeted, and slow in being disbursed. Other risk management strategies such as taking out high-interest loans or defaulting on existing loans, selling assets and livestock, or engaging in low-risk, low-yield farming to lessen their exposure to extreme events; were also described as sub-optimal coping strategies as they could often leave poor households locked into the poverty cycle. The attempt by the study to write down other adaptation measures in other to uphold the relevance of weather index insurance is, however, exaggerated. First, it ignores the basis risk dimension of weather index-based insurance and secondly, for already poor households which could be locked in poverty cycle, the study assumes sale of assets, consumption smoothening, taking up of high interest loans and so on, as options. The study, which is also not developing country sensitive, does not take into account household values concerning insurance and goes ahead to link index insurance to poverty reduction without taking into account the role of access to finance.

Adamtey *et al* (2006) argued that many studies analyse macroeconomic policies without making any explicit linkage to poverty. Even when considered, they noted that it is often an afterthought and in most cases, addressed in an isolated way. Similarly, they added that many poverty studies do not make any explicit link to macroeconomic policies. Furthermore, while most ex-ante studies use macroeconomic indicators, non-quantifiable indicators have been ignored. These studies have also focused on the macroeconomic impact and ignored the micro effects. The use of CGE models in the study, however, questions its disaggregated impact at the micro level. Holding focus group discussions with rural households to determine their response on proposed government policies for instance could provide useful insight for policy makers than estimations using computable general equilibrium model would.

One of the objectives in Garba and Garba (2011) was to examine how informal economic agents perceive and respond to government policies. They found that the perception and response of households in the informal sector to government policies are non-uniform and depend on geo-ethnic and religious considerations and certain information sets, which are non-uniform and asymmetric. Thus, they argued that for government policies to stand a chance of effective poverty reduction, they must be informed by empirical knowledge of the specific group of informal sector operators that they target.

2.1   Financial Innovation and Poverty Reduction

There are three variants of the Vulnerability framework linked to poverty and risk management: (a) vulnerability as expected poverty (VEP); (b) vulnerability as low expected utility (VEU) and (c) vulnerability as uninsured exposure to risk (VER). In the VEP framework, Chaudhuri *et al* (2002) and Christiaensen and Subbarao (2001) defined vulnerability as the probability that a household will fall into poverty in the future such that, vulnerability of a household is the probability that the household's level of consumption in the future will be below the consumption poverty line. Ligon and Schechter (2003) defined VEU with reference to the difference between the utility derived from some level of certainty-equivalent consumption, at and above which the household would not be considered vulnerable. Hence, this framework is analogous to a poverty line and the expected utility of consumption.

As argued by Hoddinott and Quisumbing (2003), vulnerability as uninsured exposure to risk (VER), is similar to the VEP and VEU approaches in that it is concerned with assessing welfare

and welfare losses in a world where some risks are at best partially insured. It, however, differs from VEP measures in that it is backward looking; it is an ex post assessment of the extent to which a negative shock caused a welfare loss rather than an ex ante assessment of future poverty. It also differs from VEP and VEU measures in that there is no attempt to construct an aggregate measure of vulnerability rather, their impact of shocks can be quantified to assist in identifying appropriate policy focus on the dependent variable used in Tesliuc and Lindert (2002) as consumption determined by covariates.

Hess et al (2002) argued that, despite the enormous potential for weather risk management in the agri-business sector in developing countries, there are barriers to take-up such as credit risk concerns. A key factor in determining demand for weather risk hedges identified in the study is access to credit. According to Hess et al (2002), farmers do not buy insurance; they are required to collateralise credit with insurance. Since in most regulatory environments, weather hedges will generally be sold in the form of insurance, end-users would be intermediaries such as agricultural banks or insurance companies, or input suppliers and agro-processing companies exposed to throughput risk. The weather risk market is, however, able to substitute some of the traditional reinsurance covers and can efficiently offer yield protection to farmers where crop insurance fails due to high expense ratios.

Since households in the rural areas of developing typically have a low asset base and little access to well-developed insurance and credit markets hence, they would be financially ill-equipped to deal with weather shocks (see Hess et al, 2002). However, as a shock coping strategy, while the authors included borrowing, reliance on transfers, sale of assets (livestock and grain reserves) for consumption smoothening with risk of poverty traps, insurance uptake was excluded from the list of ex-post shock coping behaviour of households. The study, which reviews evidence from countries Brazil, Ethiopia, India, Kenya, Malawi, the Millennium Villages (Kenya, Ethiopia and Mali), Mongolia, Nicaragua, Rwanda, Tanzania, Mexico, The Caribbean, Colombia and Thailand; suggests that access to finance plays a critical role as an ex-ante and ex-poste weather-related risk mitigation and coping strategy. Insurance, on the other hand, does not surface in the ex-post list due to the difficulty of large-scale insurance loses (basis risk issue) (see Carter et al, 2014).

2.2   Review of Measures of Inequality

There are several measures of inequality: Median share of income, calculation based on percentile distributions, Lorenz curve and the Gini coefficient, Robin Hood index, Atkinson index, Thiel's entropy measure, and coefficient of variation (krol and Miedema, 2009). Allison (1978) noted that choosing a standard inequality measure is a choice between alternative definitions of inequality rather than a choice between alternative measures of a specific theoretical construct (see Krol and Miedema, 2009). To measure inequality therefore, we adopt the percentile distribution approach. This method divides the sample population into successive quintiles according to ascending income levels and then determines the proportion of income received by each income group using the ratio of incomes received by the top 20% and bottom 40%. The choice of calculation of inequality using the quintile or percentile distribution is based on its strength of using readily available data to classify the distribution of income that captures direction and magnitude. It can also be used to compute the effectiveness of policies across income quintiles. The choice of this measure follows Krol and Miedema (2009) who argued in favour of using calculations based on quintile, decile or percentile distributions as robust measure of inequality.

Lorenz curve and Gini coefficient is another measure argued in Krol and Miedema (2009) as robust measure of inequality. It offers a graphical representation of income inequality that can be compared over time and between geographical areas. Though this measure shows that direction of income redistribution, it, however, does not indicate where the redistributions are occurring. It also does not allow for within or between income group comparisons. The Robin Hood index, used to measure the proportion of total income needed for distribution in order to achieve perfect equality, is used when the Lorenz curve has been estimated. According to Krol and Miedema (2009), however, the Robin Hood index is not sensitive to income transfers between households on the same side of the mean income.

Other measures of income inequality such as the median share of income, measures the proportion of income held by households whose incomes fall below the median household income. This measure is, however, not sensitive to varying proportions of the income distribution within the upper or lower 50% of the distribution. Krol and Miedema (2009) summarized the Atkinson index, Thiel's entropy measure and coefficient of variation. The Atkinson index is mostly used in comparisons between regions. Like the Gini coefficient it varies from 0 to 1 but also includes a sensitivity parameter, which can range from 0 to infinity. Hence, as the sensitivity

index approaches higher values, the Atkinson Index becomes more sensitive to changes at the lowest income groups. Within 0 to 1, however, a lower Atkinson value represents an income distribution that is more equal. The index, however, has been criticized for its lack of intuitiveness (see De Maio 2007, Krol and Miedema 2009).

The Theil's Entropy measure is based on an income share that each individual or group holds. Each individual is assumed to have an identical population share thus, each individuals measure is determined by the proportional distance from the mean (see Krol and Miedema, 2009). The index has a potential range from zero to infinity with higher values indicating more equal distribution of income. Despite the importance of this index in measuring inequality within group and between groups, it varies with changes in distribution whether or not the change in distribution occurs at the top, middle, or bottom. Further, because our sample is for group of rural farm households, it cannot be directly used to compare population group structure as such calculation would depend on number of individuals in the group. The last measure of inequality is the coefficient of variation. It is obtained by dividing the standard deviation of an income distribution by the mean of the same distribution. This measure, however, requires comprehensive individual data, and the mean and standard deviation used to calculate it could be influenced by outliers (high or low income values). Krol and Miedema (2009) noted that, this measure cannot be used when the income is not normally distributed.

2.3   Climate Change and Inequality

Income inequality was one of the problems that Keynes proposed to remedy in the 1930s through fiscal policy (Tcherneva, 2013). According to Tcherneva (2013) however, these problem still persist after more than 70 years of fiscal activism. The situation has even grown worse for rural household communities that are vulnerable to the impact of climate change. Tcherneva (2013) argued that, the distribution of income growth between the wealthiest 10% and bottom 90% of households have become more inequitably distributed with every subsequent expansion during the entire postwar period. Only during the 1950-53 however, the bottom 90% capture all of the average income growth in the economy. The top 10% of households have however, captured the greater and greater share of the income growth up to the 21st century. This argument shows a clear evidence of increasing income inequality and a need for adopting sustainable solutions that would help the bottom 90% in developing countries to adapt to the increasing difficulty including those caused by climate change.

Isah (2009) studied horizontal and vertical inequality in northern Nigeria. The sample, however, focused on households whose main sources of income (about 73.8%) are wages and salaries. Although the degree and extent of inequality found in the study was high in some cases and moderate in others, one of the conclusions was that minimum wage policy has only a minimal effect on reducing inequality. It also found that changes in income and non-income inequality play critical role in generating changes in poverty. The deduction from the study therefore is that, there is an interaction between income distribution and poverty reduction. The exclusion of rural farm households who do not rely on wages and salaries raises questions on the factors that would lead to changes in inequality. For instance, wages are sticky downwards due to minimum wage policy (18, 000 naira) implemented across the Nigeria. The study, however, provides a basis to measure poverty using national minimum wage lines and to examine the effect thereof on inequality. Isah (2009) also found that lack of access to services leads to poverty. The kind of sample used in the study, however, makes it difficult to deduce how access to basic services will help rural farm households, who are basically farmers, poor and lack access to services to cope with poverty in the context of climate change. This extension is critical because, inequality in communities in Northern Nigeria would be driven by the sensitivity of households to covariate and idiosyncratic shocks such as household size and climate change for instance.

The distinction between horizontal and vertical inequality by Stewart (2000) and Gboyega *et al* (2003) in Isah (2009) also presents a clear conception on the focus of this paper. While vertical inequality is a measure of the general levels of inequality between rich and poor people in a society regardless of ethnic affiliation or other group characteristics of the population (see Stewart, 2000), horizontal inequality is an alternative perspective on inequality which offers greater insight for understanding some related conditions across groups of individuals usually along a number of dimension. Thus, following Isah (2009) we construct the income of farmers from the poorest income quintile to the richest. Since they are all vulnerable to the impact of climate change, our hypothesis is that those on the lowest income quintile will be mostly women hence and have less access to formal finance to cope with the negative impact of climate change (drought and floods/flash floods).

2.4   Rural Farm Households and Group Lending

Although continents, regions and countries are affected to different extents by climate change and require different adaptation strategies, communities are affected in the same scale and would require acting together to maximise the benefit from financial services (Yunus, 2001. This leads to our next point: while the Group Lending model has so far led to a Nobel Prize for Yunus and the Grameen Bank, financial exclusiveness on the one hand, poverty on the other with climate change in the middle, challenges its implementation amongst poor farmers who are excluded and vulnerable to climate change. Though access to finance through Group lending in the Grameen bank context, requires individuals without collateral, the group size, typically three to five people (De Aghion and Morduch 2005), is not ideal for a typical village or community with 10 – 50 farm households who are poor and financially excluded. These communities would require a larger number to constitute a financially sustainable lending group which would also be consistent with social norms and larger family units. While the loans are made to individuals in a group, all members face the consequences if any member defaults. This could lead to serious adverse selection and moral hazard issues as the lending identification process could be subjective and certain beneficiaries could act in ways that does not maximise the corporate interest of the group.

The Village Banking model on the other hand, is an evolving microfinance technology originated by the Foundation for International Community Assistance (FINCA)[3] and first documented in 1988 (Deelen and Majurin, 2008). It is distinguished by a combination of three characteristics: depth of outreach, a savings as well as credit component, and a participatory management structure at the village bank level. It is a microcredit methodology whereby financial services are administered locally rather than centralised in a formal bank. Village Banking programs tend to achieve a greater depth of outreach than other sustainable microfinance approaches: the financial products and delivery system are structured and standardised to meet the needs of lower-income, less educated clients often living in remote areas. Village Banking programs now seek to increase their sustainability, scale of outreach and quality of services while maintaining this depth. However, the Village Banking Model has also been criticised along certain lines. First,

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[3] Groups vary from ten to fifty people (mostly women). In studying the constraints of rural women in informal economic activities in Nigeria, Onyenechere (2009) found that majority of rural women engaged in informal economic activities, do not have significant access to institutional finance, nor do they for socio-economic services that could enhance women's informal economic activities.

services that appeals to only the very poor have higher per unit transaction costs because of their small loan sizes; in comparison to microfinance programs that provide larger loans, village banking programs require larger volumes of clients and often more time before they are able to achieve financial sustainability. Secondly, clients prefer more flexible savings and loan terms; higher income clients may be able to pay for these higher quality services and unwilling to accept the transaction costs and limits of standardised services. Thirdly, pricing policies have also been being criticised for not being simple and manageable by the village banks, yet must cover the costs of savings as well as lending services. Finally, the democratic structure of the village banks have also been criticised as having the capability to inhibit membership growth and the security of savings unless ownership rights are clear, simple and rational. Leading Village Banking programs are thus, seeking to resolve these issues while maintaining their depth of outreach and democratic management.

Despite these criticisms, all people need financial services, and poor people often have a more urgent need for them than rich people. In poor communities, income flows are small and often unpredictable, and having access to other funds – savings or a loan – can make the difference between poverty and a decent quality of life (Banerjee et al 2009). And while evidence from the literature (e.g. Banerjee et al 2009), found that increase in microcredit borrowing had a positive effect on households, not many have considered how these households have organised themselves into savings club and how that channel can be used to strengthen their resilience to climate. Though the village banking model recognises the savings characteristics of rural households, such savings (largely in grains, harvests and financial contribution), are adversely affected by climate change. Thus, the Grameen bank model can be complemented with components of Group lending in the Village banking model context, with some modification as would be identified in this paper.

2.5 Climate Policy, Financial Services and Poverty Reduction in Nigeria

Despite MDG 2015 efforts, poverty has remained high in many developing countries[4]. In a post 2015 development agenda therefore, climate change adaptation strategies that have far-reaching consequences for poverty reduction would be critical. As contained in its National Adaptation

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[4] Survey by the NBS (2013) shows that poverty incidence in Nigeria has moved from 42.7% in 1992 to 68.7% in 2012. The MDG 2015 target for poverty reduction in Nigeria is 21.40%.

Strategy and Plan of Action on Climate Change (NASPA-CCN) (see BNRCC, 2011), Nigeria seeks to address its climate change adaptation-funding gap by:

- Situating climate change adaptation financing within the broader context of national development financing and development goals of Vision 20:2020.
- Undertaking a detailed financial needs assessment to properly determine the economic costs of climate change adaptation in Nigeria.
- Reviewing all multilateral mechanisms to finance climate change adaptation, and determine what capacities must be put in place to access and manage these funds.
- Revising the National Fiscal Policy to incorporate the cost of climate change adaptation.
- Developing an innovative, non-debt creating national financing mechanism to support adaptation, raises the necessary funds and manages those funds.
- Ensuring climate financing policies and resource allocations are responsive to real needs.

These measures, however, are not bottom-up, as none of the steps include a clear step, which targets the credit needs of rural farm households.

Another policy framework is the Nigeria Incentive-Based Risk Sharing system for Agricultural lending (NIRSAL). The framework is an initiative of the Central Bank of Nigeria (CBN), the Bankers Committee (BC) and the Federal Ministry of Agriculture & Rural Development (FMA&RD) with input from farmer groups, financial services providers, civil society groups amongst others (CBN, 2012b). Its mandate is to act as the custodian of all credit guarantee schemes, interest draw back schemes, and commercialization initiatives related to an integrated value chain approach to agriculture and agribusiness in Nigeria, while policy formulation responsibilities remains with the appropriate line ministries. NIRSAL at the initial stage is a project implementation office (PIO) within the Central Bank of Nigeria's Development Finance Department (DFD), it, however, intends to evolve into a private non-bank financial institution (NBFI). NIRSAL is a Risk Sharing Fund designed to among other things; minimise the risks of lending to the Nigerian agriculture value chain. This framework has two major loopholes that exclude poor and financially excluded farm households from its intended credit provisions.

First, it provides loans/credit to large off-takers instead of small and medium sized farmers (SMF) hence; SMFs are encouraged to join such off-taker arrangements if they are to benefit from the credit/loan. This is clearly exclusive in operation as the SMF can only benefit if they join large off-takers or lose out. On the other hand however, the framework provides that for

smallholder farmers, cooperatives and farmer groups, 75% of the loss on the individual loan with be covered under the Credit Risk Guarantee (CRG) scheme. Thus, with a lack of dedicated line in the framework to provide loan to small sized farmers, it is the cooperative farmers who would benefit the most from CRG coverage of 75%. While the framework is commended for recognising the need for small farmers to join or constitute farm groups as a medium of minimising the risk from loss on individual loan, its emphasis on minimising risk loss from loans leaves on unanswered how small farmers would access credit.

Secondly, though NIRSAL encourages counterparties (including small sized farmers) to work with credit distribution partners (microfinance institutions, trade credit providers, mobile banking providers and related institutions), its provision (in section 8.6.1 and 8.6.2 of the framework) that allows counterparties to require collateral and equity from borrowers, may not be realistic for small sized farmers. Thus, despite the effort by the NIRSAL framework to solve the access to credit/loan problem for farmers, its mechanism excludes the benefit from such credit/loans to be accessed by small sized farmers. Although they could benefit from such by joining large off-takers, the collateral and equity that borrowers are required to make, may not go down well with them for three reasons: the impact of climate change on the stock piles, poverty and continuous need for access to finance. as 2012, when the NIRSAL Risk Fund became effective, it was composed of two parts: (i) a ₦45 billion Credit Risk Guarantee (CRG) component covering losses on loans per contractual specification, and (ii) a ₦5 billion Interest Draw Back program (IDP) providing interest payment support on loans issued under NIRSAL guidelines; making a total of ₦50 billion capital pool to be expanded over time (CBN, 2012b).

Nigeria's Climate Change Adaptation and Agribusiness Support Programme in the Savannah Belt (CASP) is premised on the rationale that to continuously commit to poverty eradication across the world and Nigeria in particular. The framework which was supported by IFAD is partly motivated on one hand, by the fact that the incidence of poverty in Nigeria had continued to rise from approximately 28% in 1980 to about 70% in 2010, and on the other hand, by the fact that participating Nigerian states (which includes Kebbi)[5] of the Community Based Agricultural Rural Development Programme (CBARDP) continue to have the lowest GDP per capita (US$ 718), the highest poverty rate (74%), the highest unemployment rate and the lowest rate in school enrolment (30-40%) in the country (IFAD and FGN, 2013). There is also a third rationale,

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[5] Others are Borno, Jigawa, katsina, Sokoto, Yobe and Zamfara states

which is based on exploiting and scaling up the opportunity provided by the completion of the CBARDP in May 2013 which some have argued, brought improvement in the rural livelihoods of inhabitants in the targeted village of the participating states. Table 2.1 presents data on Nigeria for inequality and Poverty Incidence.

Table 2.1: Income Distribution in Nigeria

Income Groups/ Years	1986	1992	1996	2004	2010	Year	Poverty Incidence (%)	Estimated Population (Million)	Population in Poverty (Million)
Lowest (Bottom) 20%	7.0	4.0	5.0	5.1	4.4	1980	27.20	65.00	17.68
Second 20%	12.0	8.8	8.8	9.7	8.3	1985	46.30	75.00	34.73
Third 20%	15.8	14.5	13.6	14.7	13.0	1992	42.70	91.50	39.07
Fourth 20%	24.0	23.3	20.2	21.9	20.3	1996	65.60	102.30	67.11
Fifth (Top) 20%	41.2	49.4	52.1	48.6	54.0	2004	54.40	126.30	68.71
Total	100	100	100	100	100	2010	69.00	163.00	112.47
Gini Coefficient	38.7	45.0	46.5	42.9	48.8	2011	71.50	164.19	117.39

Source: National Bureau of Statistics (NBS), World Development Indicators (WDI)

In the 1980s, the poorest 20 percent of the population earned only 7 percent of the income while the richest 20 percent earned 41.2 percent of the income. The poor got poorer by 2010 while the rich got richer as the share of the income declined for the poorest 20% to 4.4% while the share of the richest 20 percent increased to 54 percent. This implies that while 20% of the population shared 4.4% of the nation's wealth in 2010, 54% of wealth is shared by richest quintile. There is also the problem poverty. The number of Nigerians living in poverty has also increased from 27.2 percent in 1980 to 72 percent in 2012. This is shown in Figure 2.1 below.

Figure 2.1: Poverty Incidence in Nigeria (1980 – 2012)
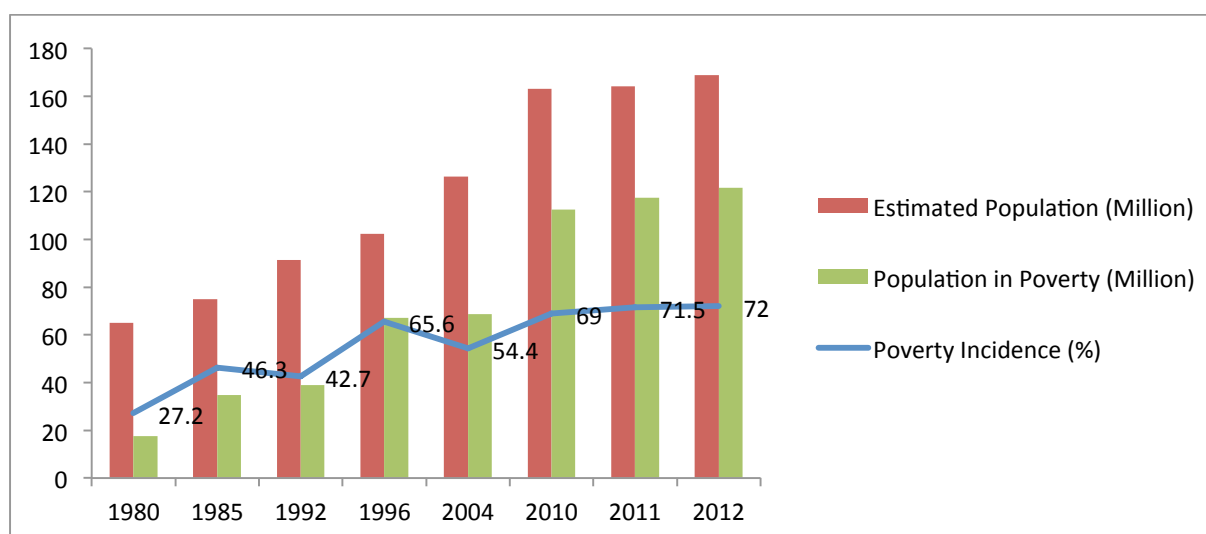
Source: NBS, 2013

As a framework, CASP is based on the lessons from the previous CBARDP and is consistent with measures of the Agricultural Transformation Agenda (ATA). Its objectives are: (1) to promote agriculture productivity enhancements and agriculture as a principal driver, (2) to integrate climate change resilience adaptation measures, and (3) work out a private sector orientation in the provision of extension services. Building on the Community Development Association (CDA) model as the primary entry for implementation, CASP also seeks to make specific considerations for insecurity in its programme implementation states while targeting women and youths in its overall goal of pursuing a landscape approach to climate change adaptation. Through its proposed investments in agriculture productivity and potential linkages of farmers to markets and priority commodity chains, it also seeks to integrate wider risks that have direct impact on productivity and rural assets. And while CASP takes advantage of emerging opportunities under the ATA for better market access, it is in full consonance with the Strategic Objectives (SOs) of the RB-COSOP. The SO goals are: (1) to Improve access by rural poor people to economically, financially and environmentally sustainable production, storage and processing technologies, markets and support services; and (2) to Strengthen community involvement in local planning and development, and promote government support for rural infrastructure (IFAD and FGN, 2013). In summary, CASP objective for Climate Change Adaptation is to scale up implementation of programmes that would enhance poverty reduction and strengthen resilience to climate change. Also, the framework being in consonance with the Strategic Objectives (SO), clearly indicates its commitment to strengthen household resilience to climate change through improved access to finance and development of rural infrastructure.

3.   ANALYTICAL FRAMEWORK

Following arguments in favour of access to credit on poverty reduction (e.g Dabla-Norris *et al*, 2013; Collier, 2013; IMF, 2014) and arguments against (see Diagne and Zeller, 2001; Zeller and Meyer, 2002; Zeller and Sharma, 2002; Sharma and Buchenrieder, 2002), we conceptualise financial innovation as a climate change adaptation strategy and argue that it is crucial for poverty reduction. Rural farmers in developing countries, like Nigeria, have certain characteristics: They are:

- poor (see GIZ, 2012; NBS, 2013; UNSGSA, 2013),
- vulnerable to climate change (Nelson and Agbey, 2005; Eriksen, *et al*, 2007; CCAA, 2010; Amuedo-Dorantes and Pozo, 2011; Christensen *et al*, 2012; etc) and
- lack access to finance to implement any given set of climate change adaptation strategy (von Braun, 2002; CBN, 2012; Culpeper, 2012; World Bank, 2012; UNSGSA, 2013, etc).

While financial inclusion means a lot of things (see Rangarajan Committee, 2008; Chakravartya and Pal, 2010; Gandhi, 2013 etc.), it has generally been conceptualized to mean having access to finance, savings and insurance (see IFPRI, 2002; CGAP 2005; Caskey *et al*., 2006; World Bank, 2008; Dupas and Robinson, 2009; Collier et al, 2009; CBN, 2012; UNSGSA, 2013). Figure 3.1 presents a framework on the link between financial innovation and poverty reduction.

Figure 3.1: Framework of Financial Innovation and Poverty Reduction

Climate Resilient Development
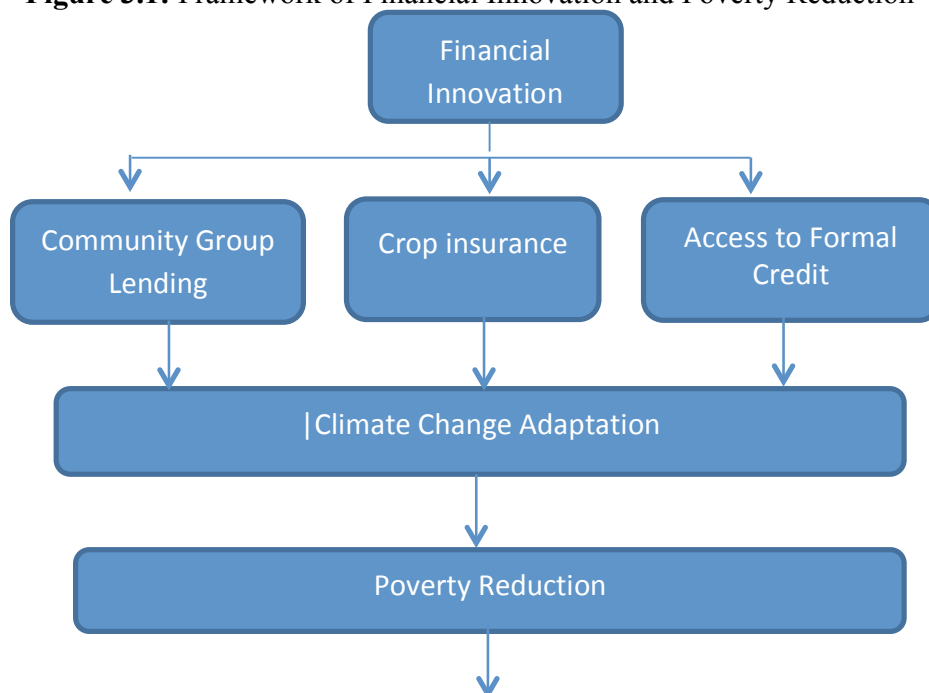
In **Figure 3.1** financial inclusion is conceptualised as critical component of climate change adaptation strategies. The implementation of government programmes (such as access to mobile phone, access to e-wallet) and financial literacy programmes) to improve rural farming productivity and livelihood are also conceptualised as critical for enhancing financial access and as climate change adaptation strategies. The argument is that financial inclusive/ innovative strategies feed into climate change adaptation strategies hence, leading to reduction in poverty. We formalise this identity below:

$$FI \in U_{CCA} : FI = \{FA_{GL}, CI, AFC\} \, and \uparrow FI \rightarrow Pov \downarrow \; \Rightarrow \text{Climate Resilient Development}$$

Where FI is financial inclusion/innovation and a member of the universal set of climate change adaptation strategies U_{CCA}, such that members of the *FI* subset are community financial access in a group-lending framework (FA_{GL}), crop insurance (CI) and access to formal credit (*AFC*). The argument is that increase in FI would lead to poverty reduction hence, bringing about climate resilient development.

3.1   Theoretical Framework

According to Ravallion and Chen (2001), three axioms form the premise of robust poverty measures: the *focus axiom*, *the monotonicity axiom*, and *the transfer axiom*. The second axiom provides the thinking for linking financial innovations to poverty reduction. Under the monotonicity axiom, any income gain for the poor should reduce poverty (Haughton and Khandker 2009). This thinking is also consistent to the typical agricultural household models (see Siegel and Alwang 2005, Schneider and Gugerty 2011, Sanfo and Gérard 2012), where households are also farmers and are consumers as well as producers. The poverty-growth-inequality triangle hypothesis also provides a theoretical link (see Grammy and Assane, 2006; Biosca, Mosley and Lenton, 2011). It states that, the extent and magnitude of poverty depends on the growth of the mean level of real per capita income and the degree of inequality in the distribution of income. Thus, income gain for the poor should reduce poverty.

Three aspects of financial innovation will be considered: access to finance, crop insurance and community savings. Sharma and Buchenrieder (2002) argued that expanding financial services may improve the welfare of the very poor, but not necessarily lift them out of poverty, because of their lack of access to markets, technology, education, and other factors that raise incomes by expanding their production frontier (see Zeller and Meyer, 2002). Sharma and Buchenrieder (2002) further argued that very poor households may benefit from microfinance largely by smoothing their consumption through borrowing or improved management of their savings. However, only those slightly above or below the poverty line might be able to use loans more effectively for productive purposes, hence raising their income and asset base. Expanding financial services may therefore improve the welfare of the very poor, but not necessarily lift them out of poverty (Sharma and Buchenrieder, 2002). Thus, the objectives of this study will be implemented using the Financial Inclusion as Climate Change Adaption framework discussed above as well as the vulnerability as uninsured exposure to risk (VER) theory (see Tesliuc & Lindert, 2002; and Hoddinott & Quisumbing, 2003); and the Poverty-Growth-Inequality Hypothesis (see Grammy and Assane, 2006).

3.2   Data and Sampling

Using questionnaire instrument, cross sectional household data were randomly collected from two rural communities in the Sudan savannah areas of North West and North central zones in Nigeria for 320 respondents. The communities studied are *Fakai* in Kebbi state and *Rijau* in Niger state, Nigeria. Kebbi state has one of the highest poverty level in the region (over 70%) while Niger state has the lowest (less than 34%). Following Foltz *et al* (2013), poverty, location and farming as occupation, where the three criteria used for selecting the study areas: Kebbi and Niger states, Nigeria. While both states have farming as their major preoccupation, they fall in geopolitical zones (North West and North Central respectively). The specific communities studied (*Fakai* in Kebbi state and *Rijau* in Niger state), both fall in the Sudan savannah region in Northern Nigeria. Another factor that influenced the choice of the study areas is poverty. While Niger state has the least poverty rate among the communities in the Sudan savannah region of Nigeria, Kebbi state has one the highest. Proximity to the communities to one another is another factor that influenced the choice of both communities (Fakai and Rijau). The sample size, 160 for each community is also within the threshold in the sample size of 150 households for Kebbi state used in Olarinde (2011) to analyse the technical efficiency differentials among Maize

Farmers in Nigeria. The sample size for the study is computed from each community using the formula:

$$s = \cfrac{n}{1 + \cfrac{n}{N}}$$ Where N is the population of each state and n population in the study

community. However, $n = \dfrac{Z^2[p(1-p)]}{D^2}$, could also be used to compute n. In that case p is proportion of households in poverty, while Z^2 and D^2 are the confidence level and interval respectively. Using figures from the 2006 Nigerian census for *Fakai,* n = 169,111 and N = 3,256,541. On the other hand, n for *Rijau* is 166,053 and N is 3,850,249. Once obtained, s is divided by 1000 in population units. Hence, the sample size for *Fakai* is 160.8 and 159.2 for *Rijau,* yielding a total of 320 households to sample randomly in each community to make up the study area.

3.3 Model Specification

Household income, the dependent variable, was classified into five: poorest 20%, second 20%, third 20%, fourth 20% and richest 20%. Thus, the ordered logit model (OLM) following Perez-Truglia (2009), was used for the estimation:

$$Y_i^* = \sum_{i=1}^{k} \beta_k X_{ki} + \varepsilon_i = Z_i + \varepsilon_i \tag{3.1}$$

where X is a vector of ' x s capturing gender of the respondents, household size, households in savings clubs, formal credit, crop insurance and government programme (e.g. distribution of subsidized fertilizers). The estimated value of Z and the disturbance term from the assumed logistic distribution can be used to predict the probability that the unobserved variable. Since Y_i^* falls within various thresholds limits, the general form of the probability is specified below:

$$P(Y_i > j) = \frac{\exp(X_i\beta - k_j)}{1 + [\exp(X_i\beta - k_j)]}, j = 1, 2, ..., M - 1 \tag{3.2}$$

Where $P(Y_i > j)$ predicts the probability for policy scenario that scales up the access to the finance, lending to households in savings clubs, crop insurance and government programmes; compared to the baseline probability obtained from estimated equation (3.1).

4.   RESULTS AND DISCUSSION

The results are discussed in two sections. The marginal effect of financial innovation on poverty reduction, and policy simulation on increased access to finance, lending to community savings clubs and the take-up crop insurance.

4.1   Marginal Effect of Financial Innovation on Poverty Reduction

The estimated ordered logit model (equation 3.1) is presented in Table 4.1. The result showed that gender, household size, savings clubs, access to formal credit, crop insurance and government programmes have significant effect on the distribution of rural farm-household income.

Table 4.1: Estimated Ordered Logit Model

Variable	Coefficient	Std error	p-value
Gender (female = 1)	-0.562	0.204	0.006
Household size	0.077	0.046	0.096
Savings clubs (Yes = 1)	-0.375	0.136	0.006
Formal credit (Yes = 1)	-0.308	0.163	0.058
Crop insurance (Yes = 1)	0.807	0.249	0.001
Government programmes (yes = 1)	0.432	0.229	0.06
Number of Observation	320		
LR Chi2 (6)	28.99		
Prob > chi2	0.0001		
Pseudo R2	0.282		

Dependent Variable Income Quintile:

The estimated marginal effect presented in Table 4.2 showed that females are more likely to be in the poorest income quintile while men are more likely to be in the 4th and richest 20% quintile (see Table 4.2). Smaller size households are also more likely to be in the poorest income quintile than households with large size. This is basically due to the use of family members for farm labour.

Those who are in a savings club are more likely to be in the poorest income quintile and those who are not, in the richest income quintile. Also, as households move from poorest to richest income quintile, the probability of their participating in community savings club decreases. Although the marginal effect also shows that those in the lowest income quintile would benefit from formal access to credit, the results were not significant at 5% critical value.

**Table 4.2:** Marginal Effects (Ordered Logit Model)

Variable	Poorest 20%	2nd 20%	3rd 20%	4th 20%	Richest 20%
Gender	0.079 (0.006)	0.052 (0.010)	0.003 (0.597)	-0.045 (0.009)	-0.089 (0.007)
House hold size	-0.011 (0.099)	-0.007 (0.106)	-0.0002 (0.792)	0.0064 (0.107)	0.012 (0.098)
Savings clubs	0.053 (0.007)	0.035 (0.011)	0.0011 (0.791)	-0.031 (0.012)	-0.058 (0.006)
Formal credit	0.044 (0.061)	0.028 (0.067)	0.0009 (0.791)	-0.026 (0.07)	-0.048 (0.058)
Crop insurance	-0.116 (0.001)	-0.075 (0.003)	-0.0023 (0.791)	0.067 (0.004)	0.126 (0.001)
Govt program	-0.061 (0.061)	-0.04 (0.069)	-0.0013 (0.793)	0.036 (0.072)	0.067 (0.061)

*Figures in parentheses are p-values; Dependent Variable Income Quintile*

Marginal effect for crop insurance had a negative effect on the poorest income quintile and positive for the richest. This implies that, the lowest income group, do not benefit from traditional crop insurance. This finding is consistent with so many studies (e.g. Skees and Barnett, 2006) that have called for weather index insurance as an innovation to help poor farmers' better cope with the negative impact of climate change. Evidence for the marginal effect further shows that the richest income quintile benefit from changes in government programmes while the poorest income quintile do not. The next section discusses simulated result for scaling up financial innovations and government programmes.

4.2 Policy Simulation and the Effect on Poverty Reduction

This section examine how each income quintile would benefit from policies that scale up financial access, access to government programmes and lending to communities organized around a savings club, using predicted probability from the estimated equation 3.1.

Figure 4a: Access to Formal Finance Scenario
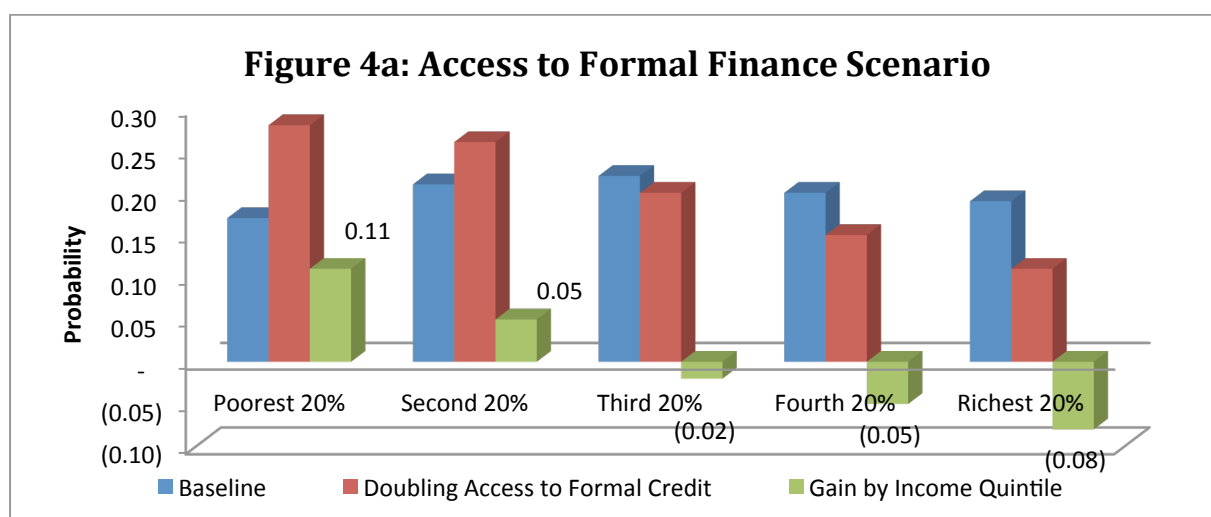
Access to formal credit also has a higher probability of being effective with the poorest income quintile than for the richest 20% farmers. Appendix A.2 shows how 95.94% of respondents say they need access to finance but only 20% (see Appendix A.5) have access to such finance from existing microfinance banks despite having presence (see Appendix A.1). For crop insurance, the probability is higher for the richest 20% and negative for the poorest 20% and second 20% respectively. This suggests that farmers in the richest income quintile benefit the most from crop insurance. Same can also be said for household experience with government programmes. The finding on formal access to finance is consistent with Dabla-Norris *et al* 2013, Collier 2013 and IMF, 2014.
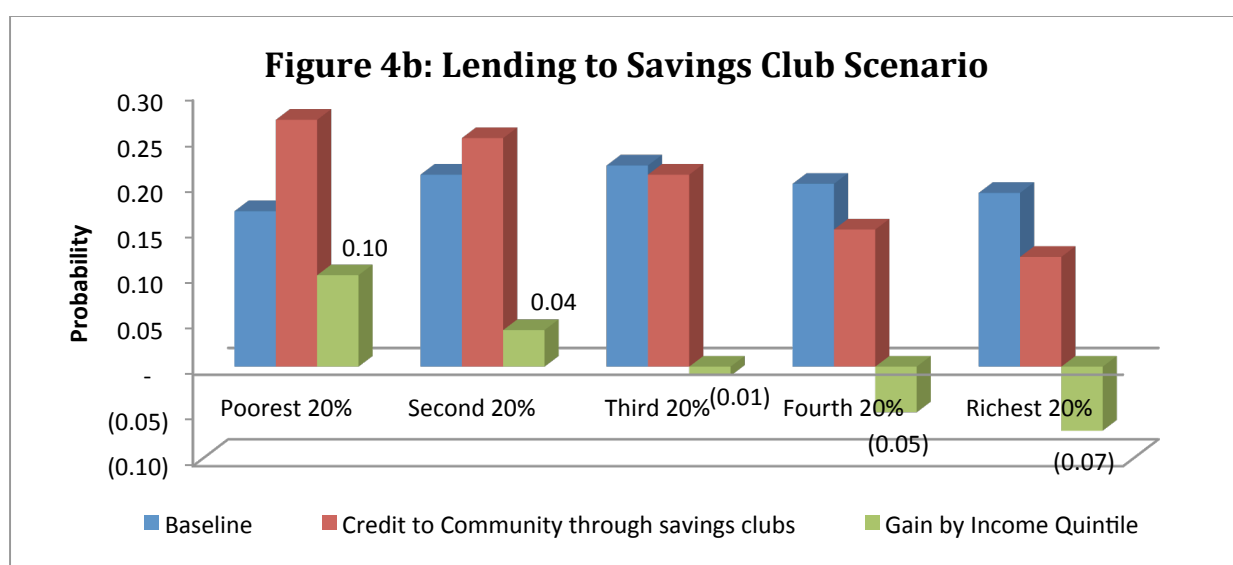
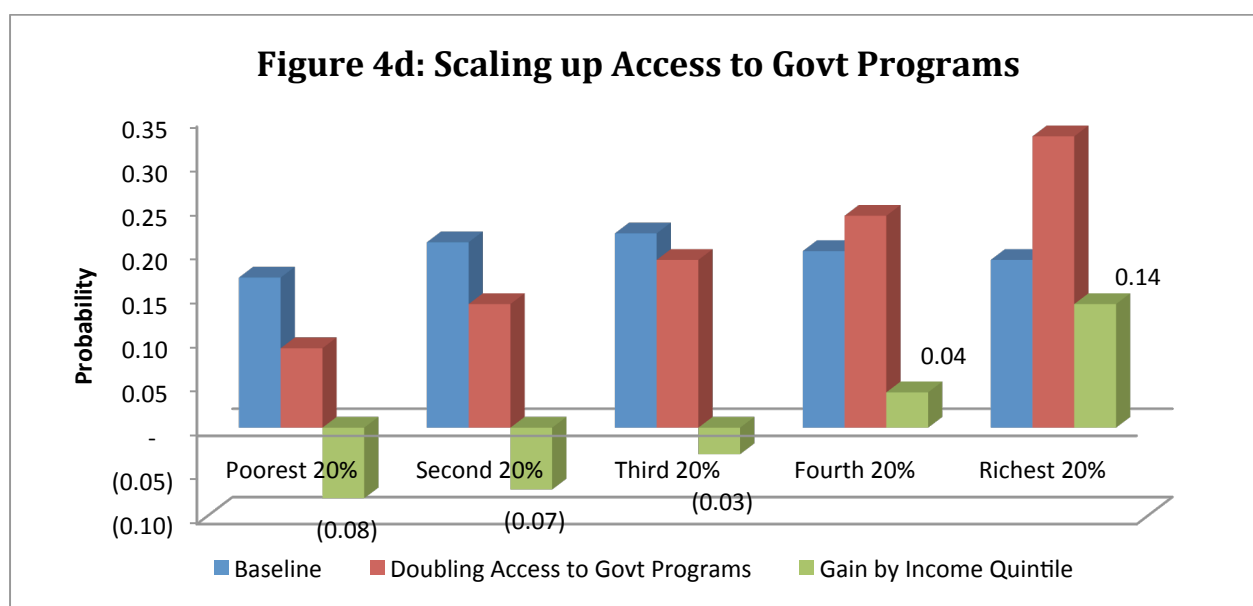**Figure 4b: Lending to Savings Club Scenario**

The gain recorded from doubling access to formal credit by the poorest income quintile is 11%, while the gain from the scenario that doubles lending to savings clubs is 10%. The competing gains to the poorest income quintile farmers from scaling up access to formal credit and lending to savings clubs also suggests that organization plays a critical role in the outcome of success. Such organization, Sorensen (2000) argued provides a platform to improve productivity and farmers access to credit. The finding from this paper on the organization of rural farm household around a savings group also suggests that horizontal linkages among base-level organizations (see Uphoff, 1998) could equally contribute to improve outcomes for rural farm households provided they are well organized and households act in the interest of the group.

Furthermore, the use of farm households organized in groups is consistent with Sorensen (2000) who argued that Informal mutual risk-sharing arrangements in rural areas often include cash and goods transfers, and labor assistance. Likewise, the group size of 10 – 15, is consistent with De Aghion and Morduch (2005) who argued that, poor and financially excluded farm households are usually organized in a group of 10 to 50 households hence, noting that the access to finance group lending model in the Grameen bank context, may not be ideal for the communities studied. The FINCA village banking (group lending) model as documented by Deelen and Majurin (2008), however, seem more likely as it has a savings and credit component, and management is participatory.

The scenario that doubles access to insurance and government programme (see Figure 4(c) and 4(d)) showed that the most benefit would accrue to the richest farmers. Government programmes, which is mostly through the provision of subsidized fertilizer in northern Nigeria, clearly shows that it does not benefit poor farmers. The evidence that crop insurance benefits the richest income quintile farmers but do not benefit the poorest to middle income farmers, was consistent with Hess et al (2002) who argued that traditional crop insurance fail due to high expense.

Figure 4c: Insurance Scenario
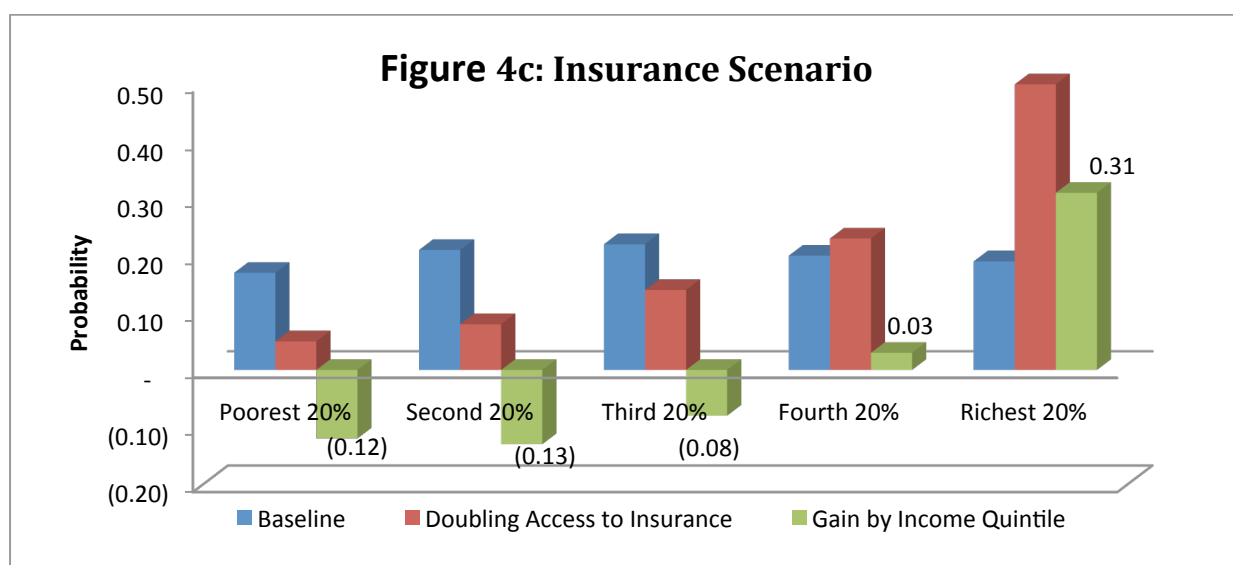
The ineffectiveness of government programmes among the poorest to middle income quintile farmers is also consistent with Garba and Garba (2011). Our policy scenario analysis on the effectiveness of government programmes showed that the gains from scaling up government programme in the agricultural sector benefits richest farm households the most. The poorest income quintile recorded the most loss (8%) due to the scaling up of government programme. The second poorest income quintile, recorded a loss of 7% and the middle income farmers, a 3% loss, while the fourth and richest income quintile recorded a gain of 4% and 14% respectively ((see Figure 4d). Tabulation from our survey (see Appendix A.7) also showed that despite some progress made in fertilizer distribution, most respondents still need finance to purchase fertilizers, met up with irrigation needs and buy improved seedlings in order to cope with the negative effect of Climate Change that hits the communities through increased temperature, prolonged dry season, flash floods/floods and drought/desertification (see Appendix A.6).

Figure 4d: Scaling up Access to Govt Programs

In all scenarios (Figure 4a – 4d), the result shows that the poorest income quintile would benefit the most from policies that scale up access to formal finance and lending to farmers organized around a savings club. The lending to savings clubs is particularly interesting as it has as the minimum negative probable gain to middle class farm households.

5.   SUMMARY AND CONCLUSION

There is strong evidence that access to financial services would strengthen the resilience of households to climate change. Whether such services would lead to a reduction in poverty in typical agricultural household-type communities that are vulnerable to climate change in developing countries, however, is not clearly established. This paper examines the effect of financial innovation (formal access to finance, rural household savings clubs and traditional crop insurance) as a climate change adaptation strategy on poverty reduction in Nigeria. This thinking is rooted in the typical agricultural household model and the monotonicity axiom of robust poverty measures, which suggests that, in situations where poor rural households are farmers (producers) as well as consumers, any income gain should reduce poverty. The philosophy behind the study is that while farmer innovation (see Tambo and Wünscher 2014) can be used to cope with the negative impact of climate change in developing countries, financial innovation could do well in other cases to help rural farmers adapt.

Applying ordered logit regression model to primary data funded by WASCAL (West African Science Service Center on Climate Change and Adapted Land Use) for two communities in in the Sudan Savannah region of northern Nigeria, the paper found that financial inclusion (having formal access to credit) and savings clubs, have significant effect on poverty reduction. When simulated for different levels of financial innovation (take up of crop insurance, increase in financial access and lending to household community-based savings clubs), the paper found that the poorest income quintile would benefit the most from poverty reduction that involves enhancing access to credit to rural households organised around a savings club. Traditional crop insurance, however, does not benefit the poorest income quintile hence, yielding a consistent result with studies that advocate for design and implementation of weather index-type insurance.

We found also that farm households are organized around a group 10 -15 households for two purposes: first, for rotational community farming and secondly, to income through community savings. The use of farm households organized in groups is consistent with Sorensen (200) who argued that Informal mutual risk-sharing arrangements in rural areas often include cash and goods transfers, and labor assistance. Likewise, the group size of 10 – 15, is consistent with De Aghion and Morduch (2005) who argued that, poor and financially excluded farm households are usually organized in a group of 10 to 50 households hence, noting that the access to finance group lending model in the Grameen bank context, may not be ideal for village or community. The FINCA village banking (group lending) model as documented by Deelen and Majurin (2008), however, seem more likely as it has a savings and credit component, and management is participatory.

The gain recorded from doubling access to formal credit by the poorest income quintile is 11%, while the gain from the scenario that doubles lending to savings clubs is 10%. The competing gain to the poorest income quintile farmers from scaling up access to formal credit and lending to savings clubs also suggests that organization plays a critical role in the outcome of success. Such organization, Sorensen (2000) argued provides a platform to improve productivity and farmers access to credit. The finding from this paper on the organization of rural farm household around a savings group also suggests that horizontal linkages among base-level organizations (see Uphoff, 1998) could equally contribute to improve outcomes for rural farm households provided they are well organized and households act in the interest of the group.

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APPENDIX

A.1

are there financial institutions in the community	Freq.	Percent	Cum.
no	20	6.25	6.25
yes	300	93.75	100.00
Total	320	100.00	

A.2

do you have need for finance to help boost poor farm harvest due to increasing c	Freq.	Percent	Cum.
yes	307	95.94	95.94
no	11	3.44	99.38
no response	2	0.63	100.00
Total	320	100.00	

A.3

have you borrowed from family and friends in the past 12months	Freq.	Percent	Cum.
no	40	12.50	12.50
yes	280	87.50	100.00
Total	320	100.00	

A.4

have you borrowed from another private lender in the past 12months	Freq.	Percent	Cum.
no	238	74.38	74.38
yes	82	25.63	100.00
Total	320	100.00	

A.5

have you borrowed from financial institution in the past 12months	Freq.	Percent	Cum.
no	256	80.00	80.00
yes	64	20.00	100.00
Total	320	100.00	

A.6

in what ways does the community feel the impact of climate change	Freq.	Percent	Cum.
high temperature	100	31.25	31.25
prolonged dry season	70	21.88	53.13
flash floods	57	17.81	70.94
land/ soil erosion	27	8.44	79.38
wind storm	25	7.81	87.19
desertification/ drought	41	12.81	100.00
Total	320	100.00	

A.7

what is the purpose of the credit	Freq.	Percent	Cum.
buy fertilizer	74	23.13	23.13
dig borehole for irrigation purpose	61	19.06	42.19
buy farm equipment	14	4.38	46.56
plant shrubs	10	3.13	49.69
hire additional labour	48	15.00	64.69
buy improved seedlings	54	16.88	81.56
make buffers that are bush fire resista	27	8.44	90.00
construct thatch fence around farm land	9	2.81	92.81
adopt sustainable land managment practi	10	3.13	95.94
plant trees	4	1.25	97.19
soil conservation	5	1.56	98.75
no response	4	1.25	100.00
Total	320	100.00	