Working paper series
African Microfinance Week

Accelerating Research on Innovations for Rural Financial Inclusion in Africa
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Foreword

In 2014, the Organizational Committee of the African Microfinance Week invited European, International and especially African PhDs, researchers and experts to submit research papers for the Research Meets Africa (RMA) workshop, an event organized by ADA, in collaboration with Positive Planet and its University Meets Microfinance (UMM) programme. The RMA workshop took place in Senegal in the framework of the African Microfinance Week, held from June 29 - July 3, 2015. The workshop leveraged research on innovations, gathering expertise from different sectors, including those which are currently outside the microfinance world; but which have the potential to bring about change, by identifying opportunities and new ways of reaching out to rural populations, and fostering new inclusive finance methodologies.

What does RMA hope to achieve?

The mission of Research Meets Africa is threefold:

1) To facilitate greater North-South and South-South convergence;

2) To stimulate local research centers and universities to conduct research and influence policies by providing a platform for exchange and knowledge dissemination;

3) To provide a setting that reflects the needs of rural African households and smallholder farmers for adapted solutions and inclusive financial services.

In 2015, the Research Meets Africa Scientific Committee reviewed the papers and selected 11. During the workshop authors of accepted papers presented their research findings, along with other interested parties, on the theme: *Accelerating Research on Innovations for Rural Financial Inclusion in Africa*. You can find the presentations of the Research Meets Africa Workshop on the African Microfinance Week website. You can access the presentations and download them.

We thank the researchers, facilitators and participants of the Research Meets Africa workshop for the fruitful exchanges.

The MFW4A Research Award

The partnership for Making Finance Work for Africa (MFW4A) is a multi-donor initiative hosted by the African Development Bank in Abid-
As part of its activities, the Partnership has launched the MFW4A Research Award to honor researchers and encourage them to pursue and refine their work on the most pressing issues in financial sector development in Africa.

In addition to the award, the recipients have benefited from wider exposure of their work, particularly through the MFW4A Working Paper series, the website, the biweekly newsletter, and through invitations to participate in conferences and seminars organized by the various member institutions of the Partnership.

For the first edition of this prize, it was entirely appropriate to partner with the African Microfinance Week and particularly at the “Research Meets Africa” workshop under the theme Accelerating Research on Innovations for Rural Financial Inclusion in Africa. Indeed, the microfinance model, which has gained so much attention in the development circles and has raised awareness on the importance of financial inclusion, is now being questioned.

Is microfinance still effective in its primary role of promoting financial inclusion for the most vulnerable households? How can it best support the rural sector, and especially the agricultural sector, the largest employer of the continent? What works and above all, what doesn’t? What innovations could we bring to enable it to better adapt to the different realities on the ground?

These are some of the most important questions addressed by the research findings presented during the workshop, and by the papers selected for the award.

The MFW4A Research Award rewarded two of the researchers who presented their work at the Research Meets Africa Workshop and presented the awards during the closing ceremony of the African Microfinance Week. Following are the winning researchers and their papers:

- Terfa W. Abraham, WASCAL PhD Programme, Department of Economic Sciences, Universite Cheikh Anta Diop, Dakar, Senegal. Financial Innovation and Poverty Reduction: Evidence from Rural Northern Nigeria

- Boubacar Barry, International Water Management Institute and West African Science Centre on Climate Change and Adapted Land Use (WASCAL). Field Facts for Crop Insurance Design: Empirical Evidence from Southern Burkina Faso
Organizers

ABOUT THE AFRICAN MICROFINANCE WEEK AND ADA

The African Microfinance Week (SAM) is an annual conference open to all microfinance practitioners, related sectors and actors of inclusive finance, organized by ADA and the networks AMT, AFMIN, AFRACA and MAIN. The conference is dedicated to bringing together key players to discuss the future of microfinance, the financing of microfinance institutions and partnerships between regional and continental networks. The event is designed to provide a platform to exchange and reflect on the industry, a forum to actively promote and accelerate financial inclusion and economic growth on the continent.

For 20 years ADA has been a leading player in the field of microfinance in Luxembourg and abroad. ADA is a Luxembourgish NGO that works to promote inclusive finance worldwide. ADA is convinced that access to financial services can bring about a lasting improvement in the living conditions of poor populations. ADA pursues its goals with the backing of the Luxembourg Development Cooperation, which has extended its mandate by five more years (2012-2016).

ABOUT MAKING FINANCE WORK FOR AFRICA

The Partnership for Making Finance Work for Africa (MFW4A) is a multi-donor initiative hosted by the African Development Bank in Abidjan, Ivory Coast. Its objective is to facilitate a scale-up in support for financial sector development in Africa, overcome fragmentation and increase aid efficiency by addressing key constraints to efficient development partner support. It provides a unique platform for joint action, dissemination of ideas and coordination amongst donors and African financial sector stakeholders to address African priorities on financial sector development.

ABOUT UNIVERSITY MEETS MICROFINANCE AND POSITIVE PLANET

University Meets Microfinance (UMM) is a European initiative implemented by Positive Planet, which fosters cooperation between universities, students in Europe and microfinance practitioners to contribute to microfinance innovation and education for development. UMM is mainly active in the domains of microfinance education, microfinance research, information capitalization, professional exchange and dissemination of information. All UMM activities are carried out under the umbrella of the European Microfinance Platform (e-MFP) in the frame of the e-MFP "UMM» Action Group.

Positive Planet, is an international non-profit organization with a mission to create a better world for future generations, by giving the poorest populations access to financial services, as well as to key essential services. Positive Planet is a broader organization which has grown out of the development of PlaNet Finance, which was initially solely dedicated to the worldwide development of financial inclusion for populations living in poverty. Financial inclusion has evolved over the last 20 years becoming a major movement offering financial services to hundreds of millions of people. Amplifying this movement, Positive Planet now implements programs focusing on additional dimensions of inclusion, to give access to entrepreneurship, education, healthcare, clean energy and environment, housing, food security and water.

The workshop was made possible thanks to the financial support of:

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Introduction

Over the past years much attention has been placed on the impact of microcredit and its utility as a poverty alleviation intervention. Many studies have highlighted the limited impacts of microcredit on the incomes of the poor. It is within this context that the Research Meets Africa call for papers and workshop were conceptualized in order to highlight the broad range of products and services that make up the financial inclusion spectrum and the innovation that is taking place throughout developing countries but especially in Africa to bring better and appropriate services and products to underserved communities especially in rural areas.

Rural financial inclusion in Africa faces many challenges in providing appropriate products and services, developing inclusive financial ecosystems that are secure, accessible and affordable as well as leveraging local and international expertise to support and promote rural livelihoods and markets.

“How can research on innovation accelerate the transfer of expertise and experiences from other sectors to the rural financial inclusion sector in Africa?”

The role of applied research as a method for identifying adapted financial practices and making them visible within the financial sector is critical to inspire financial service provision and improve rural outreach. Research findings addressing the needs and challenges of excluded and underserved people have important added value, as they produce new knowledge, insight and expertise. This research and education process is innovative. It builds on developing and marketing financial products and services arising from grassroots innovations and markets lower down the pyramid.

The objective of the RMA workshop was to support and promote this type of research as well as to identify local expertise. More than sixty participants from 30 different African countries listened to and debated topics as diverse as crop insurance design, land tenure programs for smallholder farmers across Africa, the regulatory framework of inclusive finance in rural areas, the gender dimension in microfinance, exploiting digital technologies and communication satellites for rural financial inclusion or index microinsurance for livestock.

The presented research had to account for specific national and rural contexts and factors, such as livelihoods, demography and migration,
climate and geographical conditions, infrastructure for health care, education, reliability of technology, or other “global public goods” linked to ‘environmental commons’ or natural resources accessible to all members of a society, including natural materials such as air, solar rays and water.

The following working papers explore these challenges closely.
Financial Innovation and Poverty Reduction: Evidence from Northern Nigeria

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Abstract

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 is, however, not clearly established. 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) faired in bringing about poverty reduction remains critical. While attention was given to how these strategies affected the poorest income quintile among rural farm households in a developing country in West Africa, we did not fail to examine the effect of their organisation into savings clubs and how it helps to reduce poverty. Our analysis of policy options showed that lending to rural farm households organized into savings clubs and scaling up access to formal credit would benefit the poorest income quintile. Traditional crop insurance, however, was found to benefit only farmers in the richest income quintile. 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 in order to see how to help them cope or adapt to covariate and idiosyncratic agricultural shocks. Also, helping developing country governments to move away from traditional crop insurance would also be nice.
Introduction

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 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 (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 (2013 estimate) 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: (1) would financial inclusive innovative strategies lead to poverty reduction in a typical agricultural household community and, (2) would households that constitute the poorest income quintile and are vulnerable to climate change benefit the most from such innovations? The objective of the paper therefore is to examine the effect of access to credit as a climate change adaptation strategy on poverty reduction in Nigeria. Asides the access to credit channel, household experience with crop insurance and the effect of community savings clubs on farm households across income quintiles would also be examined.

**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 order 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 smoothing, 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, that 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.

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 smoothing 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).

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,
Theil’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.

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)\(^1\) 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, 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.

\(^1\) 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.
Climate Policy, Financial Services and Poverty Reduction in Nigeria

Despite MDG 2015 efforts, poverty has remained high in many developing countries\(^2\). 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 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, raise the necessary funds, and manage 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.

\(^2\) 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%.
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) 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 in school enrolment (30-40%) in the country (IFAD and FGN, 2013). There is also a third rationale, 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.

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,

3 Others are Borno, Jigawa, katsina, Sokoto, Yobe and Zamfara states
There is also the problem of 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.

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) to 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 adapta-

### Table 2.1: Inequality and Poverty Income Distribution in Nigeria

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowest (Bottom) 20%</td>
<td>7.0</td>
<td>4.0</td>
<td>5.0</td>
<td>5.1</td>
<td>4.4</td>
<td>1980</td>
<td>27.20</td>
<td>65.00</td>
<td>17.68</td>
</tr>
<tr>
<td>Second 20%</td>
<td>12.0</td>
<td>8.8</td>
<td>8.8</td>
<td>9.7</td>
<td>8.3</td>
<td>1985</td>
<td>46.30</td>
<td>75.00</td>
<td>34.73</td>
</tr>
<tr>
<td>Third 20%</td>
<td>15.8</td>
<td>14.5</td>
<td>13.6</td>
<td>14.7</td>
<td>13.0</td>
<td>1992</td>
<td>42.70</td>
<td>91.50</td>
<td>39.07</td>
</tr>
<tr>
<td>Fourth 20%</td>
<td>24.0</td>
<td>23.3</td>
<td>20.2</td>
<td>21.9</td>
<td>20.3</td>
<td>1996</td>
<td>65.60</td>
<td>102.30</td>
<td>67.11</td>
</tr>
<tr>
<td>Fifth (Top) 20%</td>
<td>41.2</td>
<td>49.4</td>
<td>52.1</td>
<td>48.6</td>
<td>54.0</td>
<td>2004</td>
<td>54.40</td>
<td>126.30</td>
<td>68.71</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>2010</td>
<td>69.00</td>
<td>163.00</td>
<td>112.47</td>
</tr>
<tr>
<td>Gini Coefficient</td>
<td>38.7</td>
<td>45.0</td>
<td>46.5</td>
<td>42.9</td>
<td>48.8</td>
<td>2011</td>
<td>71.50</td>
<td>164.19</td>
<td>117.39</td>
</tr>
</tbody>
</table>

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

54% of wealth is shared by richest quintile.

---

**Figure 2.1: Poverty Incidence in Nigeria (1980-2012)**

Source: NBS, 2013
tion. 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.

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:

- mpoor (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.

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:

\[ F(I) \in U_{CCl} : F(I) = \{FA_{CG}, CI, AFC\} \]

and \[ F(I) \rightarrow P_{OY} \]

→ 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 (FAGL), crop insurance (CI) and access to formal credit (AFC). The argument is that an increase in FI would lead to poverty reduction hence, bringing about climate resilient development.

**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 purpos-
es, 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).

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.

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:

\[ Y_i^* = \sum_{j=1}^{k} \beta_j X_{ij} + \epsilon_i = Z_i + \epsilon_i \] (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:

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

Where \( P(Y > j) \) 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).

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.

**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.

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 labor.

Those who are in a savings club are more likely to be in savings club and those who do 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.

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.

**Table 4.1: Estimated Ordered Logit Model**

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

Dependent Variable Income Quintile:
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.

Access to formal credit also has a higher probability of being effective with the poorest income quintile than for the richest 20% farmers. 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.

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

Table 4.2: Marginal Effects (Ordered Logit Model)

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

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

Figure 4a: Access to formal finance scenario
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 Majurín (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

Figure 4b: Lending to savings club scenario

Figure 4c: Insurance scenario
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.

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.

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.

**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 (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 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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Payment default determinants in credit groups in a microfinance institution: FECECAM case in Benin

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Summary

This study aims to understand the payment default determinants of credit groups at the FECECAM Benin. For this, a field survey was conducted among members of 95 groups. As a first step the data collected was used to perform a typology of the 95 groups using a digital classification method preceded by a factor analysis (ACP or AFC) depending on the type of variables. Default risk was then modeled with logistic regression using different selection approaches to the variables. Categorization allowed identifying, regardless of the nature of the variables, four categories of homogeneous groups. These groups differ according to their proportion of men and women, the religious and ethnic homogeneity of group members, and according to their main activity. Increase in the percentage of Lokpa, in the percentage of Fon, in the percentage of members having as main activity the processing of agricultural products, and the percentage of Muslims in the group have a positive effect on reimbursement while the percentage of Bariba and the
size of the group have a negative effect on repayment. Thus, forming small homogeneous groups based on these factors enables reducing default risk.

Introduction

The efficiency of its financial system is a determining factor in the development of any nation. Characteristics such as quality, quantity, cost, and accessibility are just as important as those of traditional infrastructure (World Bank, 2000). In Benin, as in most developing countries, a large cross-section of the workforce with good economic growth potential is excluded from the traditional banking system, as they are unable to meet the required conditions for obtaining credit. Gentil and Servet (2002) pointed out that in Africa 90% of the population or even 100% in rural areas do not have access to financial banking services. This exclusion is not only a problem of social equity, but also one of efficiency. To compensate for this deficiency, the economic space left open by traditional banks has been taken up by microfinance institutions (MFIs).

Conventional banks’ low penetration rates can be explained in part by information asymmetries and transaction costs that increase the risks and expense of banking transactions especially credit (Honlonkou et al. 2006). One of the important innovations introduced by the MFIs is the substitution of the mutual supervision of physical guarantees; a precursor of this is Muhammad Yunus, 2006 winner of the Nobel Peace Prize. This win-win strategy provides the poor access to credit while the MFIs avoid being strapped with low reimbursement rates. Microcredit is thus granted either to solidarity groups of poor individuals who cannot provide material guarantees, or individually to people a little better off who have some collateral. Several studies have been made on the performance of solidarity credit groups benefiting from MFI microcredits. Khandker et al. (1995) in a study of the Grameen Bank noted the positive effect of the group on repayment; Godquin (2004) revealed that increasing the amount of the loans had a negative impact on reimbursement in Bangladesh. Recently, El Aida et al. (2014), in a study on the performance of solidarity group repayment, mentioned that women reimburse better than men. When the amount of the obtained loan is less than the amount requested, the likelihood of default increases. When the education level of the solidarity group members increases, the probability of loan default drops. Increasing the number of solidarity group members increases the risk of non-repayment and income seasonality increases the risk of default. Likewise, Mauk (2013) noted that solidarity, joint decision making, sanctions, and the length of existence of the group have a positive effect on repayment while the degree of joint responsibility and interest rates negatively influence reimbursement. Noglo and Androuais (2013) showed that credit group repayment improved with contributing variables such as mutual supervision among group members, social capital, the absence of selection, financial assistance, and informal sources of credit. Despite many written studies on the subject and the successive crises that have occurred in the sector in Benin the fact remains that very few studies have been car-
ried out in the field. The few studies that do exist are limited to southern Benin and do not account for the specificity of the agricultural sector. Honlonkou et al. (2006) evaluated the repayment rates of small businesses in southern Benin. This present report seeks to fill the field research vacuum in Benin and thereby enrich the existing literature on the subject.

Objectives

The study's general objective is to research the determinant factors leading to payment default of microcredit groups in order to address the lack of information on the subject in Benin and secondly, to complement the existing literature on the subject.

Specifically, this would involve:

- Identifying factors likely to influence reimbursement default for this type of credit;
- Categorize the beneficiary groups; and
- Forecast the probability of default.

Methods

Choice of the study's framework

FECECAM BENIN was chosen for the study because it is the only microfinance institution covering all of Benin's territory and it is particularly involved in the agricultural sector. Data was collected through a field survey. In a search for proper representativity, customers from three branches located in the municipalities of Djougou, Parakou and Abomey-Calavi (Akassato Agency) were questioned.

General information about FECECAM Benin

The Federated Caisses d'Epargne and Crédit Agricole Mutuel of Benin (FECECAM BENIN) was created in 1993 following the second restructuring phase of the Caisses Locales de Credit Agricole Mutuel (CLCAM) establishing a federation of the latter. CLCAM are former relocated structures of the Caisse Nationale de Crédit Agricole (CNCA) created in 1977 and liquidated in 1987 after a generalized banking crisis in Benin. During that period, the CLCAM were unaffected by the liquidation, retaining their autonomy. The CLCAM take in local savings, and provide credit to their members. At the national level, the FECECAM defines the national policy of the network, coordinates, supports, and oversees CLCAM activity. FECECAM's mission is to provide decentralized financial and non-financial services to rural and urban populations in order to improve their living conditions while ensuring the network's sustainability. Intended targets are farmers, dealers, traders, SMEs, SMIs and salaried workers. To complete its mission, the FECECAM Network adopted a policy of proximity by setting up a broad presence throughout the country. Indeed, the network covers the entire country and as of December 31, 2012 it had 33 local banks, 31 agencies, and 76 counters totaling 140 service points. The eight regional technical delegations and the national federation coordinates the network’s activity and its representation. At December 31, 2013 the number of members was 763,349 including 293,612 women, the number of groups was 85,883, the number of employees was 893, and the savings and loan managed an estimated CFA 42.65 billion and CFA 29.51 billion respectively. According to information provided by the Institution’s data processing service, the 90 day PAR derived
from the 2013 financial statements was estimated at 5.76%. For the same period, the repayment rate on new maturities was estimated at 92% and the credit loss rate was 0.98%. Amounts under management by the three agencies selected for this study was 12% of the total outstanding. The urban clientele, grouping those from the larger banks in Parakou, Cotonou, Abomey-Calavi, Porto Novo and Bohicon, was estimated at 27% and the rural customers of the other agencies was approximately 73%. The annual interest rate was 19% for agricultural loans, 18% for trade, and 12% for loans to salaried workers.

Data collection

The technique used to select beneficiary groups was an accidental sampling method, i.e. the groups included in the study were those whose members were present and available during our visit. Loan officers were also called on in order to obtain more information on the groups and the causes of default. Table 1 shows the sample distribution per agency. The Djougou and Parakou agencies are located in the north and those of Akassato in the south. In general, the northern population is mostly Muslim. While the south is more animist and Christian. Economically, the south is relatively more developed than the north. The community is mostly populated by the Yom Lokpa sociocultural group. That of Parakou is essentially Bariba and that of the Atlantic, where the Akassato agency is located, is largely Aizo and Toffin. The groups surveyed in Parakou and Akassato were those of women benefiting from Savings and Loan with Education schemes, while those in Djougou were made up of both women’s and mixed groups.

Table 1 defines the key variables used in the data collection.

<table>
<thead>
<tr>
<th>Agency</th>
<th>Good</th>
<th>Defaulting</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Djougou</td>
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<td>20</td>
<td>59</td>
</tr>
<tr>
<td>Parakou</td>
<td>5</td>
<td>14</td>
<td>19</td>
</tr>
<tr>
<td>Akassato</td>
<td>12</td>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td>Total</td>
<td>56</td>
<td>39</td>
<td>95</td>
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</tbody>
</table>

Data analysis

The data collected was interpreted after calculating averages, standard deviations, and proportions. Both Chi-square and Student t tests were also used to verify the independence of categorical variables to defaults and compare the quality of repayment to quantitative variables. Group typologies were made using a numerical classification method on the scores obtained after the main component analysis in the case of quantitative variables and a correspondence analysis for qualitative variables. Default risk was modeled by considering a group to be good if it properly reimburses, or has always reimbursed its loans, and defaulting otherwise. As the loan default variable is qualitative, its modeling was performed by logistic regression. Given the significant number of variables, a step-by-step selection of variables was made using backward, forward, forward to backward, and backward to forward methods. In these procedures variable subsets were selected based on Akaike information criterion (AIC) (1973) and Bayesian information criterion (BIC), Schwartz (1978). The models obtained were compared on the basis of adjustment criteria (residual deviance) and prediction (a cross-validation method with K = 1, K = 5, and K = 10).
### Table 2: Definition of variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
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<td><strong>Quantitative</strong></td>
<td></td>
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<tr>
<td>DATG</td>
<td>Length of existence of the group (in years)</td>
</tr>
<tr>
<td>EFF</td>
<td>Group workforce</td>
</tr>
<tr>
<td>ETHN</td>
<td>Percentage of each ethnicity</td>
</tr>
<tr>
<td>RELIG</td>
<td>Percentage of each religion</td>
</tr>
<tr>
<td>VILL</td>
<td>Percentage from the main village</td>
</tr>
<tr>
<td>MASC</td>
<td>Percentage of men</td>
</tr>
<tr>
<td>FEM</td>
<td>Percentage of women</td>
</tr>
<tr>
<td>FREQ</td>
<td>Frequency of monthly meetings</td>
</tr>
<tr>
<td>DRES</td>
<td>Average distance between residence and work</td>
</tr>
<tr>
<td>SUPM</td>
<td>Average land area owned by a member</td>
</tr>
<tr>
<td>ACTIV</td>
<td>Percentage per activity carried out</td>
</tr>
<tr>
<td>LPAR</td>
<td>Percentage having kinship</td>
</tr>
<tr>
<td>MNTE</td>
<td>Amount of the highest loan (past four years)</td>
</tr>
<tr>
<td>MNTB</td>
<td>Amount of the lowest loan (past four years)</td>
</tr>
<tr>
<td>REVB</td>
<td>Average revenue per member for a good year</td>
</tr>
<tr>
<td>REVM</td>
<td>Average revenue per member for a bad year</td>
</tr>
<tr>
<td><strong>Qualitative</strong></td>
<td></td>
</tr>
<tr>
<td>ACTV</td>
<td>Field of activity of the group</td>
</tr>
<tr>
<td>INTP</td>
<td>Integration of persons from outside the group</td>
</tr>
<tr>
<td>PRES</td>
<td>Pressure used in the event of default: Verbal aggression, material confiscation, denunciation to the local authorities, social ostracism, and loss of reputation.</td>
</tr>
<tr>
<td>AIDE</td>
<td>Assistance for a defaulting member comes from: equal contributions from each member, family, spouse, or informal sources.</td>
</tr>
<tr>
<td>ANB</td>
<td>Best year income-wise over the last four years</td>
</tr>
<tr>
<td>ANM</td>
<td>Worst year income-wise over the last four years</td>
</tr>
<tr>
<td>AIDI</td>
<td>Internal group mutual assistance over the last 12 months</td>
</tr>
<tr>
<td>AIDE</td>
<td>External group assistance over the last 12 months</td>
</tr>
<tr>
<td>PRID</td>
<td>Final decision-maker on group activities</td>
</tr>
<tr>
<td>SANC</td>
<td>Sanctions in case of loan default</td>
</tr>
<tr>
<td>INST</td>
<td>Highest education level of group members</td>
</tr>
<tr>
<td>RICQ</td>
<td>Wealth level of the village/neighborhood</td>
</tr>
<tr>
<td>DEF</td>
<td>Penalty paid for late repayment (repayment default: 0 = no; 1 = yes)</td>
</tr>
<tr>
<td>COS</td>
<td>Loan default causes</td>
</tr>
</tbody>
</table>
Results

Description of the groups

From the quantitative effect analysis of each loan default characteristic (Table 3), it emerges that the average number of years of creation is 5 with an average of 17 members. The most represented ethnic groups are the Den-di followed by the Lokpa. The dominant religion is Islam. Most members live in the same town (80%). The percentage of tradesman in the group was over 50%. Estimated income for a good year is approximately CFA 250,000 and that of a bad year is CFA 120,000. The percentage of Bariba, Berba, Lokpa, Muslim and members having as their main activity the processing of agricultural products affects the default rate.

Table 3: Effect of quantitative variables on default rates.

<table>
<thead>
<tr>
<th>Variable</th>
<th>DF</th>
<th>m</th>
<th>s</th>
<th>Variable</th>
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<th>m</th>
<th>s</th>
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</table>
### Categorization of the groups

#### According to categorical variables

The group typology carried out with qualitative variables allowed identifying four categories (Figure 2).

The first category is made up of 32.63% of the sampled groups. These groups come from Djougou. They are characterized by non-educated members in mixed types of activity, individual decision-making, and using social ostracism to put pressure on members to repay. Member assistance for those in repayment difficulty comes from the spouse and family. The penalty applied to a member in default is a warning.

The second category also involves groups from Djougou and represents 29.47% of the sample. It consists of agriculture groups, one of whose members is of the higher category. It accepts integrating people from outside the group. They contribute equally to help a member in need. The penalty applied to a member in default is a suspension.

The third category represents groups from Parakou with the presence of some Akassato groups. This category represents 21.05% of the sample. Their activity is trade. Decision making is collegial. Members use warnings to prevent the risk of default and exclusion as a sanction for a default.

The fourth category consists also of groups from Akassato and represents 16.84% of the sample. Essentially tradesmen, these groups do not accept the inclusion of outsiders. They use verbal aggression as peer pressure.
Figure 1. Breakdown of the groups according to repayment quality and qualitative characteristics

**Activité principale du groupe**

<table>
<thead>
<tr>
<th>Category</th>
<th>2014</th>
<th>2013</th>
<th>2012</th>
<th>2011</th>
<th>2010</th>
<th>SA</th>
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**Pression par les pairs**

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**Année de bon revenu**

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**Sanction appliquée en cas de défaut**

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**Cause de défaut de remboursement**

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**Plus haut niveau d’instruction d’un membre du groupe**

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**Apport d’aide à un membre**

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**Année de mauvais revenu**

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**Source**

- Informelle
- Conjunt
- Famille
- Contribution du groupe

**Effectif**
According to the quantitative variables

Given the significant number of variables, the ACP was made in two stages. The first allowed identifying the variables that are strongly correlated with the factorial axes and using them in a second stage for analysis. The representation of individuals in the first factorial design showing the different established groups is given in figure 3. This design accounts for approximately 63% of the total inertia. The first three axes account for 78%. The first axis shows the breakdown of the groups according to their gender composition, and according to the proportion having as their main activity either trade or agriculture. The second axis contrasts the groups according to their proportion of practicing Muslims or Christians. This therefore is a breakdown of groups on the basis of religion. The third axis, not presented in the figure, gives the group breakdown according to the proportion of members residing in a same village. The characteristics of the different categories are given in table 4. Defaults are higher in 2 and 4, respectively consisting of groups of Parakou and part of groups of Djougou, than in 1 and 3 respectively containing part of Djougou groups and Akassato groups.

Forecasting default risk.

Risk modeling was made considering only quantitative variables. Table 5 shows the variables selected according to different procedures. It is apparent from this table that all

<table>
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<th>BARIB</th>
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procedures selected variables linked to the percentage of Bariba and Toffin per group. Procedure comparisons, from the point of view of the number of selected variables, reveals that the AIC criteria selects more variables than the BIC criteria. BIC criteria therefore penalizes the variables more. Similarly, the Forward/Backward and Forward methods tend to be severe towards selection, unlike the Backward/Forward and Backward methods. The calculated values of the AIC criteria for various procedures were lower than those of the BIC. The same was true for the residual deviance. On the basis of this last adjustment parameter, the subsets selected using the backward/forward and backward procedures appear the best in terms of adjustment quality. However, a better appreciation of the models must be made in terms of prediction quality. Comparing the different procedures reveals that the forward procedure using AIC criteria had the lowest error ratio regardless of the cross-validation method used. It follows that the subset of variables obtained with this combination was the best.

Table 5: Selected variables, adjustment parameters, and validation of selected models

<table>
<thead>
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<th>Variable</th>
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<td>EFF</td>
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<td>FON</td>
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<td>TOFF</td>
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<td>BERB</td>
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<td>KOTO</td>
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<tr>
<td>CHRE</td>
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<td>MUSL</td>
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The final model is as follows:

$$P(\text{DEF}=1/X)=7.12-1.41\text{ADJA}-0.05\text{AIZO}-0.24\text{ANIM}+0.03\text{BARI}+0.09\text{EFF}-0.15\text{FON}-0.45\text{FREQ}-0.09\text{LOK}+2.62\text{MINA}-0.08\text{MUSL}-0.27\text{TOFF}-0.08\text{TSRF}$$

The coefficient signs indicate that increasing percentages of Adja, Aizo, Fon, Lokpa, Toffin, animist, and transformatives in the group, as well as the frequency of group meetings reduced the risk of default, whereas the situation is reversed with percentages of Bariba, Mina, and larger sized groups. However, the variable percentage of Adja, Mina, Toffin, animists and meeting frequency were not significant in the selected model. Variables percentages of Lokpa, Fon and Muslims in the group have a highly significant effect, while the variable percentage of Bariba, percentage of members processing agricultural products, and the size of the group have a significant effect.
Discussion

Credit risk is the largest uncertainty micro-credit institutions face. Poorly managing this risk can have a negative impact on the institution’s portfolio quality and on its profitability. The groups examined in this study show a high default rate (42%). Length of existence of the group (5 years on average) could be one of the causes. Indeed, the default rate reported in the media is often low. Noglo and Androuais (2013) reported a rate of 25% in Togo, and Mauk (2013) reported 3% for data from the Thailand.

Categorizing groups allowed distinguishing four categories of credit groups. Gender, activity, religion, and distance between members appear as the most discerning variables of the different groups. The groups surveyed in Parakou and Akassato were mainly women, while those in Djougou were made up of both women's and mixed groups. El Aida et al. (2014) reported that women reimburse better than men. This result was confirmed in this study, because the fourth category obtained in the typology - groups from Akassato, had the lowest default ratio (29.7%). However, category 2, consisting of groups of women from Parakou, showed a relatively high rate (62.2%). This contradicts the results of El Aida et al. (2014). Geographical location may be the cause. The southern region is more developed than the north.

To best understand peer monitoring, variables such as the monthly meeting frequency, the average distance between residences and the size of the group have been used. The results showed that the size of the group had a negative effect on repayment default. Indeed, as noted by Wenner (1995), large sized groups cannot be effectively monitored, because this can give rise to strategic shortcomings. It also promotes asymmetric information between members, because one of the reasons for a group’s credit problems is not an inability to repay the loan, but a lack of willingness to repay (Diagne, 1998). Indeed, since willingness to repay is of a private nature, the group members cannot know the reimbursement intentions of other members. Bad faith, moreover, has been mentioned among the most important causes of member default. A similar result was reported by El Aida et al. (2014) on solidarity groups in Morocco.

The distance between members is relatively higher in defaulting groups than in non-defaulting groups. For non-defaulting groups, the distance is estimated at 1 km and for defaulting groups 2 km. This result is in line with those of Stiglitz (1990), Varian (1990), and Noglo and Androuais (2013) who showed that assiduous monitoring through closer residence has a positive effect on reimbursement, because ex ante moral hazard is reduced. This intense monitoring among members, intended to boost effort, is because they anticipate from their neighbors an expected benefit from future financings (Aghion, 1999). This distance effect was also reported on by Wydick (1999). Peer monitoring also has the advantage of encouraging peer assistance if the reasons for the default are justified. It also allows exerting more pressure in cases of voluntary default. Contrary to expected results, meeting frequency had no effect on default. Verbal aggression was the most used peer pressure to avoid default. This peer pressure allows reducing ex-post moral hazard and avoids the risk for the group of being deprived of future credit (Wydick, 1999). However, DG et al. (2000) report that such pressure may have a negative or low impact on repayment. All the same, a member’s default can be linked to exogenous reasons that are beyond his control. Intra-group solidarity en-
sures timely reimbursement (Huppi and Feder, 1990). The most commonly used form is equal contribution. This result is consistent with those of Noglo and Androuais (2013). Defaulting members also benefit from support from their family and spouses.

Default risk modelling reveals the effect of the breakdown by ethnicity of group members, the percentage of members processing agricultural products (TRSF), monthly meeting frequency (FREQ), the size of the group and its religion. The ethnic groups in question can be found in the northern part as well as in the southern part of the country, in varied proportions. This effect reflects the heterogeneity of groups in terms of social capital and could explain the high level of default. In fact, according to Baudasse and Montalieu (2004), the channels of social capital accumulation stem from repeated working relations, the family, the village, the Church, and the ethnic group. Social capital produces trust (Adler and Kwon, 1999) and constitutes a mechanism that deals with information asymmetries. Social ties between group members is a guarantee of repayment to the lender. For Floro and Yotopoulos (1991), strong social ties can be a source of monitoring and intense pressure resulting in good levels of reimbursement. On the other hand, too much social capital can also weaken the pressure on members (Wydick, 1999). Indeed, friends or members of the same family might be less inclined to exercise sanctions that could disrupt family ties or ruin friendships. Godquin (2004) also found that strong social ties between members of the group have a negative effect on reimbursement. This result is due to the fact that the long periods spent within the group make it hard for members to apply sanctions on defaulting members.

Comparing selection procedures has shown the performance of the Forward method with the AIC criteria. A similar result on the AIC criteria in terms of forecasting was also obtained by Mauk (2013). Although selection procedures are considered to be mathematical algorithms that choose the variables automatically without consideration for their economic or sociological sense, a number of variables, however, were significant in the final model, in particular the percentage of Bariba, Fon, Lokpa, Muslim, persons in the processing business and the size of the group.

**Conclusion**

This study aims to identify the payment default determinants of credit groups at the FECECAM Benin. Credit recipient members surveyed on-site allowed showing that variables such as the gender of members, their activity, religion and the distance between their places of residence appear to be more discriminating variables of the different groups. The default rate of the sample was found to be high. This rate can be explained by several factors: the distance between the places of residence of the members, the frequency of meetings, the ethnicity of the group and the activity carried out by the members. The effectiveness of the group’s credit repayment should therefore not be limited to the sole mechanism of social guarantees. This is moreover the new approach used by the structure, in particular the dynamic incentive measures such as progressive loans and improved access to future credit. The formation of uniform groups in relation to the identified factors is also a solution. The resulting model can serve as a decision-making tool for new loans and thereby reduce the task of the MFI in forecasting the risk of new groups of borrowers. From the perspective of generalizing the results for Benin, it is important to have a larger sample size by increasing the number of communities, agencies and groups per agency. It would be also interesting to take into account other variables left out of this study.
References


Evidence from Agricultural Microfinance in Mali

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Abstract

We partnered with Soro Yiriwasso (SY), a micro-lender in Mali, to randomize credit offers at the village level. The loan product called Prêt de Campagne is designed for farmers, providing capital at the beginning of the planting season while repayment is due as a lump sum after the harvest. We found that offering credit in the villages led to an increase in investments and expenditures in cultivation compared to control villages. No statistically significant expansion of profits has been detected. We also provide evidence that farmers positively self-select into loans, so that productive farmers are receiving needed capital.
Introduction

Agriculture sustains the majority of the poor in Mali, as is the case in most of Africa (World Bank 2000), and the vast majority of cultivated land is used by small farmers for subsistence agriculture. The impact on revenue of additional investments in agriculture can be high, particularly with respect to small investments such as fertilizer and improved seeds (Beaman et al. 2013; Duflo, Kramer, and Robinson 2008; Evenson and Gollin 2003; Udry and Anagol 2006).

Underinvestment in agricultural inputs or labor is thought to drive low crop yields in Africa. Farmers may fail to invest in these potentially profitable inputs for a variety of reasons, including credit constraints.

Microcredit organizations have attempted to relieve existing credit constraints, but most microcredit lenders focus on small business financing and do not structure products to target or facilitate agricultural lending. The typical microcredit loan requires frequent, small repayments and therefore does not facilitate investments in agriculture, where income comes as lump sums once or twice a year. By contrast, the loan product in this study is designed for farmers, providing capital at the beginning of the planting season and repayment is done as a lump sum after the harvest. Therefore, the loan component of this study tests an innovative agricultural lending model that is different than those employed in the past since there is no government involvement, weak group liability, and little to no subsidy.

Research Objectives

We investigate whether capital constraints are binding among farmers in Mali, and if agricultural microfinance can help relax constraints to investment among small farmers through offering credit. The impact of the loans on a number of agricultural outcomes was measured.

The research study also includes a grant component and examines whether high-return farmers self-select into agricultural loans, but this sub-section of results from the study are not the focus of the submission for the African Microfinance Week conference.1

Methods

This study was a randomized control trial (RCT). The sample frame consisted of 198 villages, located in Bougouni and Yanfolila, two cercles in the Sikasso region of Mali.2 We partnered with Soro Yiriwaso (SY), a Malian microcredit organization (and an affiliate of Save the Children) which offered their standard agricultural loan product – Prêt de Campagne – in 88 randomly assigned villages for the 2010 and 2011 agricultural seasons. In these treatment villages, women could get loans by joining a local community

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1 Results from the study are described in the paper Self-Selection into Credit Markets Evidence from Agriculture in Mali (2014) by Lori Beaman, Dean Karlan, Bram Thuytsbaert, and Christopher Udry - NBER Working Paper No. 20387.

2 Bougouni and Yanfolila were chosen because they were in the expansion zone of SY. The sample frame was determined by randomly selecting 198 villages from the 1998 Malian census that met 3 criteria: (1) were within the planned expansion zone of SY, (2) were not currently serviced by SY, and (3) had at least 350 individuals (i.e., sufficient population to generate a lending group).
In January-May 2011, and a second follow-up survey was conducted in January-May 2012. In the three rounds, similar survey instruments covered a large set of household characteristics and socioeconomic variables, with a strong focus on agricultural data including cultivated area, input use and production output at individual and household levels. We also collected data on food and non-food expenses of the household as well as on financial activities (formal and informal loans and savings) and livestock holdings.

Data from this RCT were analyzed by an intent-to-treat (ITT) approach. This analysis guarantees an unbiased comparison across the treatment and control groups. The ITT analysis also provides the relevant community-level impact estimates needed for cost-benefit analysis.\(^5\)

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3. The average loan size in 2010 was 32,000 CFA (US$113). We use the 2011 PPP exchange rate with the Malian FCFA at 284 FCFA per USD.

4. The second stage of randomization was done after loan participation had been decided and therefore only households who did not take a loan were considered. To mitigate concerns about future take up, some grants were also given out to loan recipients who were outside of the study sample.

5. Low participation rates will lead to lower ITT estimates. However, the MFI faces many fixed costs of operating in a village, so low take up leads to higher costs-per-client. The ITT estimates of household benefits can therefore be compared to costs for policy decisions.
In order to estimate the intent-to-treat (ITT) effects of being offered an agricultural loan on a number of different outcomes, all grant recipients were excluded from this analysis and observations appropriately weighted.

**Results**

**Agricultural Lending**

About 22 percent of the households in our sample chose to accept the loan in treatment villages, which is a take up rate similar to other microcredit contexts. The loans were offered in year 1 (2010) and again in year 2 (2011).\(^6\) Offering loans in a village led to an increase in total input expenditures (US$22) and investment in cultivation, notably more family labor days (8.7 days), fertilizer (US$10), insecticides and herbicides (US$5), along with an increase in the value of agricultural output (US$32) (see Figure 2). However, we do not detect a statistically significant increase in profits (US$17). In conclusion, providing credit through a targeted microfinance product lead to increased investments in cultivation.

Looking past agricultural-related outcomes, offering a loan in a village increased the value of livestock (US$168), but we do not detect a statistically significant impact on the other outcomes including weekly food consumption (US$0.10), monthly non-food consumption (US$0.20), whether the household had a small business, or education expenditure\(^7\) (see Figure 2).

**Grants**

The provision of grants also led to an increase in agricultural investments, and ulti-
mately profits. We can compare households who received a grant to those that did not in no-loan villages to estimate the average benefits of receiving a grant. We observe that in households who did receive a grant compared to those who did not in no-loan villages, the amount of land cultivated increased (0.18 ha, se=0.065), a small but significant amount. The grant also induced an increase in hired labor days (2.7 days, se=0.80). 2.7 days is a small number, but these households use very little hired labor: the mean in the control in 2011 is only 17 days throughout the agricultural season. Fertilizer (US$11, se=4.4) and other chemical inputs (US$9, se=2.2) also increased by 14 and 19 percent respectively. Total input expenses (excluding family labor and the value of land which are challenging to value) increased to US$28 (se=8.2), by 14 percent. The grants therefore led to an increase in agricultural investment. Figure 3 shows that output and farm profits (excluding the value of family labor and land) also went up significantly. Output went up by 13 percent (US$66, se=20) and profits by 12 percent (US$40, se=15). Overall, we see significant increases in investments and ultimately profits from relaxing capital constraints.

Do the most productive farmers receive loans?

There is another key finding of the study which demonstrates a striking pattern of self-selection into credit markets. Comparing descriptive statistics from the baseline on households who chose to take up loans versus non-clients in those villages, we find that households that invest more in agriculture, have higher agricultural output and profits, and more agricultural assets and livestock, are more likely to borrow. Women in households who borrow are also more likely to own a business and are more “empowered” by three metrics: they have higher intra-household decision-making power, are more socially integrated, and are more engaged in community decisions. Households that borrow also have higher consumption at baseline than non-clients.

Are these farmers also those who would use capital most productively? Our research design allows us to capture whether farmers who did not take out loans experience lower returns to capital on average (in the form of a grant) than those who did take out loans. We cannot directly observe what the returns to a grant are to loan recipients since they received a loan and not a grant. We anticipate investment choices may be different when you have to repay a loan versus when it is an unconditional grant. Instead, we look at the returns to the grant among the subsample of households who did not receive a loan. This is a purposively selected sample. We can compare the average returns to the grants in no-loan villages – this represents the average for all farmers – to the returns to the selected sample in loan-villages. If the returns are smaller among no-loan-takers than in the representative sample, we can conclude that low-return farmers opted-out of getting a loan and high-return farmers opted-in. In terms of Figure 1, Boxes A-B tells us the average impact of receiving a grant. If (A-B) is larger than (C-D) then we conclude that there is positive selection into loan product.

There may be good reasons why low-return farmers do not get loans: they may be debt-averse, risk-averse or face additional constraints (like an imperfect labor market) that limit their investments. The results suggest that despite these potential obstacles, SY does target capital to farmers who have high returns to investments.
Discussion

These results on loan impacts stand in stark contrast both to the recent literature on the impact of entrepreneurially-focused credit (see Angelucci, Karlan, and Zinman 2013; Attanasio et al. 2011; Augsburg et al. 2012; Banerjee et al. 2013; Crepon et al. 2011; Karlan and Zinman 2011; Tarozzi, Desai, and Johnson 2013), and earlier agricultural lending literature that documented consistent institutional failures, typically with high default rates (Adams, Graham, and Von Pischke 1984; Adams 1971). The institutional results are also promising: the perfect repayment, and the retention to the following year (50 percent) is on par with typical client retention rates for sustainable, entrepreneurially-focused microcredit operations.

Capital constraints are limiting investments in cultivation for some farmers in Southern Mali, and we find that agricultural lending with balloon payments (i.e. with cash flows matched to those of the intended productive activity) is a plausible way to increase investments in agriculture. This is an important policy lesson since the majority of microcredit has focused on small enterprise lending, and the typical microcredit loan contract – where clients must start repayment after a few weeks – is simply ill-suited for agriculture. Field et. al. (2013) find similar results merely from delaying the onset of high-frequency repayment within the context of microenterprise. For example, SY is the only microcredit organization in Mali with a product specially designed for agriculture, despite the fact that the vast majority of households in rural Mali depend on agriculture for a sizeable part of their livelihood.

Key to our main objective, we find that the returns to capital in cultivation are heterogeneous and that higher marginal-return farmers self-select into borrowing more than low marginal-return farmers. This has important implications for models of credit markets. In particular, our results provide rigorous empirical evidence for optimal selection into contracts, which is embedded in models like Evans and Jovanovic (1989), Buera (2009) and Moll (2013), but they lacked clear empirical evidence. Our results also highlight the need to incorporate heterogeneity of returns into such models, as recognized by Koskin and Townsend (2011).

References


Developing Innovative Financial Inclusion Mechanisms by fostering Green Microfinance – The Case of two Ethiopian MFIs

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Abstract

The concept of green microfinance stipulates the role that microfinance institutions can play in offering affordable and sustainable access to clean energy technologies through customized financial products. Linking the microfinance and energy sectors has the potential to break down financial and energy access barriers by providing innovative financial products and services to excluded populations. Stimulating the new practice of interlinking energy and financial inclusion addresses the triple bottom line at the base of the pyramid. The present paper aims at showcasing the innovative solutions for rural financial and energy inclusion by providing an overview of the systematic approach initiated in the portfolio diversification process of two microfinance institutions in Ethiopia.
Introduction

The relationship between financial and energy inclusion is a critical impact point that has positive effects on the poverty levels of low-income clients (Groh, 2013). On one hand, access to finance can lead to energy inclusion in terms of affordability, i.e. people who have access to financial services are able to finance their basic energy needs and either pay for grid-supplied electricity or purchase an energy generation system. However, these systems have a prohibitive initial investment burden that usually cannot be covered by those at the base of the pyramid (BoP). Innovative green credit design thus allows clients to pay in monthly installments for energy appliances and sources that generate additional savings and/or income opportunities (Allderdice et al, 2007). On the other hand, energy inclusion can lead to financial inclusion by financing the purchase of an energy system through small repayments (Groh, 2013). Indeed, the savings and/or the additional income enable the excluded or marginalized population to demonstrate repayment ability and to accumulate collateral, two aspects needed for accessing services from a formal financial institution.

The concept of green microfinance enables the interplay between the two above-mentioned effects: financial and energy inclusion. Green microfinance, as microfinance services addressing the triple bottom line – impacting at the economic, social and environmental level, entails a variety of internal or external actions that microfinance institutions (MFIs) undertake with the common denominator of fostering their green businesses and at the same time contributing to environmental preservation (Realpe, 2014). In particular, energy lending aims at facilitating access to clean energy technologies (CET) whether renewable energy (RE) or energy efficient (EE) appliances through customized credit products.

Delivery models for energy lending vary in range of allocating responsibilities and ownership of the CETs between the MFIs and CET suppliers. Programs involving both actors commonly referred to as two-hand model, vary worldwide in their product offerings and in their business models. In a two-hand model MFIs negotiate their role in the allocation process of the CETs. For an appropriate supply chain design reliable CET suppliers and a high level of commitment of the MFIs management and of their operational forces are crucial preconditions (Parkerson, 2005, Morris et al. 2007).

Objectives

This paper aims at describing a systematic methodology to incorporate green microfinance services into the credit portfolio of two Ethiopian MFIs, as well as displaying the challenges and opportunities they face in developing such an innovative financial and energy inclusion mechanism. In particular, the paper seeks at highlighting the interrelationship between specific MFI institutional characteristics and the performance of each of the two MFIs in the implementation of the initial activities for green product and service integration.

Background

Microfinance and Energy Sector in Ethiopia

The Ethiopian microfinance sector has been recognized as one of the fastest growing in the world (Deribie et. at, 2013). It is characterized by a strong inclination towards achieving social and environmental sustain-
ability and by a continuously increasing outreach. At the end of 2012, Ethiopia had 25 operational MFIs serving 2.6 million individuals and households throughout the country. The industry is strongly focused on providing loans to the traditionally ‘unbankable’ market, i.e. the low-income consumers. Despite remarkable challenges faced by the Ethiopian MFIs, such as the weak governance and management capabilities, the lack of adequate funding possibilities, low diversification of products and limited product innovation, underdeveloped gender mainstreaming and the lack of a social performance management, the microfinance sector remains the main source of financial services for the BoP.

In Ethiopia electricity demand is expected to grow by over 25% (Lemma, 2014) and the rate of grid expansion will not be able to accommodate it. This will leave a large market segment off-grid for the foreseeable future: today a stunning 65 million Ethiopians (ca. 77% of the population) are not connected to the electricity grid (World Bank, 2013). Furthermore, the Ethiopian energy sector is heavily dependent on traditional biomass-based energy sources, ranking the country among the world’s lowest per capita electricity consumers, both for residential and commercial use (EUEI PDF, 2013). Moreover, although legal frameworks for the transition to RE or to EE are in place at the governmental level, the lack of financial and technical assistance, of private sector innovations, and of clear support mechanisms hinder these efforts at the policy level to be successful and sustainable.

Need and Barriers to Provide Access for Clean Energy Technologies

The lack of access to modern energy services is correlated with low absolute levels of overall economic development and widespread poverty in Ethiopia. Universal access to basic energy services has been identified as an important tool for achieving the Millennium Development Goals. Energy access is identified as a core priority in the UN Report on the Post-2015 Development Agenda and the SE4All initiative (UN, 2013). CET can play a major role in addressing the structural issues related to energy poverty in Ethiopia. While the life cycle costs of CET are considered lower than those of traditional energy sources, introduction of CET requires considerable up-front investments, which are to a large extent unaffordable to the low-income population. Affordable and accessible financing solutions—for instance offered by Ethiopian MFIs—are needed to enable the switch from unsustainable and non-reliable energy sources to renewable and income generating energy solutions.

Even though the Ethiopian microfinance market is relatively developed and energy needs are compelling, Ethiopian MFIs currently offer very few-tailored loan products targeted at providing clean energy solutions. Indeed, very few initiatives combine microfinance and clean energy and they are all with limited geographical coverage.

Green Microfinance Following a Two-Hand Model Approach

In order to overcome the main challenges in the Ethiopian energy sector for providing off-grid RE and EE technologies an innovative mechanism is highly required.

MFIs are in a favorable position to implement a two-hand model, i.e. partnering with CET suppliers by offering financial services to low-income populations for the acquisition of CETs through specific green loans. In this partnership (Figure 1), MFIs act as an inter-
mediary in the supply chain between suppliers and clients, facilitating the linkage between both sectors and boosting the dissemination of energy solutions, ensuring affordability, accessibility, and sustainability.

Moreover, MFIs can be adequate partners to meet the challenges facing energy inclusion: having a solid distribution network and a close relationship with the clients, MFIs are able to design inclusive credits for modern energy solutions (Levai et al. 2007), cutting down the high initial investments of the technologies, and facilitating necessary after sales services and expanding their coverage by developing new business models (Allerdice et al. 2007, Kebir et al. 2013).

However, after around 10 years since the conception of energy lending through MFIs, only a small number of such initiatives have managed to reach scale due to a variety of reasons (Groh & Taylor, 2014). It can be stated that disbursing green loans is challenging, and requires a strong ability to foresee and tackle market obstacles. In contrast to traditional microfinance activities aimed at commerce, green programs entail different risks, payoff streams and initial efforts and investments (Wenner, 2002). However, limitations are not only on the MFIs’ side; when it comes to building up these distribution networks, local CET supplier face important challenges in supplying microfinance clients and in matching their client-relationship conception to that of the MFIs (Realpe, 2014).

Experience from a large set of green energy projects in different countries has shown that proper strategies need to be designed and customized to a maximum to the local circumstances and the institutional profiles of the different actors involved in order to be able to setup a successful two-hand model. While the MFI and the CET supplier aim at serving the BoP, they function under different business models. Hence, a proper systematic approach shall be implemented in order to guarantee a successful partnering and a balanced supply chain design (Figure 2). Regardless of the initiator, both parties commit to select the partner and the technology to be offered following a bottom-up approach, i.e. based on the energy and financial needs of the MFI clients and on the institutional profiles.
Experience from the first Implementation Phase

As mentioned previously the performance of a MFI in the implementation of project activities (see Figure 1) necessary for a successful portfolio diversification might differ according to some specific characteristics of the institution itself. Table 1 summarizes some of the main MFI characteristics for both Ethiopian MFIs.

For the respective portfolio diversification both MFIs are guided through the implementation of the methodology to select the most adequate technologies according to an in-

Table 1: Main Characteristics of the two Ethiopian MFIs (General MFI Data from 2013)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>MFI # I</th>
<th>MFI # II</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General MFI Data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td># Borrowers</td>
<td>67,787</td>
<td>24,315</td>
</tr>
<tr>
<td>Gross Loan Portfolio (Million USD)</td>
<td>8.6</td>
<td>0.7</td>
</tr>
<tr>
<td>Average Loan Size (USD)</td>
<td>126.9</td>
<td>126.31</td>
</tr>
<tr>
<td><strong>Green Energy Lending Program</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Team Size</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Position Project Champion</td>
<td>Operations Officer</td>
<td>Business Development and Marketing</td>
</tr>
<tr>
<td>Selection of Project Champion</td>
<td>Officially appointed Champion</td>
<td>Natural/ Self-driven Champion</td>
</tr>
<tr>
<td>Main Driver (Motivation)</td>
<td>Add new green products to portfolio</td>
<td>Increase Competitiveness/Not be left behind the competition</td>
</tr>
<tr>
<td>Power Distance (between Mngt and Champion)</td>
<td>Large Power Distance</td>
<td>Low Power Distance</td>
</tr>
</tbody>
</table>
depth energy needs assessment\textsuperscript{1} that has been conducted separately by both MFIs.

However, it can be observed that the progress of each of the two MFIs and the approach to implement project activities differ.

It is likely that these differences in the performance are due, to a certain extent, to the fact that these two MFIs vary in terms of their institutional profiles. Whereas MFI I is a rather big MFI inter alia in terms of number of borrowers, employees and product portfolio range, MFI II can be considered a small institution. Another important difference between the two institutions is the approach to assign a project champion, the person mainly in charge of coordinating the project activities within the institution. While MFI I has appointed the project champion, MFI II has chosen a natural project champion, i.e. a person that has an intrinsic motivation to promote the development of green loans. Furthermore, the project champion of MFI I has a slightly lower position as the counterpart in MFI II. The latter as well as the size of the institution itself also affects the power distance between the project champion and the upper management (final decision taker), which is larger in MFI I than in MFI II.

Experience from the implementation of the energy needs assessment has shown that MFI I is slightly slower in executing activities, which is likely to be caused by a lower prioritization of the green energy project within the institution, since it competes with a wide range of other new projects/innovations and operational necessities. However, once activities are conducted it can be observed that MFI I works very efficient, which can be seen as a result of the significant experiences with new projects. MFI II, on the other hand, is quite fast when it comes to the implementation of the tasks, mainly because the project has high priority, but also since the MFI has a limited number of new projects to be implemented at a time due to their rather small size and limited capacities.

\textbf{Discussion and Lessons Learned}

It can be highlighted that energy poverty is a major structural challenge in Ethiopia inhibiting economic development and poverty alleviation. At the same time, the number of Ethiopians using microfinance services is constantly increasing making the Ethiopian microfinance sector one of the world’s fastest growing microfinance divisions.

The approach pursued with the two Ethiopian MFIs responds to the urgent need to facilitate a further collaboration between CET suppliers and financial services suppliers (as exposed in Figure 1) to ensure that the technologies are appropriate and affordable to those living at the BoP. Since the described mechanism builds a business relationship upon existing infrastructures and steadily growing outreach of the microfinance sector, the two-hand model approach is able to utilize proved channels to reach potential clients and to provide them with access to new, yet tested CETs.

However, experiences from the initial project activities have shown that given the different institutional profiles of the MFIs and their impact on the project progress, each MFI re-

\textsuperscript{1} In accordance with the preliminary identification of energy needs based on the income-generating activities of the MFIs’ current and prospective clients, the following five CETs have been preselected: solar water pumps, solar lanterns, biodigesters, improved cooking stoves, and solar home systems.
quires a customized project path and an adjusted methodology reflecting its institutional priorities, capacities, and procedures. This will ensure that both the inherent limitations and opportunities of using MFIs as channels for CET dissemination are better managed and considered in project design.

The latter is a crucial precondition to better meet the needs of existing clients, tackle new markets and thus be able to diversify successfully their portfolio and expand their client base through specialized energy loans for certain economic activities. Energy inclusion targets can only be achieved if financial inclusion is similarly addressed, thus ensuring that those at the BoP have the means and ability to take control of their own electrification, increase income-generating activities, and ultimately break out of the poverty trap.

References


Field Facts for Crop Insurance Design: Empirical Evidence from Southern Burkina Faso

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Abstract

This paper highlights the importance of using field facts in the design of innovative index-based crop insurance (IBCI) schemes in rural Burkina Faso. Farmers' awareness and perception of climate hazards (CH) in relation to crop productivity and their willingness to participate (WTP) in IBCI in Southern Burkina were captured through household survey and Focus Group discussions (FGDs). The empirical findings indicate that farmers are aware of the effects of CH on farm productivity and consider dry spell to be the most significant climate risk affecting crop productivity in the region especially, during sowing, flowering and harvesting depending on the crop type. Specifically, 98% of the sampled farmers are willing to insure maize, cotton and sorghum, but only if the most sensitive periods of these crops
to dry spell are taken into account in designing the crop insurance contracts. The implications of the findings are extensively discussed in the light of IBCI design.

Introduction

Burkina Faso is a landlocked Sahelian country that is highly dependent on agriculture. Between 1990 and 2013, the agricultural sector alone employed close to 90% of the total work force in the country. It equally accounted for over 35% of the nation’s GDP (World Development Indicator, 2014). Close to 70% of agricultural production in Burkina Faso is contributed by the crop sub-section (World Food Programme, 2010). For instance, between 2006 and 2010, a total of 1.5 million tons of crops were exported from Burkina Faso accounting for over 46% of the total export value derived from agricultural exports (Institut National de la Statistique et de la Démographie, 2014). However, despite the significance of the crop sub-sector as the nation’s major growth driver, the management of catastrophic risks associated with agricultural crop production, has remained the key challenge in the nation’s Strategy for Accelerated Growth and Sustainable Development (SCADD). These challenges include erratic rainfall, prolonged dry seasons, scarcity of arable land (less than 16.1% of the total land area), poor irrigational facilities (only 0.6% of arable land is equipped for irrigation), poor access to credit facilities, land tenure insecurity and increasing population pressures (USAID 2009, Jones-Casey, 2013, FAO, 2013, World Bank, 2014).

Traditionally, the management of agricultural risks associated with climate change and its variability by farm households in Burkina Faso, have revolved primarily around innovative soil and water conservation and harvesting techniques. These traditional innovative techniques have been shown to significantly reduce soil erosion while at the same time maintaining the soil organic matter status and its physical properties (Barry et al. 2008). These include the Zai, Stone Lines, Bouli, Straw mulching and Demi-lune1 etc. The choice and appropriateness of which technique to use by farmers depend largely on the average rainfall, soil type and the geographical location of the land (Barry et al. 2008). However, despite the popularity of these traditional innovative techniques, many have been found not to be economically beneficial for individual farmers, as grain yield increases do not cover labor inputs and construction cost. For example, Barry et al. (2008) found that at the Central Plateau of Burkina Faso, because of high labor inputs, yield increases do not cover the cost of stone row construction in the community. Accordingly, Stone row construction is only profitable if the investment costs are reduced by providing free transport of stones.

Nationally, the drive to manage agricultural risks is increasingly becoming important. However, the first high level policy document in Burkina Faso, which suggests exploring options for managing catastrophic agricultural risks through innovative financing arrangements such as crop insurance models and cereal banking, was the 2007 National Adaptation Plan of Action (NAPA). This was

1 See, for example, Barry et al. (2008) and Samari (2011) for more detailed explanation of these traditional innovative farming techniques.
immediately followed by the passing into law the Joint Ministerial Decision N° 2012MAH/MRA/MEEDD/MEF/MICA/MASSN/MATD of 2012, establishing the powers, composition and operation of an inter-ministerial technical committee charge with responsibility of setting-up an agricultural insurance scheme and a compensation fund for agriculture in Burkina Faso. This formerly led to the creation of the Direction des Assurance under the Ministry of Finance, which is now the coordinating body for all crop insurance-related matters in the country.

The first agricultural insurance pilot project (index-based) in Burkina Faso took-off in early 2011 by PlaNet Guarantee and mainly targeted cotton and maize farmers. However, similar to many existing index-based insurance schemes across the globe, yield losses are not directly measured in the fields of insured farmers but indirectly assessed through the value of an index (rainfall) [Muller, 2014]. There are many arguments raised against index-based insurance projects in the developing countries. First, many developing countries lack meteorological equipment needed to consistently monitor climatic variables such as rainfall, which is very crucial for index-based insurance design. Secondly, structural breaks in historic time series data common to many developing countries, seriously weakens the reliability of climatic data used in the design of index-based insurance schemes. Third, the frequent used of remote sensing data in designing index-based insurance has many limitations. For example, one major weakness of using remote sensing data is that it fails to take into account sensitive phases of the crops cycle, which may be more prone to climate and other environmental stresses (Muller, 2014).

Thus, it is very evident that additional work is still required in Burkina Faso to complement and scale-up the efforts of PlaNet Guarantee in allowing all stakeholders to jointly analyze insurance issues and to take informed decisions of which kind of crop insurance system is best suited and adapted to the cultures and practices of the local farmers. It is on these premises that the present study reported in this paper was undertaken. The overall goals were: (i) to understand farmers awareness and perception of CH in relation to crop productivity; (ii) to better understand the behavior and the need of the potential crop insurance clients in the region; (iii) to access farmers willingness to participate in crop insurance schemes; and (iv) to discuss the preliminary field findings with policy makers and key stakeholders.

Survey Method and Data

The field survey started on May 28th of 2014, and lasted till June 5th. A total of 10 graduate students of the University of Ouagadougou were given formal training on each topic of the 13 pages questionnaire comprising of six sections (i.e., household education and con-
sumption, employment, perception of climate risk or hazards, climate manifestation on farmlands, risk management strategies and a section on debriefing). A few pilot cases were carried out to help modify the wordings of the questionnaire. Prior to the actual survey, an official debriefing session was held with the Director of the ‘Direction Provincial de Agriculture’ in Dano. The objectives of the meeting were to explain the purpose of our field visit, solicit for assistance in setting up meetings with farmers and to identify contact persons in each community to facilitate in the holding of Focus Group Discussions (FGD). In all, 10 villages were randomly selected as shown in figure 1.

In each of the selected villages, a total of 10 households were successfully interviewed including one FGD. Overall, 100 households were sampled including 10 FGDs comprising of over 216 farmers.

**Results and Discussion**

On the average, 95% of the respondents interviewed were heads of household with their primary occupation being mainly farming. The average age for the sample was about 46 years with an average year of schooling of less than 3 years. The average household size was about 11 members with an average farm size of about 7.5 hectares. Males headed 92% of the households and the average years of farm experience was 31 years. Also, more than 70% of the sample had knowledge of CH while close to 65% reported having suffered from crop damage due to CH. Furthermore, over 70% of the sample said they felt unsecured after the last climate hazard on their farmlands with an estimated per hectare crop loss of over 1,025 kg.

*Figure 1: Sample Communities Highlighted in Blue*
Farmers Awareness and Perception of CH

Figure 2 present the results of farmers’ awareness of common climate hazards affecting farm productivity in Southern Burkina Faso.

As observed (Figure 2), 31% of the respondents rated dry spell as the most frequent CH affecting farm production in the area. Next to dry spell are strong winds that 25% of the sample rated as the next most serious CH in the region. Following lack of rains that rank third by 17% of the sample was flooding according to 12% of the sample. High temperature ranks fifth by 10% of the sample while dust and low temperature were the sixth and seventh in terms of ranking by 5.3% of the farmers. If we relate some of these facts (e.g., dry spell) with historic time series weather data for the region, we can comfortably conclude that farmers are very sensitive to the effects of CH on farm productivity in Southern Burkina Faso. For example, Figure 3 shows the frequency of dry spell occurrence and the seasonal longest dry spell in Southern Burkina Faso from 1970 to 2010. As observed, from the 90s, the trend has been on a steady rise confirming farmers’ worst fears of more days of longer dry spell.
Farmers were equally asked some pertinent questions concerning climate manifestation on farmlands in order to better understand which particular periods of the crops cycle is most vulnerable to climate shocks like dry spell. These include questions on the maximum length of dry spell days that crops like maize, millet, sorghum and cotton can support during sowing, flowering and harvesting. The results are presented in Table 1.

As observed, farmers considered 5 to 7 days without rainfall as dry spell. Also, when questioned about the number of dry spell days that occurred during the last rainy season, farmers reported an average of 3 incidences. In terms of crops tolerance to dry spell, the sampled farmers indicated that the average numbers of days that crops like maize, cotton, millet and sorghum can support dry spell after sowing are 11, 9, 14 and 9 respectively: implying that millet and maize are more tolerant to dry spell during the sowing period. Similarly, the farmers reported that the average numbers of dry spell days that maize, cotton, millet and sorghum can support during flowering are 10, 10, 13 and 13 respectively. It thus appears that millet and sorghum are more resistant to dry spell during flowering. For the harvesting period, the average numbers of dry spell days that maize, cotton, millet and sorghum can support are 6, 6, 8 and 8 respectively. Again, millet and sorghum are more tolerant to dry spell during harvesting.

Based on the above facts, we used time series data on climate (i.e., mean dates) from 1970 to 2010 on the observed rainfall onset and offset in Southern Burkina (i.e., April 1st to November 25th) to evaluate the probability of a day to be involved in the dry spell (Figure 4).

<table>
<thead>
<tr>
<th>Variable Definition</th>
<th>Mean</th>
<th>S.D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days without Rainfall seen as Dry spell</td>
<td>5 - 7*</td>
<td></td>
</tr>
<tr>
<td>Dry spell Number (Last Raining Season)</td>
<td>2.7</td>
<td>1.5</td>
</tr>
<tr>
<td>Dry spell Tolerance for Maize (Sowing)</td>
<td>9.5</td>
<td>5.8</td>
</tr>
<tr>
<td>Dry spell Tol. for Maize (Flowering)</td>
<td>10.4</td>
<td>5.4</td>
</tr>
<tr>
<td>Dry spell Tol. for Maize (Harvesting)</td>
<td>6.2</td>
<td>7.8</td>
</tr>
<tr>
<td>Dry spell Tol. for Cotton (Sowing)</td>
<td>8.7</td>
<td>8.7</td>
</tr>
<tr>
<td>Dry spell Tol. for Cotton (Flowering)</td>
<td>9.5</td>
<td>6.9</td>
</tr>
<tr>
<td>Dry spell Tol. for Cotton (Harvesting)</td>
<td>6.0</td>
<td>8.6</td>
</tr>
<tr>
<td>Dry spell Tol. for Millet (Sowing)</td>
<td>13.8</td>
<td>10.3</td>
</tr>
<tr>
<td>Dry spell Tol. for Millet (Flowering)</td>
<td>13.0</td>
<td>7.4</td>
</tr>
<tr>
<td>Dry spell Tol. for Millet (Harvesting)</td>
<td>7.9</td>
<td>9.2</td>
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<td>Dry spell Tol. for Sorghum (Sowing)</td>
<td>8.7</td>
<td>8.7</td>
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<tr>
<td>Dry spell Tol. for Sorghum (Flowering)</td>
<td>12.6</td>
<td>7.3</td>
</tr>
<tr>
<td>Dry spell Tol. for Sorghum (Harvesting)</td>
<td>7.7</td>
<td>10.3</td>
</tr>
</tbody>
</table>

Note: Except otherwise stated, the means are number of days. SD is the standard deviation while Tol. implies the maximum tolerance period of the crop to dry spell as reported by farmers.

* These numbers refer to days based on responses from farmers during our group discussions.
As observed (Figure 4), from April 29th to August 12th, the chances of having a dry spell of more than 5 days falls between 10% and 37% while from September 16th to October 21st, the chances lies between 10% and 40%. Likewise, from June 17th to July 20th, the chances of having a dry spell of more than 7 days range from 5% to 25% and from 5% to 27% between September 30th and November 7th. If we link these facts to the farming calendar in Southern Burkina Faso, we find that longer dry spell of more than 7 days are more frequent during crop sowing and harvesting. Correlating this information with the information presented by farmer in Table 1, we find that maize, cotton and sorghum are more exposed to climate shocks during sowing and harvesting while millet growers are more exposed to climate shocks during crop harvesting.

**Conclusions**

One of the most salient aspects of our study was to find out if farmers in Southern Burkina are willingness to participate in crop insurance schemes, and if willing, which crops are they likely to insure and their preferred method of payments. We found that more than 98% of the sampled farmers are willing to participate in innovative crop insurance scheme although less than 32% of them had knowledge of what crop insurance is all about. When asked about their choice of crop to be insured, 86% said they would prefer insuring maize especially from flowering to harvesting, 34% said they would prefer Sorghum during sowing and harvesting while about 26% said they will prefer to insure cotton during sowing and harvesting. When asked about their prefer method of payment, 51% said they will prefer in-kind contributions while 49% said they will prefer cash payment. Using Probit analysis to explain
farmers decision to participate in innovative crop insurance, we found that the probability to participate increases with years of farming experience, past experience of CH, educational attainment of household head, hazard insecurity and decreases with age and household size. It is important to note here that the results so far presented in this paper are based on preliminary field findings. We hope to carry out a detail contingent valuation study (CVM) to estimate farmers willingness to pay (WTP) for crop insurance coverage in Southern Burkina Faso. This will aid in accessing the demand and commercial viability of crop insurance projects in Burkina Faso.

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Recent innovations in land tenure programs for smallholder farmers across Africa: an analysis of opportunities, challenges, and benefits of case studies in Malawi and South Africa

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Abstract

An effective and coordinated approach to agricultural land tenure is crucial to sustainable economic development in sub-Saharan Africa. Gaining secure title to land can substantially improve access to financial products and services for smallholder farmers. This paper highlights the cases of Malawi and South Africa, which have had varying degrees of success in this endeavour. Even in Malawi, where stronger land tenure has resulted in increased income and productivity for 15,000 beneficiaries, the impact was limited due to the government’s failure to adopt a holistic approach when distributing the land. Cases indicate that with land titling, it is key to provide smallholder farmers with additional support as well as to, facilitate access to inputs, training, finance, and other goods and services needed for land development.
Introduction

The competition for secure land access has never been as intense as it is today. Secure access to land provides not only a source of shelter and food but also an income and a social identity. However, as a result of the rapidly increasing global population, declining soil fertility, climate change and the need for global fuel and food security, combined with increased desertification and reduced water availability the ability to gain secure land access is being greatly diminished. Worst affected by this situation are the world’s poor, particularly women, in developing countries. Throughout Africa, the majority of the continent’s poor live and work in agriculture. Sub-Saharan Africa is home to half of the world’s usable, yet uncultivated land (202 million hectares), but has the highest poverty rate in the world with 46.9% of the population living below the poverty line as of 2011. Key to secure land ownership, and to the more productive use of these resources, is the concept of land tenure, which is “fundamental to the lives of poor rural people” and is described as the “linchpin to rural economic development”. However, the delivery of equitable land reform across southern Africa continues to be prohibited by “the continuing legacy of uneven land distribution”.

Land tenure is defined by the Food and Agriculture Organisation (FAO) of the United Nations as “the relationship, whether legally or customarily defined, among people as individuals or groups, with respect to land” (inclusive of other natural resources such as water and trees). Rules of land tenure define how property rights to land are to be allocated within societies. The FAO sets out the four different categories of land tenure:

- **Private land tenure**: tenure rights assigned to a private party and other members of the community can be excluded from using these resources.
- **Communal land tenure**: rights assigned equally to each member of a community. Non-members of that community are excluded from using the land.
- **Open access land tenure**: no specific rights are assigned, but no one is excluded from using the land. Examples include rainforests and the high seas.
- **State land tenure**: property rights are assigned and controlled by a public sector authority (at any level of government).

According to the Africa Progress Report 2014 “the reason that Africa has thus far failed to reap the development gains of high growth is that, in far too many countries, rural producers [smallholder farmers] have been left behind”. Without creating an inclusive, dynamic and growth-focused agricultural sector, Africa’s economic growth will continue to suffer and the inequality gap between the rich

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1. IFAD Report, p.1
2. Ibid
3. Africa Progress Report, p.23
4. Deininger et al. 2011
5. World Bank, 2014
8. FAO, Africa’s changing landscape: Securing land access for the rural poor, p.1
10. Ibid
11. Ibid
12. Africa Progress Report, p.23
and poor will continue to widen. Smallholder farmers will play a critical role in enabling this economic development to occur.

For smallholder farmers, secure land tenure is of extreme importance, as it can help facilitate access to financial services. Indeed, smallholder farmer development and enabling access to financial services are inextricably linked. When agricultural households gain title to land, the fact that they then have poor access to financial services for inputs, machinery, and other needs means that they are not able to capitalise on their land assets. Not being able to make the land productive often makes the costs involved in getting secure land title deeds not worthwhile.

As explained by USAID “tenure security has both demand-side (incentives to farmers) and supply-side (incentives to lenders) effects”\textsuperscript{13}. These benefits are illustrated in more detail in the Conceptual Model shown below.

Furthermore, a report released by the Kofi Annan Foundation, argues that “financial services can help increase on-farm productivity and development of businesses along the entire food systems value chain by providing a mechanism for managing risks, investing in improved technologies, mechanizing farm systems or expanding a business”\textsuperscript{14}. Additionally, farmers cannot easily access loans and other financial products (such as insurance) without using privately owned land as collateral.

An often-debated challenge that is central to this discussion is that of property rights, or more specifically, how privately held land is considered in the context of property rights. Across sub-Saharan African, approximately 90% of land that is not dedicated to national

\textsuperscript{13} USAID Issue Brief, Land Tenure, Property Rights, and Food Security, p.3

\textsuperscript{14} Kofi Annan Foundation Report, p.23 http://kofianannfoundation.org/sites/default/files/suia.pdf
parks and reserves, is classified as communal or customary\textsuperscript{15}. Traditionally customary rights have not normally been formally recorded in official government registries and are instead passed down from generation to generation through the tribe or local community. Although this can ensure secure access to land (usually on small plots) this type of tenure “often has little or weak recognition in statutory law”\textsuperscript{16}. The property rights of women are another key area that needs to be addressed. According to UNICEF, women perform 65\% of the world’s work and produce 50\% of food, but only earn 10\% of the world’s income and own only about 1\% of the world’s property\textsuperscript{17}. In recognition of this, the International Institute for Environment and Development urges stakeholders to understand and regard “secure and equitable land rights, particularly for those living in poverty and using and managing ecosystems” as an essential component of the Post-2015 Sustainable Development Agenda, that should be “people-central and planet-sensitive”, and that is to be endorsed in September 2015\textsuperscript{18}.

Research Objectives

To highlight the importance of secure land tenure as a means of enabling access to financial services this paper will showcase the contrasting examples of Malawi and South Africa. In recent years Malawi has made considerable advances in enabling secure land tenure while South Africa is regarded by many as being at a crossroads. Based on the two country examples some recommendations will be put forward as to how other African states can learn from these two countries and facilitate improved financial access for smallholder farmers.

Methodology

The purpose of this paper was to develop an understanding of the relationship between secure land tenure and how it can enable and/or facilitate improved access to finance for rural smallholder farmers in sub-Saharan Africa as well as to address the need for a holistic approach to land titling. This includes further support and access to financial services for the purchase of inputs, machinery, and goods and services needed in order to maintain and develop land.

This paper draws on a wide range of existing literature and studies in these fields. The literature was reviewed to identify the scale and nature of the challenges around land tenure, why they exist and to discuss specific examples of land tenure models, their core strengths and weaknesses, as well as some of the organisations that support smallholder farmers in Africa and the level and type of support that they provide.

Analysis of the cases identified was carried out for the purpose of extracting general results of different tenure models and to provide sustainable recommendations for strengthening land tenure.

Land Tenure in Malawi

Malawi is a small, landlocked country in central Africa, bordered by Mozambique, Tanzania, and Zambia. It is one of the world’s most densely populated and least developed
countries, with an economy that is predominately agricultural. 80% of its population reside in rural areas.

Unequal access to land in Malawi has long been an issue constraining the country’s social and economic development. This was imposed primarily by the British colonial power, who took control of the majority of land in Malawi (then called Nyasaland), and imposed a tenancy system called thangata in the fertile Shire valley. Thangata, was a system whereby agricultural labour was carried out on a piece of land in lieu of cash rent, and was often exploited by the authorities.

In recent years, land access and secure tenure has emerged as an important determinant of the income of the poor. In 2002, Malawi published its first comprehensive National Land Policy, designed to deal with issues such as the residual effects of colonial land policy, the high population to land ratio, increasing land degradation, insecurity over land rights, and, amongst several further issues, the direct link between access to land and rates of poverty. Malawi’s macroeconomic performance up to that point, had been poor, as demonstrated through a "46% decline in the performance of the small-scale agricultural sector and an overall decline in real GDP growth from 3.6% in 1999 to 2.1% in 2000". The Policy also recognised that the “failure to reform and secure the tenure rights of smallholders has long been established as the primary cause of under investment, reliance on primitive technology and a fundamental reason for low wages in most rural areas. Because of the continuing deterioration of real incomes at the household level coupled with the heavy dependence of rural communities on the land, it became the Government’s imperative to place land policy at the centre of the nation’s poverty reduction strategy”.

The Malawi government has continuously demonstrated commitment to the idea of market-assisted land reform as a means of alleviating poverty and increasing access to finance for smallholder farmers.

Community-Based Rural Land Development Programme Case Study

The Community-Based Rural Land Development Programme was launched in 2004 with support from the World Bank and other international donors. The programme was designed to pilot the use of market mechanisms to help land-short farm households secure larger acreages by purchasing uncultivated and/or underutilised estate land (estimated to be 600,000 hectares). The pilot had three key elements: (a) the voluntary acquisition by communities of land sold by willing estate owners; (b) the resettlement and on-farm development, including transportation of settlers, establishment of shelter, and the purchase of basic inputs and advisory services; and (c) the surveying and registration of redistributed land. Each family received a grant of US$1,050, of which up to 30% was for land acquisition and the rest was for transportation, water, shelter, and farm development.

Implementation was decentralised

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19 CIA World Factbook
21 Jayne et al., 2003
22 Malawi National Land Policy, 1.3.3.
23 Ibid
and required capacity enhancement, especially for surveying and registration.

The pilot was partially successful in that it did reach its initial goal of relocating 15,000 farm households and resulted in an income increase of 40% for the beneficiaries\(^{25}\). However, it has also been criticised for not generating further expansion of the approach. The new settlers became dependent on the additional public financing provided to facilitate their relocation and the political support of traditional leaders was not always achieved.

Further challenges remain. Malawi's current President Peter Mutharika has taken steps to increase smallholder production of corn, the country's staple food, by subsidising fertiliser for smallholders, in an attempt to introduce a holistic approach to land tenure programs. In other regions, such as in Latin America, it has been found that an early focus on land redistribution to smallholders yielded poor results until it was later realised that farmers also required access to markets and supplies, training, and public goods such as roads and social infrastructure, if they were to make productive use of their new farms\(^{26}\).

Mutharika's attempts to provide agricultural inputs at an affordable price have been deemed successful in increasing productivity, as well as total food production in Malawi, but the question remains whether these subsidies will compensate for the land resource access and management issues that remain unresolved for Malawi's 1.8 million farm households\(^{27}\). While definite progress has been made Malawi must continue to work on issues of land access, tenure, and resource management to further reduce poverty and increase food security.

**Land Tenure in South Africa**

South Africa's National Development Plan states that "rural areas … are characterised by greater poverty than urban areas with many households trapped in a vicious cycle of poverty"\(^{28}\). However, it is also estimated that agriculture has the potential to create almost 1 million new jobs by 2030\(^{29}\).

Central to the government's rural development strategy has been their policy of land redistribution. Since 1994 and the beginning of democracy the government has successfully redistributed approximately 5.8 million hectares of land (3.4 million hectares through land redistribution and 2.4 million hectares through the restitution process)\(^{30}\) to the formerly disadvantaged. Despite this achievement, challenges and barriers to smallholder farmer development and enabling access to financial services remain.

Much of the redistributed land across South Africa, despite being fertile and ripe for agricultural production by smallholder farmers, remains unused due to the fact that it is classified as communal and is overseen by a tribal chief or elder. This communal classification becomes an obstacle when it is intended that the land be used as a farm. As a result of being classified ‘communal’ no investment on the land, by an individual or small group, is likely to occur and the land remains unproductive. For an individual to

\(^{25}\) Tchale, 2012

\(^{26}\) Land Reforms in Latin America: Ten Lessons toward a Contemporary Agenda

\(^{27}\) USAID Land Tenure Malawi Profile http://usaidlandtenure.net/malawi

\(^{28}\) National Development Plan, p.195

\(^{29}\) Ibid, p.197

\(^{30}\) Ibid, p.195
want to invest and develop a smallholder farm he/she is going to want secure private land tenure which can then enable the land to be used as collateral when applying for financial services. At present no financial institution is likely to provide services and support to a farmer who works on (but does not own) communal land. A lack of coordination between the most important stakeholders (from both the private and public sectors) in development finance in South Africa further exacerbates this situation\textsuperscript{31}.

Despite the land redistribution advances that have been made to date many of the beneficiaries have been unable to settle on the land provided to them and as a result the land has become unproductive. In some instances beneficiaries settling in commercial farming areas have had to fund the purchase of the land up front making it difficult for them to farm and productively use their land due to high levels of debt\textsuperscript{32}. Although they may have ownership of the land, if it remains fertile and unused, they are unable to benefit from any crop production sales or access to financial services.

Smallholder farmers have often lacked the required infrastructure, inputs and technical support required to help transform them from smallholders into sustainable commercial farmers\textsuperscript{33}. To date there have been 185,858 land beneficiaries and it is estimated that if they are properly supported a further 70,000 ‘livelihood opportunities’ will be created\textsuperscript{34}. Innovative market linkages are also required so that smallholders do not continue to remain excluded from high value produce markets and so that rural customers do not have to continue to pay higher food prices than urban ones\textsuperscript{35}.

The majority of smallholder farmers across South Africa continue to lack adequate skills, inputs and access to basic services. This can prohibit a smallholder just as much as not having the ‘correct’ land tenure classification. The provision of quality basic services, in particular education and training, will help develop local (particularly rural) economies as people with improved capabilities will be able to seek economic opportunities, become financially included and transfer their skills and knowledge to others. The country’s GDP growth is also likely to increase as a result of this.

While significant challenges around land tenure and small scale farmer development exist one organisation, SaveAct, has played a significant role in creating and supporting a culture of savings and enabling improved financial inclusion. This is despite the multiple challenges being faced by rural residents and smallholders across South Africa.

\textbf{SaveAct Case Study}

SaveAct is a “non-profit organisation promoting and supporting the formation of Savings and Credit groups as a simple but effective tool against poverty, as a foundation for building sustainable livelihoods and empowering women and other vulnerable groups”\textsuperscript{36}.

Since its establishment SaveAct has succeeded in establishing and/or managing over

\begin{footnotesize}
\begin{enumerate}
\item Int. Development Policy Framework presentation, Stakeholders Engagement Workshop, p.6
\item National Development Plan, p.200
\item Ibid, p.199
\item Ibid
\item Ibid, p.205
\item SaveAct, About Us website, http://www.saveact.org.za/about
\end{enumerate}
\end{footnotesize}
33,000 savings and credit groups in rural areas in South Africa. Importantly, over 91% of the members are female and many of these members are also involved in smallholder agricultural production. This is significant because women, around the world, face a range of barriers in gaining access to financial services. Women often tend to own fewer assets than men due to restrictive property rights, earn lower wages and have unequal labour force participation. Despite this, studies show that when given the opportunity to manage household finances, women are more likely than men, to spend on their family’s nutritional needs, health care and school fees for children.

Through enabling and facilitating a culture of savings and by providing financial education training and support, SaveAct, has the potential to generate huge (rural) community benefits. Improved access to finance can help families increase their investment, in such areas as agriculture and education, and insure against unfavourable events (such as paying for funerals). More broadly SaveAct is helping to break down gender barriers by helping women, and their families, live up to their full potential. Despite not working on enabling land tenure per se they are still playing an important role in developing smallholder farmers through creating an environment where investment opportunities are possible.

The example of SaveAct is relevant to South Africa and other African states because it illustrates an alternative solution for enabling rural financial inclusion. From encouraging and enabling a culture of savings numerous side benefits can arise including increased investment in smallholder farms and increased access to other financial and non-financial products and services. Encouraging partnerships, such as between SaveAct and the government, in the context of land tenure programs could have a profound impact on the way land is cultivated by smallholder farmers in South Africa as well as on the financial products and services that could potentially be provided to these savings group members and farmers.

Discussion

Based on the research undertaken by the authors and the challenges discussed throughout this research paper a number of recommendations can be made in order to enable land tenure and greater financial inclusion.

Conduct Further Work on Addressing Barriers to Land Tenure

A more holistic approach needs to be adopted and followed, such as is the case in Latin America, for example. There, it was realised that an early focus on land redistribution to smallholders yielded poor results until it was later understood that farmers also required access to markets and supplies, training, and public goods such as roads and social infrastructure if they were to make productive use of their new farms. The inclusion of smallholder farmers in high-impact value chains in productive ways has proven to result in growth through a multiplier effect – each dollar put into this effort results in more consumption and the growth of local economic activities.
Use of Mobile Technology

Mobile applications (apps) and technology are providing interesting and dynamic new ways to crowd-source land rights information and make validation of land plots quicker and less resource intensive for farmers and government officials. Financial service providers can also potentially benefit from being able to lend on a securitised basis. Mobile apps can also help disperse information that can make the farming of land more efficient and more resistant to natural disasters due to the ability to use mobile phones to forewarn farmers about weather conditions.

USAID, for example, has developed two mobile apps for these purposes. The first app is central to the Mobile Application to Secure Tenure (MAST) project, an ongoing two-year pilot program in Tanzania. It makes use of GPS and ‘Cloud Computing’, where information is stored and processed online and off-site using a third party, to allow farmers to clarify and secure their land rights. Farmers can walk towards what they believe to be the outer edges of their land with their GPS enabled phone. When they reach the boundary of their plot or farm the mobile app will then notify them of this and upload this information to the Cloud. Local government officials can then access this information and validate it, eliminating the need for professional surveyors and saving time and other resources. Program partners feel that MAST may be particularly helpful to governments as an alternative to more traditional, and more costly, land administration interventions.

The second app, known as the Land-Potential Knowledge System, can make cultivation more effective by bringing together local knowledge on soil conditions, topography, and land use. The Land Potential Knowledge System (LandPKS) program, currently being tested as a pilot in Kenya and Namibia, launched its apps to the general public on 14 April 2015. By using the app, farmers can access interesting and targeted information, such as the right mix of crops, the best grazing areas, and can determine which areas should be left fallow. The app can also connect farmers in the area and enable them to share local knowledge in person.

These mobile apps have the potential to be used in other African countries that also experience land tenure and smallholder farmer challenges, such as Malawi, if appropriate implementation partners are identified. Key partners can include local and national governments, mobile service providers, funders, and program implementers. In this case, USAID was both funder and the program implementer. USAID plans to make this app available for use on any Android smart phone through the Google Play Store.

Analysis of Best Practices in Africa

African countries can learn from other regions around the world, but also from one another. For example, Uganda and Tanzania have been exemplary in decentralising their land tenure administrations and establishing regional and community land management administrations. They have also intro-

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40 USAID, Evaluation Research and Communication: Global
41 USAID, Land-Potential Knowledge System
42 Ibid
duced innovative education and training programs and workshops on adjudication and dispute resolution mechanisms. Women are being integrated into all levels and aspects of the land management enterprise.

**Education and Training**

Providing education and training to land redistribution beneficiaries is crucial in order to enable them to use the land provided to them productively. Without knowing such things as how to farm, what to farm, what crop varieties to plant, or when to plant, having access to land can have an extremely limited impact for smallholders. Different types of education and training can be provided depending, but not limited to, the resources available to the trainers and farmers, the number of training sessions, the amount of funding available, the number of stakeholders and the practicality of doing so.

**Innovative Solutions**

In addition to information sharing, innovative digital solutions have been used for property registration and identification purposes. These types of solutions also have the potential to facilitate and/or improve access to finance for rural populations as well as to distribute important information (such as weather conditions or market prices). In the majority of African countries, it remains difficult to obtain an official land title certificate, for example. Not only can innovative solutions help a smallholder get access to the required land title certificates but they can be used to enable a farmer to more easily apply for loans and other financial services using their land as collateral.

**Multiple Solutions are Required**

There is no single ‘one size fits all’ solution for overcoming challenges related to land tenure and enabling access to finance for smallholders. Therefore, governments, institutions and other stakeholders will need to use a wide variety of different methods and solutions as they strive to enable smallholder and agricultural development. Consultations between local communities and potential investors are central to the implementation and protection of land rights for the rural poor. As such innovative and sustainable partnerships are required while both African and international lessons learnt and success stories must be promoted and shared widely.

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45 Kelles-Viitanen, 2005
46 FAO, Africa’s changing landscape: Securing land access for the rural poor’, p.5


How to insure the Poor? Evaluating the Welfare Effects of Subsidized Community-based Health Insurance in Rural Burkina Faso

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Abstract

We evaluate the impact of a 50 per cent premium subsidy on micro health insurance offered to poor households in Nouna district of Burkina Faso.

The fact that the subsidy was based on community wealth rankings allows us to use a sharp regression discontinuity design to identify causal effects of the subsidy on insurance take-up, household expenditure patterns, and health outcomes.

We find, first, that the subsidy resulted in a doubling of insurance enrolment by poor households implying that their price elasticity of demand for health insurance is large and equal to about one. Second, we find that the subsidy reduces the probability of reporting days lost due to illness by about 50 per cent in the target population.

Introduction

Motivation

Illness is one of the most frequently self-reported shocks in low-income countries (World Bank, 2013). Apart from an immediate deprivation in well-being there is also a functional dimension of illness. Health shocks cause indirect costs by preventing individuals from engaging in income-earning activities and trigger high out-of-pocket (OOP) expenditures for medical care at the same time. Therefore, health shocks constitute a severe, yet, unpredictable economic risk (Smith & Witter, 2004) threatening households’ short and long-term consumption levels (Gertler & Gruber, 2002; Wagstaff, 2007). Given unhealthy working and living conditions, poor people are especially exposed to the risk of ill health (Grant, 2005).

Due to restricted access to private insurance (Balkenhol & Churchill, 2002), the poor traditionally rely on informal insurance mechanisms. These are not only insufficient to fully insure consumption (De Weerdt & Dercon, 2006), but also come at high future economic costs that can increase their vulnerability to poverty (World Bank, 2013). Relative to informal arrangements, formal insurance schemes are expected to offer better financial protection, mainly by providing more efficient risk pooling and by circumventing enforcement problems.

Nevertheless, similar to problems of banking the poor, providing voluntary formal health insurance in developing countries is complicated by high transaction costs and asymmetric information between the insurer and the insured, as well as by liquidity constraints and a lack of trust in formal institutions among poor households. These as well as other problems tend to drive actuarially fair insurance premiums beyond the poor’s ability or willingness to pay, even when expected insurance benefits exceed its cost (Dercon 2005; Matul et al., 2013).
In such situations, there clearly is scope for both equity and efficiency-enhancing market interventions. In this paper, we analyze one important such intervention, subsidization of the insurance premium for very poor households. Primarily by countering problems of liquidity constraints and lack of trust, but also by mitigating problems of transaction costs and asymmetric information, this measure has the potential to expand the outreach of micro-insurance. Moreover, similar to microcredit, even if such subsidies are financially unsustainable in the short run, they have the potential to promote financial inclusion of the poor in the long run in a sustainable way when phased out carefully.

**Country background**

Burkina Faso has been ranked fifth to last globally regarding its Human Development Indicators and featured a poverty rate of 44.6 per cent in 2009 (1.25$ poverty line in 2005 prices). In particular, life expectancy at birth is merely 55.9 years (UNDP, 2013) and infant mortality is high with 91 deaths of 1000 births (Ministere de la santé Burkina Faso, 2011). One major reason for the dismal health indicators is insufficient access to healthcare, especially for poor households, which is mainly due to a lack of health infrastructure and financial barriers to accessing medical care. These are especially severe in rural areas, due to an urban bias regarding public spending on health. Burkina Faso has no statutory health insurance in place and people usually pay themselves at the point of service (Ministere de la santé Burkina Faso, 2011).

**Community-based health insurance**

Community-based health insurance (CBHI) schemes are a form of not-for-profit micro-health-insurance, which are particularly adapted to the needs of rural households in low-income countries. By adapting benefits, procedures and pricing, CBHIs have the potential to provide risk pooling for individuals who are otherwise effectively excluded from private or statutory health insurance (Preker et al., 2004). Furthermore, due to their use of existing local structures and their participative nature, CBHIs present a promising model to effectively dismantle the poor’s skepticism towards formal institutions (Jütting, 2004).

**Research Objectives**

**Research question**

In this study we are interested in the following two questions: first, to what extent does subsidization of insurance premia increase outreach of micro-health insurance among the poor? Second, does subsidization deliver tangible welfare effects among the target group?

**Policy relevance**

Expanding access to formal health insurance, be it private or public, is a high priority among governments of several developing countries (World Bank, 2013). We provide valuable evidence on one important policy measure in this connection, targeted subsidization of basic private health insurance. In particular, our work informs policy makers about the returns to such a policy in terms of expansion of outreach and health improvements in the targeted population.

**Contribution to academic literature**

This work contributes to two strands of literature. The first one is a literature on the dissemination of and demand for micro-health-
insurance. Apart from a wide range of observational studies that provide rather descriptive evidence, to the best of our knowledge, there are only two studies related to ours which rigorously evaluate interventions aimed at expanding the uptake of voluntary health insurance. Thornton et al. (2010) find that Nicaraguan workers from the informal sector are 30 per cent more likely to enroll in a CBHI scheme when offered six months of free coverage initially. Wagstaff et al. (2014) find that a subsidy on the premium together with an information campaign significantly increased insurance take-up among morbid households. Our innovations in this connection are that, first, our study is the first one located in sub-Saharan Africa. Second, the households targeted by our intervention are much poorer in absolute terms than those in the other two.

Second, our work contributes to a literature on welfare effects of health insurance in low-income countries in two ways. First, previous work on the effect of health insurance on household welfare, such as Aggarwal (2010) for India, has focused exclusively on direct economic costs in the form of out-of-pocket expenditures for medical treatment. Our innovation in this connection is that we consider an important measure of both immediate well-being and indirect costs of illness, days lost for work or schooling. Second, by applying a regression-discontinuity design to elicit causal effects of health insurance on individual welfare, our work requires weaker identifying assumptions than previous studies, which do not employ randomized or quasi-randomized designs and merely control for observables (see, for instance, Chankova, Sulzbach & Diop, 2008; Jütting, 2004; Franco et al., 2008; Saksena et al., 2010). Consequently, they are likely to suffer from selection bias as insurance enrolment is voluntary in all of these studies.

Methods

Empirical setup

The Nouna Health District (NHD) in the North of Burkina Faso is the local context of this work, an area populated by approximately 70,000 individuals living in rural (65%) or semi-urban (35%) areas. The CBHI scheme has been offered in 41 villages and Nouna town since 2006 and exhibits the typical characteristics of a CBHI. Members of the community strongly participate in decision-making and scheme management. Enrollment is voluntary and takes place at the household level. Annual flat premiums are relatively low (from about US$ 1 to US$ 3 per individual) and do not recover the costs of the insurance, which would not be viable without external donor support. The benefit package covers the most basic important treatments in the primary health care facilities. There is no limit regarding the frequency of consultations covered.

Since only 1.1 per cent of the poorest twenty per cent of households were enrolled by the end of 2006, a 50 per cent discount was offered to this group in 2007. Poor households in each village were identified through a Community Wealth Ranking (CWR), where three democratically elected informants ranked all community households independently in a first step and reached a decision on the eventual group of targeted households in a second step (Souares et al., 2010).

Data

The empirical analysis relies on a matching of three independent data sources. First, for health outcomes and expenditures, we use three waves (2007 to 2009) of a household survey comprising 990 randomly drawn households (De Allegri et al., 2008). Second,
for constructing the forcing variable in our regression discontinuity design, we use the village-wise community wealth rankings conducted in 2007. Third, we use administrative data from the insurance provider for each household’s enrolment status.

**Methodology**

For estimation of causal effects on enrolment and welfare, we exploit the fact that all households in each village were ranked continuously in terms of their wealth, but only households eventually ranking in the lowest quintile were offered the subsidy. By comparing households just under this threshold with households just above we obtain treatment effects which are causal for households near the threshold under the assumption that insurance demand and health outcomes absent the intervention are continuous in the household rank around the threshold. This methodology has been widely used in empirical economics over the last ten years and is called sharp Regression Discontinuity Design (RDD).

The key-identifying assumption for a RDD to be valid is that individuals cannot manipulate the CWR and thereby are not able to precisely sort themselves around the poverty threshold in order to just become eligible for the premium subsidy (Lee & Lemieux, 2009). We are confident that this assumption holds since the ordinal wealth score makes it especially difficult to approximate the corresponding 20 per cent threshold in the first place. Besides of that, in order to manipulate their CWR scores, households would have needed to strategically manipulate an array of wealth determinants which makes a precise sorting very unlikely.

As suggested by Lee & Lemieux (2009), our estimating equations are based on a so-called local linear regression model of the following form,

\[ Y_i = c + \beta Disc_i + \eta_1 WealthR_i + \eta_2 WealthR_i \times Disc_i + \varepsilon_i, \]

where \( i \) refers to one individual and \( Y_i \) is one of the three outcome variables of interest, namely being enrolled in the CBHI (data source: insurer’s administrative data), any health-related OOP expenditures during the last month, or any day lost due to illness in the last month (data source: household survey).

\( Disc_i \) is an indicator variable for subsidy eligibility and \( WealthR_i \) gives the average wealth ranking score for each individual (data source: community wealth ranking). The specification above allows for different slopes at both sides of the threshold and can be estimated by ordinary least squares. In our estimations we include households whose wealth ranking is in a pre-specified interval around the eligibility threshold (e.g. poorest two quintiles or second and third-poorest deciles).

**Results**

**Descriptive statistics**

Descriptive statistics for individuals from the two poorest household wealth quintiles are presented in table 1. Information is provided at individual level and the recall period for illness-related indicators is one month. About 7 per cent of the sample is enrolled in the CBHI and almost 11 per cent suffered from at least one episode of illness during the past month.
Table 1: Descriptive Statistics
(For Individuals in Household Survey, 2008-2009)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enrolment incidence</td>
<td>0.070</td>
<td>0.255</td>
</tr>
<tr>
<td>Illness incidenceΔ</td>
<td>0.107</td>
<td>0.309</td>
</tr>
<tr>
<td>Any day lostΔ</td>
<td>0.055</td>
<td>0.228</td>
</tr>
<tr>
<td>OOP expenditure incidenceΔ</td>
<td>0.018</td>
<td>0.131</td>
</tr>
<tr>
<td>Age (in years)</td>
<td>24.2</td>
<td>19.2</td>
</tr>
<tr>
<td>Household size</td>
<td>11.4</td>
<td>6.2</td>
</tr>
</tbody>
</table>

The sample is trimmed towards the two quintiles around the wealth threshold and contains 6,765 observations. Enrolment information is obtained from insurer’s administrative data.

*Δ 1 month recall period.

The variable OOP expenditures is constructed as the sum of transport costs, expenditures for drugs, material, and consultations, subsistence costs, and hospitalization costs; 1.8 per cent of individuals had any OOP expenditures associated with seeking care at an official health care facility.

The variable days lost is constructed as the total sum of days a person was prevented to work or go to school due to illness. About 5.5% of the sample could not go to school or work due to illness for at least one day.

With an average age of about 24 years the Nouna district has a young population while mean household size is 11.4. The latter is based on local definition that household includes all individuals sharing resources to meet basic needs (Sié et al., 2010).

Local linear regression

The non-parametric plots depicted in figure 1 show the relationship between subsidy eligibility and enrolment into the CBHI for a large and a small window around the wealth threshold. There is a clearly visible downward jump in enrolment at the threshold which ranges between values of 0.09 and 0.12. Notice that “CWR Score” denotes the wealth ranking quantile of a household (from poorest to richest) centered around the eligibility threshold.

Figure 1: Local linear regression – Subsidy eligibility and CBHI enrolment incidence

The impression from the figure is confirmed by the estimation results, which are set out in the upper panel of table 2, where a positive and statistically significant effect of similar magnitude is found. Given the estimate in the second column, being eligible for the subsidy increases the probability of being insured by 10 percentage points which amounts to a price elasticity of demand of about minus one.

Table 2: Results from Local Linear Regression
(Nouna HSS, 2008-2009)

<table>
<thead>
<tr>
<th>Window Size</th>
<th>Two Quintiles</th>
<th>Two Deciles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enrolment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>β</td>
<td>0.096***</td>
<td>0.100***</td>
</tr>
<tr>
<td></td>
<td>(0.015)</td>
<td>(0.021)</td>
</tr>
<tr>
<td>At least one day lost due to illness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>β</td>
<td>-0.029***</td>
<td>-0.047***</td>
</tr>
<tr>
<td></td>
<td>(0.011)</td>
<td>(0.015)</td>
</tr>
<tr>
<td>Any health-related OOP expenditures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>β</td>
<td>-0.003</td>
<td>-0.008</td>
</tr>
<tr>
<td></td>
<td>(0.006)</td>
<td>(0.009)</td>
</tr>
<tr>
<td>N</td>
<td>6,765</td>
<td>4,006</td>
</tr>
</tbody>
</table>

* p<0.10, ** p<0.05, *** p<0.01, Standard Errors in Parentheses
We go on to estimate the welfare effects of the intervention. As we focus on the outcomes of all households (not just those that enrolled) around the threshold, we obtain so-called intent-to-treat effects, that is the effect of being offered the subsidy on outcomes averaged over the entire population close to the threshold, including those who choose not to enroll. As confirmed by the non-parametric plot in figure 2, table 2 shows negative and statistically significant effects of subsidy eligibility on the probability of having reported at least one day lost due to illness. On average, this probability is reduced by 2.9 percentage points for eligible households close to the threshold, which amounts to a reduction by about 50 per cent given a sample mean of about 5.5 percentage points.

Figure 2: Local linear regression – Subsidy eligibility and at least one day lost due to illness

Regarding the incidence of health-related out-of-pocket (OOP) expenditures, in the third panel of table 2, we find negative, albeit statistically insignificant, program effects.

Robustness checks

We conduct a so-called placebo test by estimating the relationship between subsidy eligibility and enrolment prior to the introduction of the subsidy in 2007. The non-parametric plots as well as regression estimates of the placebo test (available on demand) do not show a jump in enrolment around the threshold with data from the year 2005. We also test for continuity of other covariates that may explain insurance enrolment and did not find any significant differences at the cut-off. Therefore, we conclude that the strong effect of subsidy eligibility on enrolment appears to be robust.

We finally check whether our results are robust to alternative specifications of the sample or the functional form. Concerning the former we first estimate the same regression model as used above at the household level. Second, we include the baseline survey round in 2007 and estimate a Panel RDD using individual Fixed Effects. No significantly different results in comparison to the main specification were found for any of these two alternatives. Finally, allowing for a non-linear relationship between the standardized wealth ranking score and the outcome variable, we estimated a Local Polynomial Regression function for the post-intervention rounds 2008-2009. Similar effects are found here as well.

Discussion

Discussion of the results

Results suggest that being eligible to receive a 50 per cent premium discount increases the probability of enrolment by about 10 percentage points. This implies a price elasticity of demand for health insurance of about minus one. This finding differs markedly from studies on the demand for health insurance in high-income countries that tend to report inelastic demand for health insurance. Thus, according to our results, the price elasticity of demand for health insurance appears to differ markedly across different contexts. Re-
Regarding policy one implication of our finding is that premium subsidies could greatly increase enrolment rates of CBHI schemes in low-income countries. This is important since CBHI schemes often struggle to expand their membership base.

Regarding the indirect costs of illness in the form of lost time, our results suggest a large and significant reduction in the probability that an individual lost at least one day due to illness. More importantly, this finding is of great economic significance since we find that subsidy eligibility reduces the probability of at least one lost day due to illness by about 50 per cent. In contrast, Aggarwal (2010) studied the effect of a CBHI on time lost due to illness in India and did not find significant effects.

Our OOP expenditures results suggest that subsidy eligibility reduces the incidence of OOP expenditures from 1.7 to 0.9 per cent over a period of one month. Nevertheless, even if a similar negative relationship between insurance enrolment and OOP expenditures is found in most of the related studies (see, for instance, Saksena et al. 2010), our point estimates are not statistically significant. It could be argued, however, that our design does not allow for identifying economically significant effects. In particular, since the average incidence of OOP expenditures is 1.8 per cent but the estimated standard error is about 0.9 per cent (table 2) only an effect of 1.9 per cent would be statistically significant at the 5 per cent significance level. Yet, such an effect would be larger than the sample average.

**Limitations**

Our empirical design allows for the identification of local effects only, that is effects which are valid for households on the threshold between the poorest and second-poorest quintile. Consequently, the results have to be interpreted with respect to those households. This subpopulation can be considered very deprived by international standards. While this is certainly a limitation of our analysis, it is also a strength as we are able to speak for a particularly poor subgroup rather than the entire rural population.

The relatively large effects found for the incidence of having lost at least one day due to illness require some more attention. In this connection complementary analyses will focus on possible adverse selection into the insurance scheme, similar to Wagstaff et al. (2014). This can be done by looking at the subgroup of eligible households and checking whether enrolment correlates with previous morbidity.

**Further research**

It is of interest to exploit the RDD further to learn more about intent-to-treat effects of the premium subsidy on child outcomes. One could focus on households with children born shortly after the subsidy implementation and compare those households close to the wealth threshold with respect to child mortality incidence. Given the relatively high child mortality rates in this region, such an analysis is especially relevant. Second, one could follow the children born shortly after subsidy implementation over time and check whether they show significantly different schooling outcomes in later years. Such a long-term analysis can shed light on whether micro health-insurance can contribute to increasing long-term investments in human capital.

Furthermore, and similar to Cole et al. (2014), a long-term analysis could investigate the dynamics of insurance demand patterns across time and thereby contribute to
the literature on microinsurance diffusion. Looking at patient’s consultation and medication records over time one could estimate the relationship between the individual’s recent medical treatment experience and the probability for extending health-insurance coverage into the next year. Furthermore, in order to check for spillover effects among peer households one could aggregate such figures of individual recent experience at village level and estimate its effect on future enrolment incidence.

Finally, considering the premium subsidy as a tool to encourage insurance enrolment, a performance-based assessment of this measure seems important from a policymaker’s perspective. First, one could conduct a cost-benefit analysis by looking at the priced hours of days that are saved (as a proxy for opportunity costs) in relation to the additional total expenses that arise due to the subsidy. Second, from a cost-benefit perspective, the premium subsidy strategy can also be compared to the option of simply increasing overall insurance coverage. Such an assessment is especially suitable in our context, since the CBHI was randomly phased-in between 2004 and 2006. Third, the performance of targeted premium subsidy programs substantially depends on the underlying targeting mechanism. Further research, therefore, should focus on the performance of Community Wealth Rankings in order to correctly identify the target group. As first step, the question should be addressed to what extent and under which circumstances CWRs provide different outcomes than conventional targeting methods, such as proxy means tests. As the CWR’s main advantage lies in its easy and cost-effective way of implementation, it has the potential of being duplicated for alternative contexts where the implementation of targeted premium subsidies is considered.

References


Accessing crop insurance in the Sahel and production unit yields in Burkina Faso

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Summary

By using a peer approach comparing two groups with and without insurance coverage, and based on the length of coverage, the paper examines the potential effects of Crop Insurance in the Sahel (CIS) on production unit (PU) yields in two Burkina Faso villages. Comparison of two pairs of PUs yielding corn, insured versus uninsured, then newly insured versus long-term insured, reveals that on average insured PUs have better access to credit, and agricultural inputs, increasing the area allocated to corn, thus stimulating its production. However, although in the peer approach both groups obtain almost the same yields, under the length of coverage approach the PUs insured over the long-term turned in better yields on average.

Introduction

Encouraged by the World Bank along with many organizations and research centers, crop insurance has become one of the most debated risk management mechanisms used to help reduce farmer vulnerability in developing countries (Ingram et al., 2002; World Bank, 2005. Pachauri and Reisinger, 2007; Cohen and Sebstad, 2008; Roth and McCord, 2008; and Ouedraogo, 2010). Among the experiences being developed, crop insurance in the Sahel (CIS) conceived by Planet Guarantee (PG) in 2011 is much appreciated in Burkina Faso. This insurance aims to create a balance between stability and improving farmer income, as well as ensuring the credit portfolio of the organizations funding agricultural investment. In this, CIS is an

1 Planet Guarantee is an insurance and reinsurance broker who developed the crop insurance in the Sahel policies and provides them in partnership with Allianz Africa Burkina Faso, a classic insurance company operating in Burkina Faso.

2 CIS is an index-based insurance providing protection against correlated risks such as extreme weather events (Roth and McCord, 2008). It is based on a parameter that compares crop losses to levels of precipitation gathered from satellite images provided by EARS, a high-tech company based in the Netherlands specialized in remote sensing. Rainfall deficits are analyzed against evapotranspiration within the corn plant growth cycle. “Satellite images provide information on the quantity of water available in the soil for certain identified areas throughout the corn’s cropping period. If the amount of water falls below a critical threshold, compensation is triggered and farmers are compensated for their estimated losses according to the index.” (Sandmark, 2012).
innovation. When faced with crop losses caused by drought, this insurance covers farmer input expenditures for corn cultivation, subject to paying a premium equal to approximately 10.8% of the value of the requested funding. In return, in case of a proven disaster, the farmer’s full line of credit is reimbursed, which he could not claim in previous such situations. This allows farmers to avoid decapitalizing, making it easier to restart their activity in the following months. De facto, this crop insurance\(^3\) covers the microfinance organization providing credit for the producers’ input enabling them to buy fertilizer. This partner-agent model allows the organization to cover its loan portfolio and helps improve its financial intermediation role enabling it to continue providing funding to vulnerable farmers. CIS insured farmers secure their working capital, reduce income instability, and are indirectly protected against food insecurity. In principle, these expected effects are relevant within the overall context of recurring drought in Burkina Faso, the weakness and instability of farmer income, and persistent areas of food insecurity.

**Objectives of the research**

After four years of experience, despite the expected theoretical benefits, hardly any studies have been made to understand CIS and especially to understand its effects on agricultural production units. By focusing on the point of view of the farmers benefitting from CIS in two Burkina Faso villages\(^4\) - Dandé and Lah, which were part of the program’s launch in 2011, the objective of this work is to understand some of the potential effects of CIS on the agro-economic performance of their production units (PUs) that face a number of risks to their cultivation and production systems.

**Methodology**

The study is built on data from two exploratory surveys made in July 2012 in Dandé and in January 2013 in Lah in Burkina Faso, using two types of methodology, one for each village covered by the CIS program.

The first methodology deployed in the village of Dandé compared the performance of two PU groups raising corn through a peer approach\(^5\) (Koloma and Oswald, 2014). One group of PUs received crop insurance and the other did not.

From a comprehensive list of 45 farmers who were CIS insured in 2011 by the Mutual Savings and Credit of the Public Sector in Burkina Faso, to the West in the area of Hauts-Bassins, and to the Northwest in the region of Boucle du Mouhoun. In these two villages, farmers were able to insure their corn crops against drought.

5 Focusing for the most part on the perception of the insured farmer (A), the peer approach is a dynamic process that relies on the similarity of the elements of Group (A) with their peer group systematically selected in tandem according to the same core criteria within the same geographical area. Each A remains singular, but it develops in interdependent relationships within its community in a defined environment. Being in the same area, undergoing the same stresses of life and production, each member of group A is best able to discern which other production unit has similar characteristics and which has totally different.

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\(^3\) However, compensation is not purely based on sustained crop losses (Roth and McCord, 2008), it is also calculated on the “base risk”. This is the risk that some policyholders are under compensated or not at all, while others with only a small loss or no loss are fully compensated (microinsurancenetwork.org, 2013).
na (MECAP), we randomly selected twenty insured PUs. The choice of the control group was made while taking into account three production factors: the number of hectares, the number of animals and the number of active family members. These criteria were selected to characterize the agricultural production units in this region (Bainville and Dufumier, 2010). In the end, we subjected 20 insured PUs and 19 uninsured PUs to a questionnaire.

The second method involved comparing two groups in the village of Lah, where over 80 farmers were insured in 2011 by the Village Savings and Loan Bank of the Boucle du Mouhoun (CVECA-BM). This time, depending on the length of their participation in the CIS micro-insurance program, the treatment group received at least two credit-insurance cycles of over a year, and the second control group received only one credit-insurance cycle of less than a year. Three reasons for this two-year break point: 1) Re-adherence: the benefits of insurance incite continuance; 2) The time to suffer a loss and thus receive damage relief; 3) We had time to observe the visible effects: increased arable land, fertilizers purchased, and an increase in production or revenue. Also, it is worth recalling that both groups overall had similar access to CIS. In the village of Lah, 36 long-term and 32 newly insured PUs were surveyed.

The analysis method was descriptive and comparative. In the case of the village of Dandé, a preliminary analysis was necessary; this involved checking the similarity of the two producer groups against identified production factors. Verification was based on the Mann Whitney statistical test that adapts to small samples such as this one. This is a nonparametric test that does not rely on the assumption of a normal distribution.

In this descriptive approach, the average within each group allows comparing the performance of two groups selected from each village. We can thus compare several performance indicators primarily focused on production, value added, corn yields and the more or less intensive nature of the culture.

**Results**

**Basic characteristics**

Table 1 data records the information on the two Dandé village groups, insured and uninsured, and the Lah village’s new and long term policyholders.

In both villages, mainly the household heads carry out the farming (90% and 91.7%). A difference of 16 percentage points can be seen between the insured group (90%) and the uninsured group (73.7%) in Dandé Village and there are 4 percentage points between new policyholders and long term policyholders. Although in Dandé the insured PU group appears more educated than the uninsured, 50% versus 15.8% literate and 50% versus

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6 It enables stating the results but it does not establish the systematic links between CIS access and the performance of all PUs under consideration.

7 The test relies on two statistical assumptions: 1) The rank-sum of group A is similar to that of NA and hypothesis (2) assumes there is a difference between the two groups based on the variables used to form them. The null hypothesis is confirmed if U, the test’s observed value, is greater than the critical test’s U value tabulated at a 5% level of significance. Conversely, the null hypothesis is rejected if $U_{obs} < U_{crit}$ in favor of the alternative hypothesis. In principle, the test result should allow us to make a performance comparison between the two producer groups.
Table 1: Descriptive Statistics - Production Units (PU) of Dandé (2012) and Lah (2013)

<table>
<thead>
<tr>
<th>Observed characteristics</th>
<th>Dandé Village</th>
<th>Lah Village</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Insured</td>
<td>Uninsured</td>
</tr>
<tr>
<td>Head of household</td>
<td>90%</td>
<td>73.7%</td>
</tr>
<tr>
<td>Literate</td>
<td>50%</td>
<td>15.8%</td>
</tr>
<tr>
<td>No education</td>
<td>50%</td>
<td>89.5%</td>
</tr>
<tr>
<td>Number of active family members</td>
<td>5.3 (3.7)</td>
<td>4.7 (2.4)</td>
</tr>
<tr>
<td>Area owned</td>
<td>6.3 (5.2)</td>
<td>7.2 (5.8)</td>
</tr>
<tr>
<td>Number of hectares cultivated</td>
<td>4.2 (3.4)</td>
<td>5.9 (4.5)</td>
</tr>
<tr>
<td>Plow-oxen</td>
<td>2.1 (1.6)</td>
<td>2.1 (1.6)</td>
</tr>
<tr>
<td>Main activity - agriculture</td>
<td>60.0%</td>
<td>94.7%</td>
</tr>
</tbody>
</table>

(1) In parentheses SD
Source: author’s calculation, July 2012 Dandé and January 2013 Lah survey data

Table 2: Mann-Whitney test - Similarity of production factors

<table>
<thead>
<tr>
<th>Statistical tests</th>
<th>Parameters</th>
<th>Number of hectares owned</th>
<th>Surface occupied</th>
<th>Number of active family members</th>
<th>Number of oxen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mann-Whitney U</td>
<td>173,500</td>
<td>142,000</td>
<td>184,500</td>
<td>189,000</td>
<td></td>
</tr>
<tr>
<td>Wilcoxon W</td>
<td>383,500</td>
<td>352,000</td>
<td>394,500</td>
<td>399,000</td>
<td></td>
</tr>
<tr>
<td>Z</td>
<td>-0.465</td>
<td>-1.353</td>
<td>-0.157</td>
<td>-0.029</td>
<td></td>
</tr>
<tr>
<td>Asymp. Sig. (2ed)</td>
<td>0.642</td>
<td>0.176</td>
<td>0.875</td>
<td>0.977</td>
<td></td>
</tr>
</tbody>
</table>

a. Grouping variable: Access to RS in 2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Insured status</th>
<th>N</th>
<th>Average rank</th>
<th>Rank Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of hectares owned</td>
<td>Uninsured</td>
<td>19</td>
<td>20.87</td>
<td>396.50</td>
</tr>
<tr>
<td></td>
<td>Insured</td>
<td>20</td>
<td>19.18</td>
<td>383.50</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface occupied</td>
<td>Uninsured</td>
<td>19</td>
<td>22.53</td>
<td>428.00</td>
</tr>
<tr>
<td></td>
<td>Insured</td>
<td>20</td>
<td>17.60</td>
<td>352.00</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of active family members</td>
<td>Uninsured</td>
<td>19</td>
<td>20.29</td>
<td>385.50</td>
</tr>
<tr>
<td></td>
<td>Insured</td>
<td>20</td>
<td>19.73</td>
<td>394.50</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of oxen</td>
<td>Uninsured</td>
<td>19</td>
<td>20.05</td>
<td>381.00</td>
</tr>
<tr>
<td></td>
<td>Insured</td>
<td>20</td>
<td>19.95</td>
<td>399.00</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>39</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: author’s calculation, July 2012 Dandé and January 2013 Lah survey data
89.5% with no education at all in Lah, the newly insured PU group appears more educated than their long-term insured counterpart.

A slight difference exists between the two villages when taking into consideration the three main production factors. In Dandé, insured PUs own on average 6.3 ha versus 7.2 ha for the uninsured PUs, which results in larger amounts of occupied arable land during the 2011 growing season for the uninsured PU group - 5.9 ha against 4.2 ha. In Lah, the long-term insured PUs own an average of 15.3 ha versus 13.4 ha for the group of new policyholders. As in Dandé, the treatment group of long-term insured cultivate more land. It was also noticed that the Lah village PUs are more specialized in agriculture as their main activity (93.4%) than in Dandé where a clear difference appears between the insured group (60.0%) and the uninsured group (94.7%).

Despite these observed differences, especially in Dandé, both groups are broadly similar on average in terms of production factors considered to be peer selection criteria, as demonstrated in the Mann Whitney test results (Table 2). Results suggest that there are no statistically significant differences between the insured and uninsured farmers. In fact, based on the critical values of n1 = 20 and n2 = 19, p = 0.05, the U obtained for each production factor is higher than the U (119) in the table of critical values. This verification of “similar basic characteristics is important in order to proceed with a comparison” (Hill and Viceisza, 2010).

CIS and access to financing

In Dandé village, figure 1 shows the amount of credits obtained by the two groups. We compared the total loans obtained respectively without and with the CIS mechanism. In the first case, which approximates a situation without CIS, the average amount obtained by each farmer is roughly CFA 97410.30 (€148.50); the group of insured PUs receives less financing from the various agriculture funding institutions. Specifically, the uninsured group received CFA 127,315.80 (€194.10) on average and the insured group CFA 69,000 (€105.20). This means they received CFA 56,684.20 (€86.40) less than the uninsured (i.e. 54.2%) of the total amount received by the uninsured.

Figure 1: Amount of credit and insurance status in the villages of Dandé and Lah (CFA)

Source: author’s calculations, survey data from July 2012 and January 2013
uninsured group significantly benefitted from funding from SOFITEX, the National Cotton Company, the Agency for Agriculture, and the Federation of Agricultural Professionals of Burkina Faso (FEPABE). This was not the case with the insured PU group who were funded by the Dandé Cooperative and MECAP.

When taking into account the existence of the micro-insurance program, this reality is reversed. When they have access to micro-insurance (CIS), the insured PU group sees its average amount of credit increase. This is normal since credit is connected to insurance. For the uninsured group, the total amount of credit does not change. Specifically, those insured receive 1.4 times more funding than the uninsured. The difference is significantly less than the difference seen between the two groups without considering the micro-insurance contribution - CFA 58,315.80 (€88.90) versus CFA 54,359.20 (€82.90). The difference between the groups is significantly in favor of the insured PU group.

In the Lah village newly insured PUs access lower average amounts of credit than long-term insured farmers. Indeed, the long-term insured group received for their latest loan CFA 134,722.20 (€205.40) versus CFA 100,781.30 (€153.60) for the newly insured to cover their investment spending on agricultural inputs. The Mann-Whitney test (table A2 in the annex) shows that the difference in the amount of credit between the two groups is statistically significant. The assumption of seniority and confidence towards producers in the micro-insurance program, knowing that the products are related, improves access to progressively higher amounts of credit.

**CIS and insured PU performance**

Figure 2 data appears to show a difference between the two villages in terms of treatment groups. Although in Dandé village the uninsured PUs devote more area to corn, in Lah the insured PUs allocate larger areas to growing corn than the newly insured.

On the other hand, in both villages PU groups of insured and long-term insured are motivated by a more intensive use of fertilizers compared to the newly insured and the uninsured. Thus, spending for urea and NPK in-

![Figure 2: Varying surfaces devoted to corn, fertilizer, production and yield (Dandé, 2012; Lah, 2013)](source: author’s calculation, July 2012 and January 2013 survey data)
puts are higher. This implies resorting to a more intensive use of production factors. The number of bags of fertilizer per hectare and the associated expense appears to be almost two times higher for insured PUs.

This is reflected in each village control group, uninsured and newly insured, by relatively lower production levels. This difference is much greater in the village of Lah. However, the two villages conflict in terms of crop yield results. In Dandé village, they show that the uninsured PUs appear somewhat more efficient; they obtain slightly superior yields than the insured PUs. All the same, in the village of Lah, the long-term insured PUs, by cultivating more land and using more fertilizer, obtain higher average yields. These results would suggest that the insured and long-term insured groups take higher risks cultivating corn compared to the respective control groups due to their access to microcredit.

With relatively different performance expectations, figure 3 reveals that in the two villages, the insured and long-term insured PUs, by investing more and producing more corn, realize higher gross added values. This confirms that the insured PU’s corn cropping system engages higher amounts of working capital. The added value ratio of the corn per hectare is also higher for the two treatment groups. They are able to produce more than the other comparative groups - the uninsured and newly insured.

In the Lah village, the newly insured may also experience significant improvements but they remain on average lower than the long-term insured group. In both villages, it can be easily seen that the treatment groups, insured and long-term insured, have overall better yields despite the fact that some hold slightly less land than the control groups. They realize higher gains. Longer participation in the program seems to positively impact the performance of agricultural households in the village of Lah.

**Figure 3: Comparison of different results between Dandé and Lah PUs (in CFA)**

Source: author’s calculation, July 2012 and January 2013 survey data
Discussion

Based upon exploratory investigations in the Dandé and Lah villages in Burkina Faso, this present research led to three main results.

First of all, regardless of the methodology used in the two villages, results converge towards overall higher yields from the insured PUs in Dandé and the long-term insured PUs in the village of Lah. Micro-insurance programs may add to overall performance improvement in agricultural households. These results converge with those obtained by Karlan et al (2011; 2013) in Ghana, and Hill and Viceisza (2010) in Ethiopia. The latter found that fertilizer purchases significantly increased in production units covered by an assumed insurance policy. In Ghana, Karlan et al. (2011, 2013) found that insured farmers bought more fertilizer, planted over larger surfaces, mobilized more work and obtained higher yields than the uninsured PUs.

Secondly, in the village of Lah, although the long-term insured PUs returned clearly superior yields than the newly insured PUs, this still remains contrasted in Dandé. Though the volume of corn produced was higher for the insured group, the yield was higher for the uninsured. One factor explaining this contrasting result would be the difference in agricultural experience and specialization. The uninsured group appears more specialized with a more diversified production system, cultivates more cotton and vegetable crops in the dry season, and relies on other sources of agricultural funding for their inputs. These factors contribute to improving their performance. On the other hand, CIS access enables less specialized PUs to catch up in terms of accessing agricultural finance and to carry out riskier agricultural activities.

Thirdly, by diversifying sources of income to limit the effects of agricultural risks, CIS does not replace but rather supplements the range of risk management strategies already being used by the production units. Its use is related to the PU leader’s particular profile. In Dandé, CIS access seems to be correlated with the level of education and amount of cattle (wealth); meaning that it is being contracted mainly by farmers who have a more diversified range of resource generating activity than the uninsured, and are therefore in principle less vulnerable to the vagaries of the crops. This result agrees with the analysis of Giné and Yang (2009) who also noted that in Malawi the use of credit insurance was positively correlated to the farmers’ level of education, income and wealth, which are proxies for estimating individual default costs. On the other hand, in Lah, CIS initially benefited PUs of less educated leaders dependent on agriculture.

All in all, the insured producers in both villages seem to have various specific experiences that require further analysis. Although our results focus on only a few producers - more than half of the insured PUs in the considered villages, the study leads to several recommendations as to the current CIS mechanism: the broader agricultural risks and actual losses and needs of the PUs should be taken into account, a better understanding of the farmers’ environment and the strategies they develop towards risk, better communication concerning crop micro-insurance, and efforts to better target the most needy farmers should be undertaken in their own national language due to their low level of French literacy.

This study is not devoid of certain methodological limitations related to the selection of the sample, its size and, all other things being equal, the results obtained and their
scope. The methods developed to randomly select two pairs of producers and the sample size should be improved in order to better assess qualitatively and quantitatively the effects of CIS on the agro-economic practices and performance of producers in Burkina Faso. Due to cases of observed withdrawal, or even avoidance of new memberships or re-memberships, this study could be preceded by an analysis of the determinants for choosing the PUs having prior knowledge of the existence of crop insurance.

References


African rural financial and digital inclusion exploiting Nigerian communications satellite

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Abstract

Africa remains the least wired continent in the world in terms of robust telecommunications infrastructure and systems to cater for its more than one billion people. The research paper examines a case study of utilization of regional Communications Satellite with service-oriented national public security network to drive financial and digital inclusion as well as bridge the digital hiatus as a short and medium term measure amongst other strategic needs.

Introduction

Existing communication infrastructure in the African hinterlands is grossly inadequate, thus there is a need to develop intra-city, inter-city, national, sub-regional and regional carrier of carriers and digital links with cross-border inter-connectivity. Although, the continent has adequate capacity on submarine fibre optic cables along the shores of the African coastline, it lacks adequate ICT infrastructure in cities, suburbia and especially rural areas. The demand projection suggests that there is a need for a robust passive infrastructure built in and around Africa to address the large un-met demand for information and communication services in the short and medium term. The success of Africa’s information technology policy and infrastruc-
ture depends greatly on satellite communications in conjunction with variants of broadband-based terrestrial wireless technologies to rapidly actualize universal access goals and leverage the tens of terabyte capacity of the marine optical fibres that have been installed along the African coastline. This paper examines the role of the Nigerian Communications Satellite including the National Public Security and Emergency Network as the last mile wireless infrastructure to drive and position National e-readiness for effective implementation of Nigeria’s Cashless Policy to enable financial and digital inclusive socio-economic development of Nigeria, which in turn provides a self-sustaining demonstrator for the dedicated broadband-based National Public Security and Emergency Network.

**Methodology and research objectives**

The research paper is non experimental to examine a pilot cashless policy implementation project as a case study in Nigeria exploiting a regional communications satellite and National Public Security Communications Network as a Technology Acceptance Model (TAM) to promote financial and digital inclusion nationwide and at the same time supporting the sustainable of the project itself. The objectives are as follows:

- To utilize dedicated public security networks to drive financial and digital inclusion in locations lacking sufficient last mile ICT infrastructure.
- Lessons learnt from challenges for more effective implementation of cashless society in Nigeria.
- To develop a long term sustainability model for Public Security Services (PSS) and Emergency Network in Africa by utilizing the excess capacity of such networks for National strategic goals such as financial and digital inclusion without exclusivity.

**Background and needs assessment for cashless policy implementation**

Nigeria lags behind many African countries in terms of provision of financial services. In 2010, 36% of adults, which roughly translates to 31 million out of an adult population of 85 million, were served by formal financial services. The figure compares to 68% in South Africa and 41% in Kenya (Financial Inclusion in Nigeria, 2012). The existing banking infrastructure in Nigeria has the capacity to accommodate and grow financial inclusion up to 70% when considering the combined total of 5,797 bank branches, 9,958 Automatic Teller Machines (ATMs) and 11,223 Point-of-Sales (POS) terminals as at December, 2010. The available banking infrastructure was operating below its potential because it has the capacity to serve more clients. The average number of clients per branch was 3,882 compared to 3,922 in Kenya and 8,595 in Tanzania. The financial inclusion strategy of Nigeria outlined a framework to significantly increase both access to and use of financial services by 2020. The framework seeks to increase the formal use of financial services to 70% from the current level of 36% of the adult population and also reach the best-in-class levels while doubling the number of clients each bank branch serves. Financial inclusion is becoming a mainstream global topic especially amongst emerging economies – which are all trying to increase access to and use of financial services that include rural areas. Some countries have made significant progress such as Brazil and Malaysia including Indonesia while Kenya
and South Africa are best in class emerging economies in Sub-Saharan Africa. While Nigeria has 36% formal payments penetration, South Africa and Kenya had 59% and 52% electronic payments penetration respectively. Despite the high penetration and tele-density of mobile phones in Nigeria, the use of mobile payments in Nigeria is worrisome. Figure 1 shows relative access to formal and informal financial transactions and mobile payment services in selected countries compared to Nigeria including South Africa and Kenya.

In order to promote financial inclusion, check corruption and enhance accountability as well as ensure transparency in governance and avoid delays in Government transactions, the Federal Government of Nigeria (FGN) through the Central Bank of Nigeria (CBN) directed all Ministries, Departments and Agencies (MDAs) to adopt E-payment mechanisms for disbursing salaries to employees and also for making third party payments in line with its national financial inclusion strategy 2020 (Financial Inclusion Strategy, 2012).

E-payment is simply an electronic method of transferring funds rather than the usual inconvenient way of carrying large sums of money that may lead to misappropriation. It is a system that seeks to eliminate many of the problems associated with physical cash distribution. Some of the problems are cost of production, associate costs of maintenance and sustenance, management etc. Under the current scheme, the Federal Government of Nigeria (FGN) has made it mandatory for the employees, suppliers/vendors, pensioners, utility organisations (water, electricity, telephone bills, etc.), Insurance Organisations, Subscription organisations (clubs, associations, etc.) to indicate their

Figure 1: Relative Access to Formal and Informal Financial Transactions and Mobile Payment Services in Selected Countries (Financial Inclusion Strategy, 2012)

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<td>59%</td>
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M-payments users in % of adult population

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<th>Country</th>
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<tr>
<td>Malaysia</td>
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bank account number and other relevant e-payment details so that payment can be transferred via electronic means instead of payment through cheques or Cash. However, implementation of the E-payment systems by some organisations in the country is marred by payment delays with cumbersome processes and procedures largely attributed to improper implementation and inadequate ICT readiness for the E-payment programme (Garcia-Swartz et al, 2006). The system currently implemented has earned a name for itself as “manual e-payment” because the requisite connectivity requirement is not adequate.

The Lagos cashless policy implementation as a first trial pilot project: the success and challenges

The Lagos trial pilot project was an eye opener to all stakeholders in terms the strengths and weaknesses of its performance, opportunities and risks of implementing and enforcing a nationwide cashless policy in Nigeria. Over N80billion ($500 Million) was recorded in volume of daily transactions as at Dec 2012 in Lagos metropolitan city, whilst associated savings in terms of cash handling costs by CBN and banks was estimated at over N14billion ($87.5 Million) per day. The pilot was a success in terms of saving the tremendous costs associated with huge volume of cash transactions and management, increased use of electronic payment systems, enhanced the efficacy of the CBN monetary policy etc. Based on SWOT analysis of the Lagos trial project, a six-states pilot project was conceived before nationwide cashless policy implementation with expected savings amounting to N160 billion ($1 Billion) per day.

The lessons learnt were mainly attributable to the inadequacy of a reliable and consistent communication infrastructure. The inadequacy of consistent telecommunication links grossly affects complete electronic transaction processes and interoperability of Point of Sales (POS) transactions. Affordability of the telecommunication services by merchants also needs to be addressed. Other challenges were public perception, soaring e-banking charges, insecurity etc (Ayo et al, 2010).

Nigeria communications satellite intervention for the six states pilot project

We followed with special interest the CBN’s policies to reduce the high usage of cash, moderate the cost of cash management and encourage the use of electronic payment channels with a view to reduce the dominance of cash in the economy and its attendant implications for the cost of cash management to the banking industry, security and money laundering amongst others. The pilot cash policy started in Lagos State on January 1st, 2012 ("tagged Cashless Lagos"), it provided the writer (researcher) with an insight into how a combined hybrid solution of the regional Communications Satellite (NIGCOMSAT-1R) and the National Public Security and Emergency Network could be used as a model to mitigate against the failures experienced in the Lagos trial project, drive financial and digital inclusion and thereafter roll out the policy to other regions across the country on a nationwide scale for a win-win scenario. The policy will no doubt reduce the cost of banking services; improve the effectiveness of monetary policy in managing inflation and driving economic growth, increase tax collection, check corruption, enhance accountability, ensure transparency in governance, avoid delays in government
transactions and drive development and modernization of our payment system in line with Nigeria’s financial inclusion strategy as well as investment in ICT infrastructure and technology. However, the success of this policy depends largely on easy, affordable and the ubiquitous availability of broadband Internet access in the country. Presently, 75% of broadband connectivity exists only in urban areas and it is expensive. Last mile deployment of broadband through wire-line requires huge investment, which is hardly affordable; deployment in rural areas is time consuming and not economical. As a “Proof-of-Concept (POC), locations experiencing connectivity challenges and transaction difficulties using the inadequate last mile infrastructure of commercial mobile operators for live-demonstrations by guaranteeing at least a consistent 4kbps to enable POS terminals conduct end-to-end query with the backend E-payment servers of the clearing house; the Nigeria Inter-Bank Settlement System (NIBSS). The bottom-top approach yielded success and the combined executive of CBN and NIBSS provided NIGCOMSAT Ltd with a further 20 locations across six geopolitical regions of the country slated for the six-state pilot project. The Areas covered by the National Public Security Communications System (NPSCS) network were identified in the six state locations and Lagos State namely Abuja, Abia, Anambra, Kano and Ogun States as shown in figure 2. Areas with inactive Base Transceiver Station (BTS) powered down as a result of insolvency were immediately activated considering the future potential of the cashless policy implementation, which will sustain the NPSCS network while areas outside NPSCS coverage were com-

Figure 2: shows Signal Strength of the deployed nationwide CDMA network across Six-Geo Political Regions of Nigeria, where the Cashless Policy Pilot Project was implemented on the 450MHz Terrestrial Spectrum.
implemented with a Communication satellite solution.

The NPSCS is a communications platform based on Code Division Multiple Access (CDMA) technology for security and emergency network with exclusive capacity for strategic commercial and socio-economic activities. The cashless policy is considered to be a national strategic priority and thus POS terminals were procured and facilitated on the network.

A typical Point-of-Sale (POS) terminal as shown in figure 3, it is designed and manufactured with standard communication links using Ethernet (LAN Port), General Packet Radio Service (GPRS), Dial-up modem, CDMA, and/or Wifi links. The POS terminals are usually equipped with one or more of the communications link options.

![Figure 3: A Typical Point-Of-Sales (POS) Terminal.](image)

The CDMA communication link is usually built for the 800/1900MHz frequency and thus a special request to POS manufacturers were made to build a 450MHz-based CDMA POS terminal for compatibility with security communications network (NPSCS network).

Figure 4 and 5 shows POS terminal and Telephone built for 450MHz networks, which provides additional suitability for rural and sparsely distributed population considering its superior propagation characteristics and better penetration compared to commonly used frequencies such as 800/900/1800/1900MHz. A single cell tower can cover 7,521 Km2 compared to 553Km2 on 1900MHz. The POS terminal branded NIGCOMSAT Model POS E330 as shown in figure 4 is designed to work optimally with support for security of transactions. It has a high-speed thermal printer for POS receipts. The FX200 model shown in figure 5 was built to support not just CDMA 450 MHz but also CDMA800/1900MHz for economy of scale. It has a battery backup system, USB modem, SMS, display, Stopwatch, Alarm, FM radio, Calendar, POS Support for the Cashless policy programme and digital inclusion especially in rural areas.

![Figure 4: Specially Built CDMA450MHz POS Terminal for Direct use with the NPSCS Network on 450MHz](image)

To complement the success of 450MHz CDMA-based POS terminal in the Nigerian Market, a solution by the writer as depicted in figure 6, was rolled out to utilize existing wireless-based and Ethernet based Point-of-
Sale (POS) terminal through a 450MHz IP cloud of the nationwide NPSCS network.

Figure 6: System utilizing the Nationwide 450MHz-Based CDMA Network to support existing Wifi-Based and Ethernet-Bases POS terminals and thus driving the National Cashless Policy.

Figure 6 illustrates how an off-the shelf 450MHz CDMA-EVDO USB dongle was inserted, integrated and configured as a 3G/4G wireless router, which also has 5-hours battery backup power enabling a wireless-based POS terminal to communicate with the NIBSS back-end E-payment servers through IP for completion of online payment transactions. A total of 78,482 POS terminals exist in the Nigerian E-payment market as at February, 2014. The POS terminals have varying communication modules supporting WIFI, LAN (Ethernet), GPRS, Standard CDMA. Figure 7 shows POS distribution across the country utilizing various wireless network technologies. 88% are predominantly utilizing the General Packet Radio Service (GPRS) of the Global System for Mobile Communications (GSM). The issues and challenges experienced by users of POS are mostly with the GPRS-based POS terminals considering the fact that most GSM networks were deployed in early 2000, they are mostly first and second generation systems designed originally for voice and not data. The NigComSat-1R Communication Satellite’s complements the National Public Security Communications System (NPSCS) terrestrial network infrastructure especially in rural areas.

Each deployed VSAT is equipped with a secured hotspot facility within 500 meters radial coverage to enable wifi-based and Ethernet (LAN)-based point-of-sales (POS) terminals in shops, neighbourhood centres, shopping malls especially in areas without NPSCS coverage, while a good percentage of the GPRS-Based POS are being retrofitted with Wifi modules thus facilitating effective cashless transactions and fast tracking cashless policy implementation and most importantly in urban areas with inadequate terrestrial wireless infrastructure. The IP-based Wide Area Network (WAN) and Local Area Network (LAN) are backhauled to the Nigeria Inter-Bank Settlement Scheme (NIBSS) headquarters for completion of the back-end transaction as the financial clearing-house of Nigeria shown in figure 8. The NIBSS provides the infrastructure for automated processing, settlement of payments and fund transfer instructions between banks, discount houses, and card companies in Nige-
ria etc. Figure 9 illustrates the top-level design of the VSATs with a secured hotspots network, while Figure 10 shows the writer deploying a VSAT solution in a shopping complex location outside the reach of the public security (NPSCS) coverage zones.

The VSAT, as shown in figure 9 and 10, is integrated into a high-powered outdoor access point radio as shown in figure 11. The radio has a good multi user performance, high capacity delivery, faster user rates and superior connectivity under both line-of-sight (LOS) and non-line-of-sight (NLOS) conditions. It has adaptive technology for optimal performance and interference mitigation.

Discussion and Conclusion

Successful proof-of-concept (POC) has been conducted with pockets of challenges on customized POS terminals and perception of the public for a state owned enterprise (SOE) to ensure sustenance of network services for
financial transactions. Stakeholders such as financial institutions, Network Service Providers, Microfinance Investors and Central Bank of Nigeria (Promoters of Financial Inclusion) are currently being rallied to leverage on the coverage of public security as technology acceptance model (TAM), which presently covers capital cities and the Federal Capital Territory (FCT-Abuja) of Nigeria to promote and foster financial and digital inclusion especially in rural areas considering 450MHz technology advantage. Satellite terminals exploiting Nigerian Communications Satellite will be deployed in areas not covered by the terrestrial public security network to ensure nationwide coverage without exclusivity. Figure 12 shows the NPSCS network deployment and population distribution.

Figure 12: Map of Nigeria showing population distribution and NPSCS network coverage.

Nigerian Communications Satellite (NIG-COMSAT-1R) is playing a strategic role as a critical ICT backbone infrastructure to drive the national ICT revolution in providing cost effective solutions and affordable access to meet the telecommunications services of the nation especially in the effective implementation of Nigeria’s cashless policy to help drive financial and digital inclusion. The first phase in the Banking and Financial Service inclusion strategy has greatly improved e-payment performance and efficiency. The cashless service is already in Nigeria to stay and the combined hybrid communications satellite is already providing a more robust and resilient capacity for our banking industries enabling them to offer more efficient financial transactions including online banking services. The pilot project also serves as demonstrator to dedicated public security network’s sustainability by using exploiting excess network capacity for the strategic commercial telecommunication needs of the state and its citizens as exemplified by Nigeria’s Cashless policy pilot project for financial and digital inclusion. This effectively drives the universal access goals, without exclusivity, in a continent, which still remains the least wired in the world. The success of Nigeria’s information technology policy and other developing nations with little or no terrestrial infrastructure depends greatly on satellite communications and its supporting technologies to meet short and medium term plans. Satellite Communications have a competitive advantage as they complement the present sparsely distributed terrestrial links (fiber optic) and radio link extensions contributing to accelerated economic growth, secure communications for security agencies, socio-economic development and are a launch pad for all-inclusive participation in the global knowledge-based economy; thus accelerating sustainable growth and development. (Lawal & Chatwin, 2012; Lawal, Ahmed-Rufai, Chatwin & Young, 2013; Lawal, Ahmed-Rufai, Chatwin & Liu, 2013; Lawal & Chatwin, 2014).
References


Conclusion

What has emerged through the papers presented in this publication and during the Research Meets Africa Workshop, is that promoting innovative financial inclusion frameworks signifies stimulating new processes, practices and methodologies within the microfinance sector and learning from experiences in other sectors with the capacity to bring about solutions or break down barriers for inclusive finance.

In the process innovation category, Arcadius Yves Akossou indicated the homogeneity of group loan members as a positive factor influencing the performance of group loans in Benin. Sophie Wiesner described the adaptive nature of microfinance borrowers and, on this basis, derived a predictive model of microfinance institution performance. Djamchid Assadi, Mathilde Bauwin and Getaneh Gobezie adopted the analytical perspective of individual microfinance clients. Assadi analysed the poor’s preferences when directly able to make choices about household welfare and indicated investing in education as the preferred welfare improvement measure. Bauwin described a tendency, originating at the loan officer level, to grant lower credit amounts to women in Tunisia. And Gobezie identified women as crucial entrepreneurial actors in African societies. Finally, Nicoló Tomasselli presented research from Innovations for Poverty Action (IPA) led by Lori Beaman and Dean Karlan, analysing the Malian agricultural microfinance sector where they utilized the randomized control trial (RCT) methodology to determine the effectiveness of loan products on farmers’ productivity, cash flow management and profits. The various research methodologies, models and approaches that have been employed by these researchers demonstrates the opportunity to take processes well developed in other fields to benefit increased knowledge about financial inclusion and financially underserved clients.

The discussions about product innovation focused on the major innovative trends in financial inclusion: agricultural products, specifically index-based products, as well as the use of technology as a delivery channel for financial services and the provision of sustainable energy technologies via microcredit. Boubacar Barry and Yaya Koloma investigated crop insurance as a main tool to improve income management and food security. Furthermore, they highlighted the major challenges of technical infrastructure for weather readings and farmer’s willingness to pay for crop insurance. In addition, Terfa Williams Abraham explored the effects of credit, insurance and group savings on the ability of farming households to adapt to the effects of climate
change and improve their income. While Ahmadou Dicko applied the index-based method to design a weather related index to livestock and showed how this technique could be applied to a livestock insurance for the Animal Trypanosomosis in sub-humid zones of West Africa. Various technologies were presented as key to financial inclusion in Africa. Lasisi Salami Lawal shared insights from Nigeria about the lack of telecommunications infrastructure and reliable connectivity between cities and rural areas that affects national plans for financial inclusion. Taking a look into humanitarian work in different countries and the use of technology for cash transfer payments, Sara Murray presented a comparison of cash, mobile money and electronic vouchers in the DRC to determine the cheapest and fastest cash transfer mechanism for beneficiaries. Finally, Lukas Kahlen outlined the challenges of supplying sustainable technologies like solar lamps or improved cook stoves in rural areas and the role that MFIs can play in supporting the supply chain as well as financing for such technologies. Much of the research around product innovation demonstrates that financial services targeting the base of the pyramid can be an avenue to livelihood and household improvements in rural areas if the products are designed to take into account client needs, infrastructure, climate and other environmental and contextual characteristics.

In terms of policy innovation, Kenneth Fullerton and Alyssa Rivera described African land tenure as disproportionately detrimental to women and generally pointed to a regional need for land reform. Specifically, they analysed the Malawian land reform, which they indicated as a major factor contributing to the improvement of household economic conditions. Manuel Roland Tcheumalieu Fansi looked at the fiscal regimes of microfinance institutions in Africa and calls for a reduction of the VAT regimes on the bases of the social mission of these institutions. As the financial inclusion sector develops and progresses it is key for national policies and regulations to modernize in order to promote more inclusive financial systems. Research on the effects of policy changes on populations traditionally excluded and on the micro as well as the macro economy can be a key political driver for positive change and financial sector development.

The research presented in this publication and during the Research Meets Africa Workshop marks the trajectories of innovations that can and will foster financial inclusion in rural Africa.
Annex I: List of Research Meets Africa speakers and participants

UMM and ADA would like to thank the following people for their participation:

Laura Foschi, ADA; Frances Fraser, Positive Planet Southern Africa; Pierre-Valère Nketcha Nana, Making Finance Work for Africa; Boubacar Barry, WASCAL; Yaya Koloma, ISTOM; Tobias Wegmann, Frankfurt School of Finance & Management; Arcadius Yves Akossou, Parakou University; Sophie Wiesner, University of Bayreuth and ADA; Kenneth Fullerton, Positive Planet Southern Africa; Alyssa Rivera, Inclusive Business Consultant; Manuel Roland Tcheumalieu Fansi, University of Luxembourg; Susann Seifert, Positive Planet Germany; Lukas Kahlen, MicroEnergy International; Terfa Williams Abraham, WASCAL and Université Cheikh Anta Diop; Djamchid Assadi, ESC Dijon Bourgogne; Mathilde Bauwin, Université Paris Dauphine and Enda Inter Arabe Tunisia; Getaneh Gobezie, PEPE; Julien Guth, Tigo; Lasisi Salami Lawal, University of Sussex and Nigerian Communications Satellite Ltd; Sara Murray, Mercy Corps; Véronique Faber, Microinsurance Network; Nicolò Tomasselli, Innovations for Poverty Action; Adama Camara, Northwestern University; Soro Yiriwos, Northwestern University; Lori Beaman, Northwestern University; Ahmadou Dicko, ISRA and CIRAD; Juana Ramirez, ADA

**PARTICIPANTS**

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Annex II: List of Research Meets Africa scientific committee

ABBOUD Marina, ADA
AMATULLI Giuseppe
Professor ARVIND Ashta, Burgundy School of Management - ESC Dijon
BENSOUSSAN Pauline, Sciences Po Paris
BEVACQUA Cristian, Microfinanza srl
de BRIEY Valeria, Microfinance consultant
CAMARA Anne Hofer, Microfinance consultant
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CHONGO Bezant, Positive Planet South Africa
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DESWARTE PIPIEN Emilie, Positive Planet Madagascar
FABER Veronique, Executive Director at Microinsurance Network
FORCELLA Davide, ULB, FNRS, CERMI
FOSCHI Laura, ADA
FRASER Frances, Positive Planet South Africa
GENAZZINI Matthew, ADA
GRAHAM Julia, Microinsurance Network
GÜRGÖZ Yekbun, International Advisory Services, UNEP
HENNING Karla, Positive Planet
KESSLER Hansjorg Leo, Chairman of the Supervisory Board of the Alliance Group Microfinance Organization (AGM), director of Swiss Microfinance Holding, director of a bank in Namibia, CEO of a German social business fund
KRAUSS Annette, Center for Microfinance, Department of Banking and Finance, University of Zurich
Professor LATORRE Mario, Università di Roma
LÓPEZ SABATER Verónica, Fundación Afi
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MONTEIRO Joaquim, ADA
Professor MORO VISCONTI Roberto, Catholic University Milano
Professor N’GUESSAN Tchétché, Africap
NIANG Birahim Bouna, Directeur du Centre de Recherche et de Formation pour le Développement Economique et Social (CREFDES) à l’Université de Dakar
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RANDAZZO Francesca, ADA
RODRÍGUEZ PULIDO Patricia, ACAF Italia
SIDIBE Sory, Positive Planet Burkina Faso
WIESNER Sophie, ADA
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