

Towards a better understanding of informal financial service
interventions in West Africa:
Investigating impact, evolution, and key challenges

A thesis
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of
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Curriculum Vitae

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EDUCATION

- Ph.D. **The Fletcher School of Law and Diplomacy, Tufts University**
International Relations (concentration: Development Economics),
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- M.A. **School of Advanced International Studies (SAIS), Johns Hopkins University**
International Relations and International Economics, May 2007
- B.A. **Stanford University**
Political Science, June 2002
Straitharn Sportsmanship Award Recipient (2002), awarded annually to one member of
the Stanford Athletic Department in recognition of a career of outstanding sportsmanship

PROFESSIONAL EXPERIENCE

Associate Director

- The Fletcher Leadership Program in Financial Inclusion (FLPFI)** July 2018 – present
- Lead curriculum design process for the *Fletcher Leadership Program in Financial Inclusion*; develop and facilitate the fellowship's online course; facilitate workshops during the in-person residency; advise fellows throughout policy development process including written feedback on policy memos.
 - Manage student workers and consultant: design and monitor workflow, provide training and ongoing support, review work products on projects including development of new online course, Research Prize pilot activities, review of fellows' policy memos.
 - Donor relations: meet with donors; lead writer for proposal to the Bill and Melinda Gates Foundation that secured \$1.3 million in November 2018; lead writer for proposal for MasterCard Foundation that secured \$200,000 in December 2017.
 - Develop new online courses: *Capital Markets Development – Lessons for African Practitioners* – review syllabus and materials; manage development of the Canvas course site. *Eight Question Method for Policymaking* – leading development process including creating teaching materials, designing and developing Canvas course site.
 - Develop program strategy: in consultation with the FLPFI team, develop vision and strategy for the program through 2019.

Senior Program Administrator

2017 – 2018

Curriculum Advisor and Workshop Facilitator, FLPFI

2013 – 2017

- Led curriculum design process for the *Fletcher Leadership Program in Financial Inclusion*; developed and facilitated the online course modules; prepared and taught workshops during the in-person residency; advised fellows throughout policy development process.
- Write and review case study publications

Manager of Teaching Assistant Team

April 2016 – August 2017

Certificate in Digital Money Course, The Fletcher School & The Digital Frontiers Institute

- Manage team of ten teaching assistants for the Fletcher School's first entirely online course, the Certificate in Digital Money. Develop teaching materials; recruit, train, and supervise teaching assistants; institute systems for ongoing supervision and management of teaching assistant team. Three cohorts managed with an average pass rate of 88%.

Thesis Advisor, Global Master of Arts Program, The Fletcher School 2012 - 2015

- Consulted individually with Master's degree students throughout their thesis process to foster research interests, develop research skills, and strengthen analytical and writing skills. Mentored more than 90 students to completion of their thesis. Implemented a new process of remote support and follow-up that helped a record percentage of students to complete their thesis on time (91-94% completed on time each cohort).
- Created and facilitated workshops and videos on conducting in-depth research and academic writing.

Director, The Fletcher Graduate Writing Program 2011 – 2014

- Created and facilitated workshops on academic writing, professional writing, academic honesty, and editing;
- Managed writing tutor program: recruited, trained, managed, and supervised 6-9 writing tutors per year. Instituted new policies for scheduling and student interfacing, resulting in an increase of writing tutor hours utilized by students of 20-30% annually

Consultant, Catholic Relief Services August 2011

- Implemented field research project in Benin: Designed research instruments, conducted qualitative field research, and wrote paper on institutional governance of mature savings groups and utilization of financial services in Benin.

Consultant, Catholic Relief Services and Nike Foundation August 2010

- Implemented field research project in Zimbabwe: Designed research instruments, conducted qualitative field research, and wrote paper on Economic Strengthening for Adolescent Girls in Zimbabwe.

Microfinance Technical Advisor, Catholic Relief Services 2009 – 2010

Microfinance Program Specialist 2008 – 2009

International Development Fellow (Mindanao, Philippines) 2007 – 2008

- Managed \$1.7 million microsavings and peacebuilding project in Khartoum, Sudan, serving 5,000 internally displaced people. Managed and supervised a team of 3 people
- Lead technical advisor for savings group initiation in Central American region (El Salvador, Nicaragua, Honduras, Guatemala) and expansion to 7,000 clients
- Strengthened and expanded microsavings programs by providing technical advice, strategic direction, trainings, and proposal development. Technical writer and reviewer on winning proposals for CRS country programs in Sierra Leone, Rwanda, Cameroon, CAR, Lesotho, Guatemala, El Salvador, Nicaragua
- Developed, coordinated, and provided technical advice on evaluations, monitoring, research plans, and learning agendas, including for the Bill and Melinda Gates Foundation-funded SILC Innovations research project

Investment Intern, MicroVest Capital Management 2007

- Monitored financial performance and country risk of investments in microfinance institutions
- Performed due diligence analysis and portfolio management for the Investment Team
- Developed and tested a proprietary credit scoring model

Graduate Student Intern, Urwego Community Banking (Kigali, Rwanda) 2006

- Managed the Individual Microloan Development Project: directed the market research, designed individual loan prototype, and loan evaluation and approval procedures
- Evaluated and redesigned microsavings processes to improve security and prepare for product roll out
- Wrote the microsavings manual to standardize procedures and implement changes
- Designed microenterprise development project for HIV-affected clients

Intern, PlaNet Finance (Beijing, China) 2005

- Researched microfinance best practices and policy regulations relevant to the Chinese context
- Wrote policy briefs for dissemination to partner NGOs through PlaNet China's internet portal

Consultant, Fundación Alternativa, Banco Solidario (Quito, Ecuador) 2003 – 2004

- Executed technical assistance project to strengthen and expand microfinance services in credit unions. Evaluated loan products and financial performance of three urban and rural credit unions; conducted market research, including focus groups and surveys; designed loan approval procedures, credit products, portfolio growth strategy.
- Analyzed Banco Solidario's social impact, wrote study for Agencia Española de Coop. Internacional

RESEARCH EXPERIENCE

Dissertation Research, Development Economics Department May 2014 – present

- Conduct quantitative and qualitative field research in Niger, clean and analyze data for a research project examining the impact of SMS messages and personal savings devices on the saving and spending behavior of poor rural households. Supervised by Prof. Jenny Aker.

Research Assistant, Development Economics Department 2014 - 2016

- Conducted quantitative field research in Niger, cleaned and analyzed data, developed project documents for research projects, including examining the impact of mobile phone curriculum on adult literacy. Supervised by Prof. Jenny Aker.

Research Assistant, Feinstein International Center, Tufts University May – September 2011

- Conducted literature review and contributed to four papers on livelihood protection in South Sudan and Uganda for the Sustainable Livelihoods Research Consortium. Supervised by Prof. Daniel Maxwell.

TEACHING AND ADVISING EXPERIENCE

Teaching Assistant February – April 2016

Certificate in Digital Money, The Fletcher School & The Digital Frontiers Institute
Supervising Professors: David Porteous and Ignacio Mas

Lecturer, Osher Institute for Lifelong Learning, Tufts University Spring 2014

- Taught “Beyond Microcredit: New Financial Services for the Poor.” Student evaluations available upon request.

Guest Lecturer, *Microfinance and Financial Inclusion*, Prof. Kim Wilson, The Fletcher School

- Lectured and facilitated class discussion on “Saving groups and financial inclusion” (Spring 2012).

Teaching Assistant - *Econometric Impact Evaluation*, The Fletcher School
Supervising Professor: Jenny Aker (Fall 2014).

Teaching Assistant - *Design, Monitoring and Evaluation*, The Fletcher School
Supervising Professor: Cheyanne Scharbatke-Church (Fall 2012).

Teaching Assistant - *Microfinance and Financial Inclusion*, The Fletcher School
Supervising Professor: Kim Wilson (Spring 2011).

PUBLICATIONS

Miller, C., Sawyer, M., and Rowe, W. *My Skills, My Money, My Brighter Future in Zimbabwe: An Assessment of Economic Strengthening Interventions for Adolescent Girls*; Catholic Relief Services, 2011.

Sawyer, M. and Jarrin, S.; *Small Customers, Big Market: Commercial Banks in Microfinance*; Malcolm Harper and Sukhwinder Singh Arora, editors; Stylus Publishing, 2005.

PUBLICATIONS AS EDITOR

Mazzota, B., and Chakravorti, B. *The Cost of Cash in Mexico*; Melita Sawyer Constable and Jamilah Welch, editors; Institute for Business in the Global Context, The Fletcher School, 2014.

Chakravorti, B., and Mazzota, B. *The Cost of Cash in the United States*; Melita Sawyer and Jamilah Welch, editors; Institute for Business in the Global Context, The Fletcher School, 2013.

PRESENTATIONS

Sawyer, Melita. *The Fletcher School: Teaching and Research Related to Digital Money and Financial Inclusion*; Mobile Money, Financial Inclusion, and Development in Africa Symposium; April 22, 2017. Cornell University, Ithaca, NY.

Sawyer, Melita. *Get Your Goat: Planning, Saving, and Ceremonial Spending in Niger*; New England Universities Development Consortium (NEUDC) Conference; November 6, 2016; MIT, Cambridge, MA.

Sawyer, Melita. *Get Your Goat: Planning, Saving, and Ceremonial Spending in Niger*, Centre for the Study of African Economies (CSAE) Conference; March 22, 2016; Oxford University, Oxford.

Sawyer, Melita. *Integrating Savings-led Microfinance and Agroenterprise: Chickpea Value Chain in Tanzania*; CRS Agriculture Symposium; April 2009, Washington, DC.

Sawyer, M. and Best, R.; *Integrating Savings-led Microfinance and Agroenterprise: Chickpea Value Chain in Tanzania*; Poster presented at Centre for Development Studies Seminar: Sustainable Livelihoods and Pro Poor Market Facilitation; July 2009, University of Bath.

Mukankusi, A., Rowe, W., and Sawyer, M.; *Empowering Rwandan Youth through Savings-led Microfinance*; Making Cents Global Youth Enterprise Conference: Focus on Finance; September 2009, Arlington, VA.

ADDITIONAL INFORMATION

Service: Student representative to the Fletcher PhD Committee, 2011; Fletcher PhD Conference Co-Chair, 2011.

Languages: Spanish (fluent); French (fluent)

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Abstract

This dissertation adds to our knowledge on the role of simple informal savings devices in helping households in West Africa cope with shocks, smooth consumption, and invest in the short term and the longer term. The studies presented herein find that a simple savings device can help households smooth consumption in the face of serious health shocks. In Niger, households with a simple lockbox who faced a health shock were less likely to go a day without food. The households' self-insurance strategies improve as they are more likely to use cash savings than selling assets or using loans. I also find that savings group usage in Benin can endure for years after NGO support ends. The groups continue to provide members with financial services that the members use and can benefit from. On average, members' savings amounts increase over time, and "share-out" amounts increase over time facilitating investment in productive assets for some members. I also find that low levels of literacy are a challenge to optimal usage of informal financial tools including SMS messages and ASCAs. However, the recent research shows that adults can learn to read and suggests that adult literacy programs may be improved with more practice, explicit instruction in each stage of literacy acquisition, and increased flexibility.

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Being a PhD student is a humbling experience in the most wonderful ways. I am immensely grateful to have had the opportunity to conduct the research presented herein. At the end of this stage of learning, I am humbled anew as I contemplate how every single day that I was able to spend in pursuit of knowledge and becoming an effective researcher was enabled by a web of people and institutions. I am cognizant of how fortunate I have been to receive their support.

I am grateful to The Fletcher School and its vibrant community of faculty, staff, and students. My positive experience at Fletcher has been strongly influenced by the faculty with whom I have been fortunate to work.

Above all, I thank Professor Jenny Aker, the Chair of my Dissertation Committee, my mentor and advisor, for her excellent teaching, thoughtful advice, and patient guidance. I am so thankful for the opportunities that Professor Aker has given me to learn how to conduct careful field work, and to ask and answer questions that are relevant to people's lives. I am especially grateful to Professor Aker for the incredible, unwavering example she sets of how to be an ethical, thoughtful researcher, a generous teacher, and an effective and empathetic supervisor.

I thank Professor Kimberley Wilson for her thoughtful insights, for sharing her deep knowledge about informal financial services, for her penetrating questions which always take the process of inquiry in a better direction. I feel so fortunate to have met Professor Wilson while working for Catholic Relief Services in Nicaragua. From that first meeting, and on every subsequent collaborative project, her curiosity, kindness, and abilities to truly listen and to question accepted beliefs have been a tremendous inspiration.

I thank Professor Julie Schaffner for her exemplary teaching and keen insights. Professor Schaffner's careful analytical approach has taught me to think more thoroughly and logically about important questions. I am so grateful for Professor Schaffner's clarity of thought and attention to detail. Every comment and question has generated insights and improved my work.

Thank you to the Fletcher PhD Program administrators, and to Jenifer Burckett-Picker in particular for her constant support and guidance.

Conducting field research takes a team of dedicated people. A profound thank you to all the research participants who gave generously of their time and personal information. I thank the research team from Sahel Consulting in Niger, especially Adamou Hamadou and Maman Lawan Borko. I thank the research team from Catholic Relief Services (CRS) and CRS-Benin, in particular Tom Shaw and Jerome Dadjo.

I thank those organizations which financially supported this research, including the Umbrella Fund for Gender Equality, the Hitachi Center at Tufts University, and Catholic Relief Services.

Finally, I humbly thank my family and friends for their support. I thank my parents, Toni and Bill Sawyer, for teaching me to love learning. I thank my sister, Ty Webber, for her encouragement and amazing example of being a working mom. I thank my children, Alphonse and Alice Rose, for their love and for sharing their mom with the computer and library. I especially thank my spouse and partner, Peter Constable; I am so fortunate to have a partner who supports and encourages me in every way, and who created time and space for me to do this work.

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Introduction

Saving money to achieve goals for oneself or one's loved ones is practiced universally. While saving is challenging, people of every socioeconomic class and in every country manage to do it (Geertz, 1962; Ardener, 1964; Rutherford, 2000). But how people save and the savings mechanisms available to them differ wildly.

In developed countries like the United States, Canada, and Australia, more than half of adults save in a formally regulated financial institution. In contrast, in many countries in West Africa, fewer than 10 percent of people save formally (Demirguc-Kunt *et al.*, 2018). In many poorer or more remote places, the percentage of people saving formally is significantly less. This dissertation presents the results of field work conducted in two studies in Niger and Benin; in Benin, no one in the study sample saved formally, and in Niger less than 1% used a formal account. Only 20% of adults in Benin have a financial account in a formal institution for any type of financial service (Demirguc-Kunt *et al.*, 2018).

However, in spite of the low levels of formal financial inclusion, many people in West Africa are saving, and they use informal methods to do so. In Benin, 28% of adults save in a community-based savings method such as a savings group; this is on par with the average of 26% of adults throughout Sub-Saharan Africa (Demirguc-Kunt *et al.*, 2018). Community-based savings methods promoted by NGOs have been rapidly adopted. NGOs promoting the Accumulating Savings and Credit Association (ASCA) methodology report more than 10 million members across 70 countries since 2005 (Karlan *et al.*, 2017).

Informal finance is practiced the world over, in developed and less developed countries alike. Informal finance is defined as “contracts or agreements conducted without reference or recourse to the legal system to exchange cash in the present for promises of cash in the future” (Schreiner, 2001). More intuitively, informal finance is finance that happens outside of formal regulated banks and institutions (Hussain *et al.*, 1998). Indeed, whether they label it as such or not, every household with a piggy bank, or that borrows from a parent or sibling to pay for school, or that lends to a friend for a health treatment is practicing informal finance. In developing countries, common forms of informal finance include savings mechanisms at home,

community-based savings groups such as ASCAs and Rotating Savings and Credit Associations (ROSCAs), moneylenders, supply credit, money guards, and savings collectors (Rutherford, 2000; Adams, 1992). Microeconomic theory suggests that the ideal is that every individual and household can use a range of financial tools, including savings, insurance, credit, remittances, payments, and encompassing both informal and formal options (Modigliani, 1986; Ando and Modigliani, 1963). The reality is that for many households in developing countries their current menu of financial options is entirely limited to informal services.

Policymakers and NGOs have acknowledged this reality. As mentioned above, many NGOs now actively incorporate informal financial tools such as ASCAs into their programming. In recent years, policymakers in Africa are also including informal financial initiatives in official policies. To date 16 African countries have implemented 29 policies with savings group components (SEEP, 2018).

Although investment in financial inclusion and informal financial tools is increasing, several critical challenges threaten the success of these initiatives. In particular, illiteracy is a significant challenge to achieving meaningful financial inclusion. Many people without access to formal finance are less educated; 62% of unbanked adults worldwide have only a primary education or less (Demirguc-Kunt *et al.*, 2018). SEEP has found that high levels of adult illiteracy are an impediment to informal financial services being used optimally in poor rural communities and may place member funds at risk (SEEP, 2018). A recent survey of savings groups in Rwanda, Burkina Faso, Tanzania and Madagascar found that “almost all groups had their record maintained by a recordkeeper. However, 16 percent of surveyed groups reported that no member other than the recordkeeper was capable of maintaining group records” (SEEP, 2018; pg. 26). The results discussed in this dissertation echo the challenge of illiteracy. The first paper of this dissertation finds that compliance with an SMS messaging intervention in Niger was low, given low levels of literacy despite all respondents having previously participated in a two to three-year adult literacy program. The second paper of this dissertation finds that written recordkeeping can a challenge for ASCA savings groups.

Research question

Given the prevalence and importance of informal savings, this dissertation develops three independent articles which jointly address the following question:

Can simple informal savings devices help households cope with shocks, smooth consumption, and invest in the short term and the longer term? What are the key constraints?

The research question is investigated using mixed methods, looking at different time periods, and diving deeply into the identified constraint of illiteracy. The first two papers examine different types of informal savings devices in two different contexts. The informal financial services explored in this dissertation – a simple individual lockbox, SMS reminders to save, and savings groups – all emphasize savings as the primary financial activity. The third paper brings together the recent neuroscience, cognitive psychology, education, and economics research on adult literacy acquisition in order to develop insights into program design.

Specifically, the first paper, “Just a Bit of Cushion: The Role of a Simple Savings Device in Meeting Planned and Unplanned Expenses in Rural Niger,” co-authored with Professor Jenny Aker, Markus Goldstein, Michael O’Sullivan, and Margaret McConnell, uses a randomized control trial to examine the short-term impact of an individual-level savings device in rural Niger. The second paper, “Sticky little institutions: A study of older savings groups in Benin,” uses qualitative methods to examine how a group savings methodology functions in the longer term (after three and four years) in rural Benin. The third paper, “Making sense of the signs: What do we know about learning in adulthood?” co-authored with Professor Jenny Aker, reviews and analyzes the literature from a variety of disciplines from the last 30 years of published research on adult literacy, a key constraint identified in the literature and in papers 1 and 2.

The research question is important because of its implications for the well-being of poor households. We know that poor rural households in West Africa are vulnerable to fluctuations in income and shocks, given that many derive their income from seasonal agriculture and that weather-related shocks are increasing in frequency and severity (Fafchamps et al 1998; Kazianga and Udry 2006). Financial services exist to help people address such challenges. The theory tells us that households should be able to smooth consumption and facilitate investment through savings, insurance, or loans (Modigliani, 1986; Ando and Modigliani, 1963). But given the lack of access to an array of formal financial services, including safe places to save (Demirguc-Kunt *et al.*, 2018), such strategies can be impossible to implement (Deaton 1991, Townsend 1994, Karlan and Morduch 2010).

However, previous research tells us that informal mechanisms can be safe repositories for savings and reliable sources of loans or insurance funds, and are often the only source of those services for their members (Gash 2017; Matthews et al, 2010; Wilson et al, 2010; Allen 2002; Johnson et al, 2010). Poor households can benefit from informal services; for example, those who had access to informal savings services were more likely to increase their investment in health and increase their productivity and income (Dupas and Robinson, 2013), and accumulate livestock assets over time (BARA and IPA, 2013)

Savings in particular has been found to be a critical financial service for the poor, especially rural households who derive their income from agriculture as do the households in this study. Such households are especially vulnerable to food insecurity during the hungry season before the harvest, as they are liquidity-constrained and food prices tend to rise (Gash 2017; Fafchamps et al 1998; Kazianga and Udry 2006, MKNelly and Dunford, 1998). In her recent meta-analysis of savings group impact evaluations, Megan Gash determines that there is strong evidence that savings groups help to strengthen food security (Gash, 2017).

Yet, in spite of the suggestive evidence on the utility of informal savings mechanisms and the increased investment in informal savings by NGOs and the public sector, large gaps exist in our knowledge. Surprisingly little is known about the impact of informal savings mechanisms, particularly beyond the short-term, or how these services and their effects evolve after NGO engagement (Karlan *et al.*, 2012). Very few impact evaluations have been conducted on informal financial interventions, there is very little evidence on the impact of informal services in the longer term, and there is very little evidence on the effects of informal services in the context of the poorest communities. Therefore, in order to understand household financial management in poor communities of West Africa, it is necessary to develop our knowledge of informal savings tools and the challenges they face.

This dissertation adds to our knowledge on the role of simple informal savings devices in helping households cope with shocks, smooth consumption, and invest in the short term and the longer term. The studies presented herein find that:

- A simple savings device can help households smooth consumption in the face of serious health shocks. In Niger, households with a simple lockbox who faced a health shock were less likely to go a day without food. The households' self-insurance

strategies improve as they are more likely to use cash savings than selling assets or using loans.

- Savings group usage can endure for years after NGO support ends. The groups continue to provide members with financial services that the members use and can benefit from. On average, members' savings amounts increase over time, and "share-out" amounts increase over time facilitating investment in productive assets for some members.
- Low levels of literacy are a challenge to optimal usage of informal financial tools including SMS messages and ASCAs. However, the recent research shows that adults can learn to read and suggests that adult literacy programs may be improved with more practice, explicit instruction in each stage of literacy acquisition, and increased flexibility.

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Just a Bit of Cushion:

The Role of a Simple Savings Device in Meeting Planned and Unplanned Expenses in Rural Niger

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April 2019

Abstract. The welfare impacts of expanding access to new financial services depend upon whether such services better meet households’ financial needs in terms of savings, investment and insurance. We report the results of a randomized control trial in Niger, whereby households were provided with access to a simple savings device – an individual lockbox – or SMS reminders designed to remind households about managing spending during religious festivals. Take-up and usage of the lockbox was high, similar to rates found in other studies. We show that the lockbox did not affect households’ expenditures for religious or ceremonial expenses, although it did shift the way in which households financed these ceremonies. However, we find that when faced with health shocks – a widespread occurrence with negative consequences in rural Niger – lockbox households were better able to mitigate the negative impacts of the shock on their food security, assets and livestock ownership. This seems to be linked to the ways that households financed their health expenditures: They relied more on cash savings and reduced their reliance upon livestock sales and loans. We do not find significant effects from the SMS intervention: Only 18-53 percent of respondents received the messages, depending on the measure used, in part due to high phone churn rates and low levels of literacy. Taken together, our results suggest caution for SMS-based interventions in similar contexts, while demonstrating that simple savings devices can lead to household improvements in the face of common shocks in sub-Saharan Africa.

Keywords: Savings, ceremonial expenditures, self-insurance, Niger

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Family ceremonies and religious festivals – such as funerals, weddings, baptisms, Christmas, and Ramadan -- are an important expense for households worldwide (Banerjee and Duflo 2007, Shukla 2010). Globally, the amounts spent on these ceremonies by poor households represent a significant proportion of the household budget (Banerjee and Duflo 2007). In Niger, households spend as much as 20 percent of per capita income on the annual religious festivals of *Eid al-Adha* and *Eid al-Fitr*, yet our pre-research qualitative work revealed that they are regretful about these expenditures and unable to manage unplanned expenditures at later periods. Indeed, the high rate at which poor households experience severe covariate and idiosyncratic shocks, such as drought and illness, exacerbates the challenges of financial management to smooth consumption and meet other large expenses, such as ceremonies (Crookston *et al* 2018, Gash and Gray 2016, Jacoby and Skoufias 1997, Kochar 1995).

A household's vulnerability to poverty is influenced by its ability to mitigate or cope with shocks (e.g., Ambrosius and Cuecuecha 2013, Banerjee and Duflo 2007, Kochar 1995), including idiosyncratic health shocks (Islam and Maitra 2011, Jacoby and Skoufias 1997). If financial markets are performing optimally, then households could save, take out loans, or insure to cope with shocks and cover other large expense events. Yet given the highly seasonal nature of incomes and imperfect credit markets, such strategies can be difficult to implement, especially for the rural poor, and households must often resort to self-insurance and suboptimal coping strategies (Deaton 1991, Townsend 1994, 1995, Fafchamps *et al* 1998, Kazianga and Udry 2006, Collins *et al* 2009, Karlan and Morduch 2010, Dupas and Robinson 2009, 2013, Rutherford 2000). Even without credit market imperfections, households' consumption may outpace their ability to perceive their declining marginal utility of consumption of goods, especially after a period of deprivation (Kahneman 2011, Bennett and Levy 2018). This behavior may be exacerbated in cases where there is intense social pressure to participate in ceremonies, or when ceremonies are timed such that they occur immediately after a period of low consumption.

There has been great interest in addressing these issues by relaxing liquidity or credit constraints. A large body of research has shown that financial mechanisms can effectively help poor households reduce their vulnerability to shocks (Meredith *et al.* 2013, Collins *et al.*, 2009; Dupas and Robinson 2013; Prina 2015), whether via simple savings technologies (Dupas and Robinson 2013), remittances (Ambrosius and Cuecuecha 2013) or microcredit (Islam and Maitra 2012, Thanh and Duong 2017).

Yet access to useful financial tools may only partially explain the challenge of saving for expected and unexpected events. Given time-inconsistent preferences, individuals may exhibit a present bias towards consumption, especially after periods of intense deprivation (Kahneman 2011) or for expenditures where social pressure is high, such as ceremonies (Karlan *et al.* 2012). Randomized experiments in both developed and developing countries have found that combining behavioral nudges with access to financial services can increase savings rates and reduce debts (Benartzi and Thaler 2007; Choi *et al.* 2004, Bracha and Meier 2015, Prina 2015).

We designed a field experiment in rural Niger to support households in managing their spending and savings for religious festivals and other planned and unplanned expenditures, including health shocks. The first intervention was a simple lockbox, which offered individuals a locked place to put their money, but without any commitment to make deposits or limit withdrawals. The second intervention was a series of SMS reminders about household spending on religious festivals and other savings goals. A subset of households was assigned to both treatments. We focused the SMS reminders on balancing festival spending with later health and education goals, primarily because of the frequency and severity of health shocks in rural Niger, their unexpected nature and the relevance of health as a stated savings goal in the baseline survey. In addition, households specifically stated that religious festivals often had unexpected, last-minute expenses due to social pressure.

In line with other studies on simple savings technologies (e.g., Dupas and Robinson 2009, 2013, Prina 2015, Ashraf *et al.* 2006), we find that take-up of the lockbox intervention was relatively high: Almost all households who were offered the lockbox had it one year after the intervention. Six months after its introduction, 63% of households were saving in the lockbox, and 41% had savings in it one year later, with a savings balance of US\$10. There were no differential effects of lockbox usage by gender. Given the wide variety of informal savings mechanisms used by rural households in Niger, lockbox usage suggests that there is unmet demand for savings mechanisms (Prina 2015). However, it should be noted that we are not able to determine the extent to which the lockbox savings represent new savings rather than a shift in saving mechanism for savings amounts that would have been stored, for example, as cash under the mattresses or in a savings group in the absence of the intervention.

For the SMS, however, take-up was significantly lower: While approximately half of the intended recipients were sent all messages – primarily because of changes in phone numbers – only 20% of intended recipients recalled receiving a message, and only 40% of those read the message, with starkly different usage patterns by men and women. The low take-up suggests that using SMS for reminders may be of limited effectiveness, especially in populations with high phone churn rates and relatively low functional literacy levels. These results contribute to the growing literature on the use of behavioral nudges to address inattention and savings goals, and suggest that using information technology as a means to do so may have additional challenges. Given the limited uptake in the SMS intervention, we focus on the impacts of the lockbox intervention on outcomes.

Our research also contributes to the literature on simple savings devices, and the role they play in easing liquidity constraints in coping strategies, festival spending, and longer-term goals (Dupas and Robinson 2009, 2011, 2013, Prina 2015). While average expenditure and consumption patterns for ceremonies amongst households in lockbox and non-lockbox villages were unchanged, the lockbox allowed households to better cope with health shocks, which affected 60% of our sample. Households affected by health shocks had lower self-reported income, assets, livestock and food security than those without a health shock; however, the lockbox

enabled those households to mitigate the negative effects of these shocks. This appears to be explained by the fact that lockbox households affected by health shocks relied more on liquid savings and less on loans and livestock sales, which can be a costly means of financing expenditures.

These findings are consistent with the literature on self-insurance and risk-coping strategies in the face of shocks. There is widespread literature showing that asset accumulation in the forms of livestock, food, or cash are common self-insurance strategies (Fafchamps 2010, Townsend 1994, 1995, Deaton 1991). The divisibility and liquidity of cash can make it a preferable self-insurance medium, given that food can degrade over time, and livestock is a lumpy and productive asset (Townsend 1994, 1995, Fafchamps 2010). Liquidity-constrained households often finance costs related to idiosyncratic shocks through a combination of debt, selling productive assets, or reduced consumption or investment (Fafchamps, Udry and Czukas 1998, Townsend 1994, 1995, Gertler et al. 2009, Islam and Maitra 2011, Jacoby and Skoufias 1997, Deaton 1991), yet such coping strategies may affect the longer-term productivity (Damme *et al.* 2004). Indeed, Fafchamps et al (1998) and Kazianga and Udry (2006) find that the fear of losing productive assets dissuaded households in Burkina Faso from selling livestock to purchase grain during times of drought. Our finding that households switched to using their cash savings to meet health expenditure needs, rather than loans and livestock, is in line with this finding.

Finally, our work contributes to the small yet growing literature on festival spending. Banerjee and Duflo (2007) find that spending on festivals is common in poor households all over the world, perhaps because participation in ceremonies can improve household status, strengthen trust and generate social capital (Rao 2001, Shukla 2010). We find that all households in our sample are participating in celebrating religious festivals, and that they leverage multiple financial strategies to do so. While access to savings accounts has been shown to increase ceremonial spending in some contexts (Prina 2015), we do not find similar effects, perhaps because the savings technology only allowed for small savings amounts or was not fully committed.

The rest of this paper proceeds as follows. Section I provides background on financial access and ceremonial spending in Niger. Section II presents the experimental design and data, and Section III presents the estimation strategy. Section IV discusses the main empirical results. Section V discusses threats to identification and potential mechanisms. Section VI concludes.

I. Research Setting and Design

Niger, a landlocked country located in West Africa, is one of the poorest countries in the world. With an estimated 85 percent of the population living on less than USD\$2 per day, Niger is the lowest-ranked country on the United Nations' Human Development Index (UNDP 2018). Access to formal financial services is extremely limited. Fewer than 10% of adults countrywide have an account in a formal financial institution (Demirguc-Kunt *et al* 2018), and under 1% of households in our study have a formal financial account.

Ceremonial spending is an important part of Nigerien culture and households contribute generously to weddings, *sunas* (naming ceremonies), funerals and religious festivals, such as Ramadan and Tabaski. The magnitude of ceremonial spending is significant; the average expense for Tabaski in our baseline survey sample was 53,000 CFA (US\$90), equivalent to more than 20% of per capita GDP. Despite the fact that Tabaski is a predictable annual event, purchases for the holiday (which often include a goat or sheep, food, children's and adults' clothing) represent one of Nigerien households' greatest financial burdens.

Rural households in Niger demonstrate significant financial dexterity in managing expenses for planned and unplanned events by utilizing a variety of financing mechanisms, including various forms of savings, loans, asset and livestock sales and gifts. Saving is a key component of households' money management strategies, including for ceremonies and as self-insurance against shocks. Households experience shocks with a very high frequency: Almost every household in our sample experienced drought or a health shock in the prior year. Therefore, it is unsurprising that saving for emergencies was nearly universal, with over 95 percent of households saving for shocks such as health events, drought, and death.

Ceremonial expenses were also critical savings goals. Prior to our intervention, households were saving for Tabaski or Ramadan (63%), *sunas*(85%) or weddings (83%). Three quarters of households also reported saving for educational and agricultural investments. Yet despite widespread savings behavior, almost half of households had been unable to meet their savings goals, attributing the failure to not having enough money (89%), spending on an urgent need or emergency (47%), or unexpected expenses, often during religious ceremonies (23%).

These financial patterns are in line with other studies on the financial lives of the poor, which demonstrate how the poor households must use a range of inventive and often informal strategies to execute household financial management (Banerjee and Duflo 2007, Collins *et al.* 2009, Duflo *et al.* 2013).

A. Interventions

Starting in August 2013, Sahel Group, a local non-governmental organization (NGO), implemented a savings intervention in Niger. The first intervention was a lockbox, a small metal blue box with a coin slot in the top and a keyed lock. The lockbox was designed to provide households with an alternative and more secure place to save and was delivered without any instructions or labeling approximately one month after the baseline survey, in September 2013.

The second intervention was the provision of SMS reminders prior to the Muslim festivals of Tabaski (October 2013 and September 2014) and Ramadan (June 2014). 99.9% of respondents celebrated these festivals. The messages were designed to increase the saliency of savings goals during periods of time when households reported that they most regretted their spending behavior. Three types of messages were sent to households in the two weeks prior to each religious festival, namely: 1) a reminder that the holiday was approaching, but cautioning

against spending too much; 2) a reminder that the holiday was approaching, and to save for health or school fees, which were specifically listed as constraints during our baseline; and 3) a simple holiday greeting, which was to serve as a placebo message.² A household assigned to the SMS treatment was supposed to receive 15 messages over the course of 2013 and 2014, five messages for each of the three holidays.

What are the features of these interventions, and how might they affect savings, expenditures and welfare? The *lockbox* intervention was intended to provide individuals with a more secure and visible place for liquid savings as compared with other informal mechanisms commonly used. The security of the box may have provided some physical distance between individuals and cash (Dupas and Robinson 2013). This could have made it easier for individuals to resist unplanned expenditures, especially during religious festivals, a common concern amongst respondents. The locked savings space also marginally increased the security of the savings for the key holder, as unintended borrowing by household members would be less likely to occur. Second, the visibility of the physical box may have helped to make savings behavior “top of mind,” increasing its saliency. Third, even though there was no targeted commitment or explicit labelling, if households used the lockbox for a specific savings goal, they may have created a labeled “mental account”, thereby enabling households to forego unplanned expenditures (Dupas and Robinson 2013). Finally, the liquid nature of the cash savings could have helped households to cope with shocks and meet education expenses or festival expenditures without liquidating in-kind assets or taking on debt.

The SMS messages were intended to focus individuals’ attention on unplanned expenditures during the religious festivals, as well as increase the salience of other savings goals. By focusing individuals’ attention on specific savings goals prior to and during the festival period, this could have improved households’ planning, thereby reducing unplanned expenditures in the short-term. This intervention may have been particularly effective if households tended to focus on festivals at the expense of future expenditures, such as school fees or saving for unexpected health expenses.

Identifying testable hypotheses related to each of these technologies depends upon the types of savings barriers that individuals face. In theory, the *lockbox* intervention should help individuals to resist unplanned expenditures (including transfers to others), such as last-minute expenses on weddings and religious festivals; this could therefore reduce spending and help households to better achieve their savings goals. Yet if the lockbox was used to save for religious festivals, then overall spending could be higher in the *lockbox* treatment. Similarly, the SMS intervention could have helped individuals to reduce “unplanned expenditures” for festivals to better meet

²For example, messages included “Tabaski is coming! Enjoy the celebrations, but don’t forget to save for your health and your family’s health!” and “Tabaski is coming! Enjoy the celebrations but don’t spend too much!” The messages were sent in the two weeks’ prior to the festival, rather than earlier, as our pre-intervention work revealed that households felt social pressure to spend on “last minute” items in the days leading up to the festival.

savings goals in other areas such as health and education. This may be less likely without a secure place to save, such as the lockbox.

B. Experimental Design

Prior to the program, we identified 70 intervention villages in the Dosso region of Niger. All villages had previously participated in an adult education program with Catholic Relief Services between 2009 and 2011, with a subset assigned to a mobile phone-enhanced adult education program (ABC). Among these 70 villages, we stratified by administrative division and ABC treatment status before assigning villages to the *lockbox* or control condition. Thus, there were 35 villages that were assigned to the lockbox treatment and 35 that were not.

Within each village, we identified 50 literacy participants (25 men and 25 women) who had previously participated in the adult education or ABC program. There was little attrition due to migration or death since the end of the adult education program in 2011 (Aker and Ksoll 2018). Within each village, we stratified the literacy participants by gender and randomly assigned participants to receive a SMS reminder or none. Eight individuals per village were assigned to a reminder message. The SMS randomization was therefore a cross-cutting randomization at the individual level, stratified by gender. The timeline of activities is provided in Figure 1.

II. Data

The data we use in this paper come from three primary datasets. First, we conducted two rounds of household surveys to measure the impact of the interventions on household expenditures and savings goals. Second, we conducted three telephone surveys for a subset of households to measure the impact of the interventions on expenditures for religious festivals, health shocks and food security. And finally, we collected administrative data from the SMS software to note whether intended recipients received the SMS, as a measure of compliance.

A. Household Survey Data

Household surveys were administered to 16 households (8 men and 8 women) within each village prior to the start of the intervention in August and September 2013, for a total of 1,120 respondents across 70 villages. We also conducted a follow-up survey in October and November 2014, immediately following the Tabaski festival for that year.³

Each survey collected detailed information on socio-demographic characteristics, income and expenditure patterns, savings behavior and savings goals, asset ownership, time and risk preferences, shocks and coping strategies. In particular, we gathered detailed information on households' spending for large expense events, such

³Tabaski occurred around or immediately prior to the harvest for most households in our sample during the baseline and first follow-up phone survey, and before the harvest for approximately half of the households in our survey during the endline period.

as weddings, *sunas* (naming ceremonies), religious festivals (Ramadan and Tabaski), illnesses and funerals.

While attrition is typically a concern in most household surveys, attrition was 9.8% in control group between the baseline and follow-up, and there was no differential attrition between any of the treatments and the control or between the treatments (Table A1). In addition, as mentioned previously, we observed little attrition amongst respondents from a previous intervention, upon which our sample was based.

B. Telephone Survey Data

The second primary dataset is a telephone survey with 300 randomly selected respondents (after stratifying by the *lockbox* and *SMS* treatments). Three phone surveys were conducted in December 2013 (after Tabaski), May 2014 and August 2014 (after Ramadan). The phone surveys collected information about recent expenditures on religious ceremonies, shocks, savings behavior and food security, all indicators that have high intra-annual variation.

C. Clickatell User Data

The final dataset is the user report data from Clickatell, the software that was used to send out the SMS messages to respondents. Clickatell provides detailed information on whether the message was sent, and, if not, the type of error message received. We use these data to provide insights on non-compliance (i.e., non-receipt of messages) at the individual level.

D. Pre-Program Balance of Household Characteristics

Tables 1 and 2 show the results of pre-program balance tests by treatment status, focusing on the differences between lockbox and non-lockbox villages and controlling for the SMS intervention. The focus on the lockbox treatment is explained further below. Overall, the results in these tables suggest that the randomization created balanced groups along observable dimensions. We test for differences in the means of a variety of characteristics, including socio-demographic characteristics, religious and other ceremonial expenditures, health expenses and savings goals. Nearly all of the differences between the treatments and the control, as well as between treatments, are small and not statistically significant.

Respondents were, on average, 41 years old. Nearly all respondents (88%) were married, and the majority were from the Hausa ethnic group (Table 1, Panel A). A majority of households engaged in agriculture and owned their own land, using an average of four income-generating strategies. Mobile phone ownership and usage in this area was nearly ubiquitous, with 90 percent of households owning a mobile phone (Table 1, Panel B). 72% of households owned a sheep at baseline, and 22% of households had gone a day without food since the previous harvest. Nearly every household experienced at least one shock prior to the baseline, most commonly drought (71%), serious illnesses (45%) and death (15%) (Table 1, Panel C). The marital status of the respondent and sheep ownership were the only characteristics that were systematically different between the lockbox and non-

lockbox villages, with those in the *lockbox* treatment more likely to be married and own sheep as compared with the control group.

Nearly everyone in our sample reported that they were saving, with less than 1% using a formal account. Individuals primarily used informal savings mechanisms such as livestock (75%), savings groups (40%) and saving at home under the mattress (40%) (Table 2, Panel A). Festivals, ceremonial expenditures and emergencies were common savings goals. The prevalence of these goals accords with the high cost of these ceremonies; indeed, religious festivals were the largest expenditure category in our sample, with annual Tabaski expenses averaging US\$90 (Table 2, Panel B).⁴

In addition to religious festivals, households also spent a significant amount on other ceremonies, such as weddings and naming ceremonies. Roughly 1/3 of households had a birth and 15% celebrated a marriage prior to the baseline (Table 2, Panel C). While the unconditional expenses for these ceremonies were lower as compared with religious festivals, conditional expenditures were significantly larger, averaging US\$304 for weddings (not shown).⁵ Those in the *lockbox* treatment spent 30% less on *sunas* as compared with the control.

Finally, 55 percent of respondents had an illness and spent approximately US\$30 to receive treatment for the most recent illness. Notably, household spending on funerals was significantly lower than expenditures on other ceremonies, in part because many funeral expenses in Niger are covered by the community.⁶

All of these variables demonstrate that households in our sample area worked creatively with informal financial mechanisms to manage their income to cover expected and unexpected expenses throughout the year, as well as the frequency and severity of shocks.

III. Results: Take-Up

Table 3 presents summary statistics of the two treatments. Take-up -- broadly defined as receiving and using the specific intervention to which a respondent was assigned -- was measured in the full sample during the baseline and endline surveys, and for a subset of the sample during the phone surveys.

Overall, take-up of the lockboxes was high: 96.4 percent of those assigned to the *lockbox* treatment reported receiving a lockbox and nearly all of those individuals still had the lockbox during the endline survey, as verified by the enumerators (Table 3, Panel A). Usage rates were high as well; at 3 and 6 months, 63 percent were using the box to save, and at the time of the endline survey, 41 percent had non-zero saving amounts in the lockbox (Figure 2). Since the endline survey took place immediately after the Tabaski holiday and prior to the harvest in a subset of villages, households may have withdrawn their savings to cover festival and other expenses.

⁴ This represents only spending on Tabaski, as our baseline survey did not ask about Ramadan expenses. 99.5% of our sample was Muslim.

⁵ Conditional on a household celebrating a suna, sunas cost US\$84. The unconditional mean of wedding expenditures is US\$32, and the unconditional mean of suna expenditures was US\$22.

⁶ The unconditional mean of funeral expenses is US\$3.

Conditional on saving in the lockbox, households had an average savings balance of US\$4 in the lockbox for most of the year, with a savings balance of US\$9 at endline.⁷ Take-up and usage were similar amongst men and women, although men were more likely to have a savings balance in the lockbox at endline.

Identifying compliance in the *SMS* treatment is more nuanced, as it requires verifying that the message was sent, as well as the fact that the individual received and read it (Table 3, Panel B). To test this, we use several different data sources: Clickatell reports, which specify whether the message was delivered to the respondent’s telephone number; data on household and individual phone number churn rates; and self-reported measures of having received and read a message.

The Clickatell data show that over 90 percent of households received at least one of the messages for all three of the holidays, with only 8 percent of respondents not receiving any of the messages. The partial receipt of the messages coincides with the data on phone number churn rates: in the year between the baseline and endline, only 47 percent of individuals and households in our sample maintained the same phone number. These delivery rates were broadly similar for men and women, although men were more likely to receive the messages, suggesting that they were less likely to change their phone numbers. Overall, this suggests that only half of our intended recipients received the *SMS* intervention in its entirety.

The self-reported data suggest that actual *SMS* usage may have been lower still; only 18 percent of those assigned to the *SMS* treatment recalled receiving an *SMS* message for the previous holiday. Despite the fact that our sample was drawn from respondents who had previously participated in an adult education program, low literacy levels compounded this issue; only 39 percent of those respondents who recalled receiving a message were able to read the message themselves, which is supported by the endline data on literacy rates.⁸ These rates were starkly different for men and women, with men reporting higher rates of receiving and reading the messages. Overall, these results suggest that the *SMS* intervention may have been more salient for those respondents who kept the same mobile phone and were able to read the *SMS*. Nevertheless, these issues highlight some of the potential limitations of *SMS*-based interventions for behavioral nudging, especially in contexts with low literacy rates and high phone churn rates.

IV. Results

A. Estimation Strategy

Given the experimental design of the lockbox and *SMS* interventions, the full empirical specification would control for the lockbox intervention, the *SMS* intervention and the interaction between the two.⁹ However,

⁷While the lockbox savings amounts at 3, 6 and 9 months were self-reported via phone surveys, the amounts in the endline survey were verified by the enumerators. The unconditional amounts saved in the lockbox were \$US3, \$US2.5 and \$US 1.6 at 3, 6 and 9 months, respectively.

⁸These rates are not conditional on the respondent having received a message, as per the phone churn rates or Clickatell data.

⁹ The full specification is $Y_{iv} = \beta_0 + \beta_1 lockbox_v + \beta_2 SMS_i + \beta_3 lockbox_v * SMS_i + \gamma X'_{i0} + \theta_R + u_{iv}$

given the low take-up in the SMS intervention, we focus primarily on the lockbox intervention, controlling for the SMS, using the following specification:¹⁰

$$Y_{iv} = \beta_0 + \beta_1 \text{lockbox}_v + \beta_2 \text{SMS}_i + \gamma X'_{i0} + \theta_R + u_{iv} \quad (\text{Eq. 1})$$

Where Y_{iv} is the outcome of individual i in village v at the endline, lockbox_v is an indicator variable equal to 1 if the village was assigned to the lockbox intervention ($\text{lockbox}=1$), 0 otherwise. SMS_i is an indicator variable for whether individual i was assigned to the SMS intervention ($\text{SMS}=1$), 0 otherwise. θ_R are geographic fixed effects at the sub-regional level. X'_{i0} is a vector of individual level baseline covariates, mainly gender (in all specifications) and marital status, which are included as robustness checks. The error term u_{iv} captures individual shocks. In cases where we have data from the phone and endline surveys, we also control for time fixed effects. Standard errors are clustered at the village level to account for the village-level randomization of the lockbox.

Thus, the coefficient on lockbox (β_1) is the average effect on the outcome of interest of being assigned to the *lockbox* as compared with no lockbox, controlling for the SMS treatment. Our key identification assumption is that the lockbox assignment is exogenous, conditional on stratification fixed effects, SMS treatment assignment and baseline characteristics. We also provide the results from full specification in Table A2.

In addition to these key specifications, we perform a number of robustness checks. First, we modify equation (1) using an ANCOVA specification for those variables for which we have baseline data. Second, given the noisy and skewed nature of expenditure data, we transform these data using an inverse hyperbolic sine, as well as winsorizing. Third, we also estimate the regressions using the full specification. The coefficient for the ANCOVA specification is presented in each table for those outcomes for which we have baseline data, and the p-values for regressions using transformed expenditure data are reported in the necessary tables.

B. Impacts on Ceremonial Expenditures

Table 4 reports the impacts of the *lockbox* intervention on religious festival expenditures. The non-*lockbox* households – regardless of SMS status - spent a total of US\$190 on religious festivals for 2014, with slightly more spent on Tabaski than Ramadan (Table 4, Panel A). Almost all the non-*lockbox* households purchased clothing for the festival (95%), followed by poultry (68%), sheep (27%), goats (18%) and wood (12%).¹¹

Overall, the *lockbox* intervention did not have strong effects on households' or respondents' total festival expenditures or on the types of items purchased, whether investment (clothing) or consumption (such as food and livestock). While households in *lockbox* villages reported spending approximately US\$10 less on Tabaski and

¹⁰In general, we find few statistically significant results for either the SMS or the SMS*lockbox treatments. This could be either due to the lower power of this treatment group or the fact that these reminders were not addressing a primary barrier to savings. Although we are unable to disentangle the two, we believe that low take-up is the primary constraint in this context.

¹¹While traditionally sheep are slaughtered for Tabaski, given the high cost of sheep, households may slaughter goats or poultry for the festival, which are relatively cheaper. Yet households in Niger report that slaughtering poultry gives them a feeling of shame, as they are not following normal customs.

approximately US\$5 more on Ramadan, neither of these coefficients are statistically significant at conventional levels (Panel A, Column 2). The *lockbox* intervention also did not affect the allocation of spending across different categories; the extensive and intensive margins were similar between *lockbox* and *non-lockbox* households for all categories (Panels B and C).¹²

While the lockbox did not affect households' expenditure patterns, it did seem to affect the way in which households financed these ceremonies (especially Tabaski); lockbox households were more likely to use cash savings and less likely to sell livestock to finance their Tabaski expenditures, with statistically significant effects at the 5 percent level (Panel D). While this could be costless crowd out, this is not necessarily the case, given the transaction costs associated with selling livestock, the potential productive uses of those assets, the lumpy nature of livestock and the high intra-annual variation in prices.

Table 5 shows the impacts of the lockbox intervention on other planned ceremonial expenditures, namely weddings and sunas for newborn children. While weddings are often planned – many households in our baseline sample reported deferring weddings until after the harvest – sunas are not, although they are known well in advance. Overall, and similar to the effects on religious ceremonies, there are no strong effects of the lockbox intervention on the intensive or extensive margin of expenditures on these ceremonies, or on the allocation of spending. The only significant finding at the 10 percent level was an increase in the likelihood of having a daughter be married.

C. Risk-Coping

Overall, the results in Tables 4 and 5 suggest that the lockbox intervention did not have strong average effects on ceremonial expenditures along the extensive or intensive margins, even if controlling for baseline outcomes. Yet given the high incidence of shocks in rural Niger as well as the reliance on self-insurance, a reasonable question is whether the lockbox allowed households to better plan for – and respond to – idiosyncratic shocks. For example, approximately 45% of households reported having any household member experience a major illness over the past year, with 63% of respondents and 69% of children in *non-lockbox* households falling ill in the two weeks leading up to the endline. Unsurprisingly, however, there is a strong seasonal pattern to illness, with higher incidence of illness during the rainy season (the time of the baseline and endline surveys in October, ranging from 55-63%), and lower rates during the hot season (ranging from 31-36%).

In order to test this, we estimate a specification of the following form:

¹²The missing values for household Tabaski expenditures are primarily due to the respondent answering “I don't know” when asked this question. Respondents felt comfortable in reporting their own expenditures on these holidays, but not necessarily the expenditures of the entire household. The missing values are not correlated with treatment status. Ramadan expenses were in part collected during one of the phone surveys and the endline survey.

$$(2) Y_{iv} = \beta_0 + \beta_1 \text{lockbox}_{iv} + \beta_2 \text{SMS}_i + \beta_3 \text{lockbox}_{iv} * \text{healthshock}_{iv} + \beta_4 \text{healthshock}_{iv} + \gamma X'_{i0} + \theta_R + u_{iv}.$$

Where lockbox and SMS are defined as previously, and “*healthshock*” is a binary variable equal to 1 if the household experienced a major health shock in the previous year. If households in both *lockbox* and *non-lockbox* villages can cope in the face of health shocks, then β_3 and β_4 should both be zero. If *non-lockbox* households are unable to fully cope with health shocks, then β_4 should be negative. The coefficient on the interaction term (β_3) tests whether households in *lockbox* villages are better able to cope with health shocks, whereas the test of whether β_3 and β_4 are jointly equal to zero tests whether *lockbox* villages are fully insured.

Table 6 reports the estimates of this regression of equation (2), defining “illness” as a major illness in the household over the course of the past year. While health shocks consistently reduced *non-lockbox* households’ self-reported income, assets and livestock owned and food security status (Column 3), *lockbox* households who were affected by a health shock were able to mitigate these negative effects (Panel A, Column 4, with Column 5 providing the p-values for the combined value of *illness* + *lockbox***illness*). In terms of food consumption, *lockbox* households affected by a health shock reduced their likelihood of going a day without food (Panel B) by 11 percentage points, with a statistically significant effect at the 5 percent level. This effect is almost completely offset by the presence of a lockbox. And finally, while *non-lockbox* households affected by a health shock had fewer children in school, the coefficient on the interaction term is positive (but not statistically significant at conventional levels).¹³ None of these risk-coping effects are present when looking at the impact of the lockbox on another common shock in Niger, drought (Table A3). While the coefficients on the ANCOVA specifications are slightly smaller in terms of magnitude and statistical significance, especially for outcomes with baseline imbalance, the results are robust to this specification. One puzzling result in Table 6 is the reported negative total cash savings (from all cash savings mechanisms, including the lockbox, a savings group, under the mattress, etc.) of *lockbox* households who were not affected by a shock; overall, these households had approximately 9,000 CFA (US\$16) less in cash savings than *non-lockbox* households that were not affected by a shock, with a statistically significant effect at the 1 percent level.¹⁴

Table 7 provides further insights into these results by looking at how households financed the response to unforeseen illnesses. Specifically, Table 7 presents households’ health expenditures for the subset of households who had an ill child or adult in the two weeks prior to the baseline, as well as over the course of the year.¹⁵ All of the results are conditional on illness. Overall, the lockbox did not affect a respondent’s likelihood of being treated

¹³None of these welfare effects are jointly statistically significant.

¹⁴ Savings figures reflect savings balances at one point in time. Savings balances were self-reported in the phone surveys, and verified by enumerators in the endline survey.

¹⁵The results in this table are conditional on those households with a health shock, as only those who experienced a health shock answered questions about health expenditures during an illness. Imputing a zero value for households without an illness, we can also estimate equation (3) on the full sample, with similar effects.

or the amount spent (Table 7, Panel A); however, it did affect the way that the household paid for these expenses, decreasing the likelihood of selling off livestock and taking out loans by 6-7 percentage points, with a statistically significant effect at the 5 percent level. A similar pattern emerges for child illnesses (Panel B): *lockbox* households were 2 percentage points more likely to treat the child's illness and were more likely to use savings to pay for the child's health expenses, with a statistically significant effect at the 5-10 percent levels. While households were also less likely to take out loans or sell livestock for children's health expenditures, these effects are not statistically significant at conventional levels. This is consistent with previous literature that suggests that, while livestock are important self-insurance strategies, they are also viewed as productive assets that households do not want to sell in times of distress (Fafchamps, Udry and Czukas 1998, Kazianga and Udry 2004). The results change slightly when using the ANCOVA specification, although still suggest that households were more likely to use cash savings as compared with loans.

While this, in part, explains how households were able to smooth their consumption, it does not explain the finding that *lockbox* households that were *not* affected by a shock held lower levels of cash savings. Table 8 presents some suggestive evidence of how these savings were used, focusing on ceremonial expenditures. First, conditional on having a wedding, households with a *lockbox* (and no illness) were 11 percentage points more likely than others to use savings to pay for the wedding (significant at 10 percent) (Column 2). Households with an illness, on the other hand, were less likely to use cash savings for a wedding. Second, conditional on having a child and having a *sunna*, we again see households with a *lockbox* (and no illness) using cash savings to pay for the ceremony.¹⁶ As with weddings, illness makes this a less likely mechanism for financing the ceremony. Taken together, these results suggest why we find a negative impact of *lockboxes* without illness shocks on cash savings in Table 6 – the *lockbox* helps individuals build cash savings to use for ceremonies in the absence of shocks. We do not include the ANCOVA results for this table, as these results are conditional on having had a wedding or *sunna* in the past year. There was very little overlap amongst those households at baseline and follow-up who had weddings and *sunas* during the previous year, and so baseline values for these expenditures are missing, significantly reducing the sample.

V. Threats to identification

There are several threats to the identification of the above findings. First, while we find the rate of attrition is relatively low (9.8%) in the control group, as mentioned previously, there was no differential attrition between *lockbox* and non-*lockbox* households (Table A1). While there could be unobserved differences between

¹⁶These results are robust to simply conditioning on having a child, as only 24 households who had a birth did not have a child, primarily because the child died or the seven days had not yet passed

attritors and non-attritors, we do not view this as a primary concern, as study attrition between the treatment and control groups was less than 1%.

Second, an obvious concern with estimating the effects on risk coping is whether the health shock is truly exogenous; in other words, if *lockbox* reduced the incidence of a health shock because households used the savings to invest in preventative health measures, this would bias our results. We specifically test for this in Table A3, regressing a number of health shock measures on the *lockbox* variable, using the phone surveys and endline surveys. The results show no statistically significant relationship between the lockbox treatment and health outcomes, thereby suggesting that the lockbox treatment did not affect the likelihood of an illness. In addition, there are also no statistically significant impacts of the lockbox intervention on other shocks, namely, those that were unexpected events, such as drought (Table A4).

Third, in Tables 4-7, we examined the impact of the treatments on over 40 different outcomes. Overall, we do not find any average effects of the *lockbox* intervention on key outcomes of interest related to ceremonial expenditures, but find that the savings device allowed households to better cope with risk in the face of health shocks (Table 6) and somewhat modified the way in which households paid for ceremonial and health expenditures (Tables 4 and 8). Nevertheless, given the number of comparisons in these tables, this may raise concerns that any observed effects cannot be attributed to the *lockbox* intervention, but are rather simply observed by chance among all of the different outcomes. We therefore use a False Discovery Rate (FDR)-adjusted p-value (or q value), which adjusts for the mean correlation among correlated outcomes, focusing on the key outcomes of interest. Using these adjusted q-values, many of the statistically significant results remain significant – or marginally statistically significant – with the exception of self-reported income and plow ownership (Table A5).

Fourth, we acknowledge that non-classical measurement error (NCME), which occurs when the “error in measuring a variable of interest is correlated with the true value of that variable, with the true values of other variables in the model, or with the errors in measuring those values” (Abay *et al.*, 2018) is a fundamental issue in empirical economics, and that it is possible that some of our variables are affected by NCME. NCME could bias our results, even if only dependent variables are affected (Schennach, 2016). Recall-based surveys such as our household and phone surveys can be vulnerable to NCME as respondents misremember values over extended recall periods, anchor later responses on earlier misremembered values, round values, or intentionally misreport values to hide wealth, seek approval of enumerators, or try to position themselves to receive future development project inputs. We have used several strategies to minimize the likelihood of NCME. For example, the recall periods for key variables were carefully considered as is considered best practice (MacKenzie, 2012); events that are easy to remember like household weddings or sunas had a longer time horizon (since the last harvest), versus harder to remember events like a respondent’s illness and treatment (the last two weeks). In addition, we conduct three follow-up phone surveys with a subset of the sample in addition to the in-person follow-up survey; multiple follow-ups can reduce NCME by shortening the recall periods (Schennach, 2016; MacKenzie, 2012). The

enumerators used for all phone and in-person surveys are experienced and carefully trained before every survey round to be conscious of behaving in an objective manner and not offering verbal or non-verbal cues to respondents that connote approval for particular answers. Finally, for the critical variable of the amount of savings in the lockbox, the amount was visually confirmed by enumerators and is not based on respondents' recall.

VI. Conclusion

Poor households in rural Niger face significant financial management challenges. In the absence of formal financial tools, they strive to smooth day-to-day consumption and finance important religious and ceremonial expenditures while weathering frequent severe shocks. We find that by using a variety of financial strategies, even very poor rural households accumulate and spend significant amounts of money to celebrate religious festivals, but are often unable to meet savings goals for education, health or agriculture expenses. We also find that health shocks are prevalent and have seriously negative effects on households' measures of wellbeing including income, assets, and food security.

We use a field experiment in which we randomly varied access to a simple savings technology, combined with SMS message reminders, to better understand ceremonial spending behavior, coping behavior, and the roles played by self-control and lack of access to savings products. To address the lack of a safe place to save, we provide an informal savings technology, a simple lockbox, which offered individuals a more secure place to put their money. To address self-control, we send SMS savings reminders about households' spending and savings goals, in particular for religious festivals (Ramadan and Tabaski), health and education, and general savings. We also provide a subset of households with access to both treatments. We analyze a combination of pre- and post-household survey data, telephone survey data, and Clickatell user data to estimate the effects of the interventions on our outcomes of interest.

Overall, due to high imperfect compliance for the SMS intervention, we concentrated on the lockbox intervention. The lockbox allowed households affected by shocks to smooth their food consumption and maintain their asset holdings, in part explained by households' shift away from using livestock and loans and towards using cash savings to finance their expenditures. These results suggest that a simple savings device can allow households to finance unexpected events by holding onto their productive assets, namely livestock.

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Figure 1. Timeline of Data Collection and Intervention Activities

Year	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
2013						Design program	Baseline survey	Baseline Survey Lockbox distribution	Tabaski Harvest	Harvest	Phone survey (1)
2014		Phone survey (2)			Ramadan	Phone survey (3)		Tabaski	Harvest	Endline Harvest	

Figure 2. Savings usage and balances among lockbox households over time

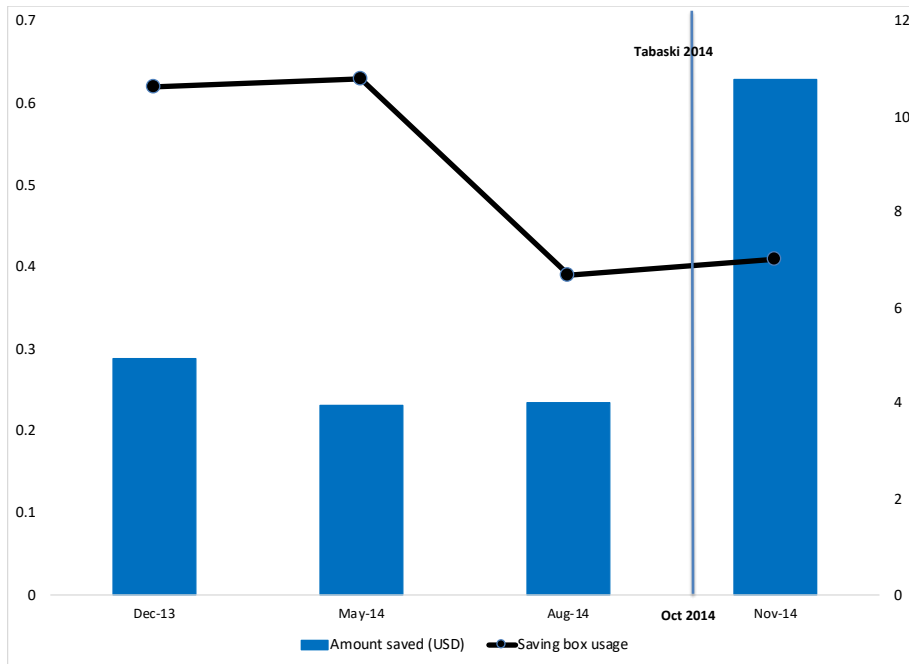


Table 1: Baseline Household Characteristics

	Control Group	Lockbox	
	Mean (s.d.)	Coeff (s.e.)	Obs
	(1)	(2)	
Panel A: Socio-demographic characteristics			
Age of Respondent	41.13 (14)	1.24 (1.75)	1121
Respondent is a woman	0.49 (0.50)	0.00 (0.01)	1121
Respondent is married	0.88 (0.32)	0.06** (0.02)	1121
Respondent is Hausa	0.89 (0.31)	-0.01 (0.02)	1121
Panel B: Assets, Income and Food Security			
Number of asset categories owned by household	6.18 (1.89)	0.08 (0.15)	1121
Household owns a plow	0.22 (0.42)	0.04 (0.04)	1121
Household owns sheep	0.72 (0.43)	0.07** (0.03)	1050
Household owns a cellphone	0.90 (0.29)	-0.01 (0.03)	1121
Respondent has used a cellphone since last harvest	0.90 (0.31)	0.00 (0.02)	1118
Self-reported income	2.24 (0.90)	-0.02 (0.06)	1121
Number of income sources used by household (out of 12)	4.04 (1.21)	-0.09 (0.07)	1121
Household has gone a day without food	0.22 (0.42)	0.01 (0.04)	1096
Panel C: Shocks			
Household has experienced serious illness in past year	0.45 (0.50)	0.01 (0.04)	1121
Respondent was sick since the past harvest	0.55 (0.50)	0.01 (0.03)	1121
Household experienced a death in the past year	0.15 (0.35)	-0.00 (0.02)	1121
Household has experienced drought since last harvest	0.71 (0.45)	0.01 (0.03)	1121

Notes: Column 1 presents the mean for the control group (non-lockbox, non-SMS); Columns 2-4 report the coefficient from a regression of the dependent variable on an indicator variable for treatment assignment and village level fixed effects to account for randomization. Robust standard errors clustered at the village level are in parentheses. *, **, *** represent significance at the 10 percent, 5 percent and 1 percent levels, respectively.

Table 2: Baseline Household Characteristics

	Control Group Mean (1)	Lockbox Coeff (s.e.) (2)	Obs
Panel A: Financial Mechanisms			
Save at home	0.40 (0.49)	-0.03 (0.03)	1121
Save in a savings group	0.40 (0.49)	-0.04 (0.03)	1121
Save in a bank	0.00 0.06	0.01 (0.01)	1121
Save as food	(0.06) (0.46)	0.03 (0.03)	1121
Save as livestock	0.75 (0.43)	0.04 (0.03)	1121
Panel B: Tabaski expenditures			
Household's total spending for Tabaski (CFA)	53404.00 (44949.00)	2,403.21 (4,589.10)	867
Respondent's total spending for Tabaski (CFA)	22323.00 (24784.00)	3,658.51* (2,130.25)	1102
Household purchased clothing for Tabaski	0.95 (0.22)	0.00 (0.02)	1121
Household purchased sheep for Tabaski	0.31 (0.46)	-0.01 (0.03)	1121
Household purchased goat for Tabaski	0.27 (0.45)	-0.02 (0.03)	1121
Household purchased poultry for Tabaski	0.68 (0.47)	-0.06 (0.04)	1121
Household spending on sheep for Tabaski	18313.00 (25791.00)	-30.94 (2,318.40)	1046
Panel C: Other ceremonial expenditures			
Household had a birth since the last harvest	0.33 (0.47)	-0.01 (0.03)	1121
Of those with a birth, household celebrated suna	0.93 (0.26)	-0.01 (0.03)	354
Household spending on suna (unconditional) (CFA)	13368.00 (28388.00)	-1,969.28 (1,578.18)	1099
Household celebrated a marriage since last harvest	0.16 (0.37)	-0.01 (0.02)	1121

Household spending on wedding (unconditional) (CFA)	19236.00 (67472.00)	1,827.71 (5,022.59)	1121
Panel D: Health and Funeral expenditures			
Respondent was sick since the last harvest	0.55 (0.50)	0.01 (0.03)	1121
Household spending on respondent's last illness (CFA)	19264.00 (46866.00)	-3,457.56 (3,492.60)	544
Child in household was sick since the last harvest	0.64 (0.48)	0.07* (0.04)	1121
Household spending on child's last illness (CFA)	4153.80 (10504.00)	489.74 (897.27)	725
Household experienced a death since the last harvest	0.15 (0.36)	0.00 (0.03)	1121
Household spending on funeral expenses (CFA) (conditional)	1830.22 (7224.00)	-925.10* (518.72)	1121

Notes: Column 1 presents the mean for the control group (non-lockbox, non-SMS); Columns 2-4 report the coefficient from a regression of the dependent variable on an indicator variable for treatment assignment and village level fixed effects to account for randomization. Robust standard errors clustered at the village level are in parentheses. *, **, *** represent significance at the 10 percent, 5 percent and 1 percent levels, respectively.

Table 3. Take-up and Usage

	Entire Sample			Women		Men	
	Obs.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Panel A: Take-up and usage of lockbox							
Received lockbox	556	0.96	0.19	0.96	0.2	0.97	0.17
Still has lockbox (Endline)	512	0.99	0.11	0.99	0.09	0.98	0.13
Will show lockbox (Endline)	505	0.99	0.09	0.99	0.11	0.99	0.06
Keeps lockbox locked (endline)	505	0.78	0.41	0.77	0.42	0.8	0.4
Has savings in lockbox (Endline)	505	0.41	0.49	0.35	0.48	0.46	0.5
Amount of money in lockbox conditional (CFA) (Endline)	180	5391.00	7567.00	5413	8514	5375	6817
Panel B: Take-up of SMS message							
<i>Clickatell delivery rates:</i>							
Received SMS for all three holidays	556	0.53	0.50	0.5	0.5	0.59	0.5
Received SMS for some of three holidays	556	0.39	0.49	0.39	0.49	0.35	0.48
Did not receive SMS for any of three holidays	556	0.08	0.27	0.1	0.3	0.06	0.25
<i>Phone number churn rates:</i>							
Individual had same phone number	233	47	0.5	0.34	0.47	0.21	0.41
Household maintained same phone number	1123	0.48	0.50	0.48	0.5	0.57	0.5
<i>Self-reported take-up:</i>							
Received an SMS reminder for Tabaski 2014	556	0.18	0.38	0.06	0.24	0.25	0.44
Read the message themselves	71	0.39	0.49	0.09	0.3	0.55	0.5
Someone read the message for them	45	0.77	0.43	0.86	0.35	0.03	0.18
Spouse received an SMS reminder for Tabaski 2014	378	0.03	0.17	0.03	0.18	0.02	0.14

Notes: Each column simply shows the mean of that variable for the given sample. These data are comprised of the household and phone surveys, as well as the Clickatell usage data.

Table 4: Tabaski and Ramadan Expenditures

	Control Group Mean (s.d.)	Lockbox Coeff (s.e.)	Lockbox (ANCOVA) Coeff (s.e.)	Winsorized p-value of lockbox	Non-Linear transformation p-value of lockbox	Obs
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Tabaski and Ramadan Total Expenditures						
Total Tabaski spending for the household (CFA)	61,342 (73910)	-5,866.25 (6,702.04)	-3,589.24 (4,696.59)	0.69	0.34	821
Total Tabaski spending for the respondent (CFA)	26,192 (29702)	1,618.59 (1,846.05)	273.80 (1,600.99)	0.37	0.28	978
Total Ramadan spending for the household (CFA)	53,624 (41553)	2,894.77 (3,777.27)		0.51	0.3	788
Total Ramadan spending for the respondent (CFA)	27,020 (29722)	1,822.90 (2,275.22)		0.78	0.97	788
Panel B: Investment expenditures for Tabaski and Ramadan						
Household purchased clothing for Tabaski	0.95 (0.21)	0.01 (0.02)	0.02 (0.03)			995
Household purchased children's clothing for Tabaski	0.70 (0.46)	0.02 (0.03)	0.01 (0.01)			995
Household purchased clothing for Ramadan	0.86 (0.34)	0.02 (0.01)				995
Panel C: Consumption expenditures for Tabaski and Ramadan						
Household purchased poultry for Tabaski	0.65 (0.47)	-0.06 (0.04)	-0.00 (0.03)			995
Household purchased sheep for Tabaski	0.27	0.01	0.02			995

	(0.45)	(0.04)	(0.03)			
Amount spent on sheep for Tabaski (CFA) (unconditional)	18,292.00	-827.36	-860.02	0.94	0.97	953
	(26927.00)	(2,836.27)	(1,902.40)			
Household purchased goat for Tabaski	0.18	-0.02	0.01			995
	(0.39)	(0.04)	(0.03)			
Household purchased wood for Tabaski	0.12	-0.01	0.00			995
	(0.33)	(0.03)	(0.03)			
Household purchased goat and/or sheep for Ramadan	0.13	-0.00				995
	(0.33)	(0.03)				
Household purchased wood for Ramadan	0.13	-0.01				995
	(0.34)	(0.03)				
<hr/>						
Panel D: Financing Mechanisms						
Used savings to pay for Tabaski	0.55	0.06**	0.05*			995
	(0.50)	(0.02)	(0.03)			
Used livestock to pay for Tabaski	0.18	-0.05**	-0.04**			995
	(0.39)	(0.02)	(0.02)			
Used loans to pay for Tabaski	0.27	0.02	0.00			995
	(0.44)	(0.03)	(0.03)			
Used savings to pay for Ramadan	0.37	-0.01				223
	(0.49)	(0.10)				
Used livestock to pay for Ramadan	0.31	-0.08				223
	(0.47)	(0.07)				
Used loans to pay for Ramadan	0.41	-0.10				223
	(0.50)	(0.07)				

Notes: Column 1 presents the control group (non-lockbox) mean. Column 2 presents the coefficients from a regression in the form of Equation 2. Column 3 presents the coefficients from an ANCOVA regression. Robust standard errors clustered at the village level are reported in parentheses. ***, **, * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

Table 5: Other Ceremonial Expenditures

	Control Group	Lockbox	Lockbox (ANCOVA)	Winsorized	Non-Linear transformation	
	Mean (s.d.)	Coeff (s.e.)	Coeff (s.e)	p-value of lockbox	p-value of lockbox	Obs
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Sunas						
Household had a birth since the last harvest	0.37 (0.48)	0.04 (0.04)	0.04 (0.04)			995
Total suna spending for the household (CFA) (unconditional)	12203 (25257)	2,136.19 (1,563.91)	2,321.41 (1,636.20)	0.19	0.36	995
The respondent contributed to the suna expenses	0.32 (0.47)	0.04 (0.03)	0.04 (0.03)			995
Panel B: Weddings						
The household celebrated a marriage since the last harvest	0.21 (0.41)	0.02 (0.03)	0.03 (0.03)			995
Son was married (unconditional)	0.10 (0.29)	-0.01 (0.02)				995
Daughter was married (unconditional)	0.09 (0.28)	0.04* (0.02)				995
Total wedding expenditures for the household (CFA) (unconditional)	24484 (60831)	3,995.37 (4,885.23)	4,001.60 (4,934.64)	0.17	0.71	995
Dowry was a wedding expense	0.13 (0.32)	-0.01 (0.02)	-0.01 (0.02)			995

Bed was a wedding expense	0.09 (0.30)	0.04 (0.02)	0.04* (0.02)	995
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Notes: Column 1 presents the control group (non-lockbox) mean. Column 2 presents the coefficients from a regression in the form of Equation 2. Column 3 presents the coefficients from an ANCOVA regression. Robust standard errors clustered at the village level are reported in parentheses. ***, **, * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

Table 6: Households' Responses to Health Shocks

	Control Group Mean (s.d.)	Lockbox Coeff (s.e.)	Illness Coeff (s.e.)	Lockbox*Illness Coeff (s.e.)	p-value (<i>Lockbox*Illness</i> + <i>Illness</i> =0)	Obs
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Core Specification						
<i>Income, Assets and Savings</i>						
Self-reported income (scale of 5)	2.71 (0.62)	-0.05 (0.07)	-0.23*** (0.06)	0.16* (0.09)	0.26	998
Number of asset categories owned	5.92 (1.93)	-0.06 (0.23)	-0.44** (0.21)	0.41 (0.29)	0.91	998
Owned a plow	0.28 (0.45)	-0.01 (0.05)	-0.07* (0.04)	0.11** (0.05)	0.27	998
Owned sheep	0.75 (0.43)	-0.04 (0.04)	-0.09** (0.04)	.13** (0.06)	0.24	998
Total amount saved using all mechanisms	18,594 (44976)	-8,996.92*** (2,242.70)	-3,076.21 (2,841.12)	7,424.12** (3,123.47)	.00***	998
<i>Food Security and Education</i>						
Months of Adequate Household Food Provisioning (MAHFP)	8.88 (1.85)	0.08 (0.20)	-0.82*** (0.16)	0.13 (0.24)	.00***	998
Household went a day without food	.18 (0.39)	0.03 (0.03)	0.12*** (0.03)	-0.11** (0.05)	0.92	866
Any child in the household attends school	0.90 (0.30)	0.00 (0.03)	-0.01 (0.03)	0.06 (0.04)	0.33	998
Number of children in household attending school	2.60	0.17	-0.15	0.34	0.11	998

	(1.81)	(0.18)	(0.17)	(0.26)		
Panel B: ANCOVA						
Self-reported income (scale of 5)	2.71 (0.62)	-0.04 (0.06)	-0.22*** (0.06)	0.15* (0.09)	0.26	998
Number of asset categories owned	5.92 (1.93)	-0.08 (0.17)	-0.39** (0.17)	0.34 (0.24)	0.79	998
Owned a plow	0.28 (0.45)	-0.04 (0.04)	-0.06 (0.05)	0.10* (0.05)	0.17	998
Owned sheep	0.75 (0.43)	-0.06 (0.04)	-0.08** (0.04)	0.13** (0.05)	0.18	998
Household went a day without food	.18 (0.39)	0.02 (0.03)	0.11*** (0.03)	-0.11** (0.05)	0.97	866

Notes: Column 1 presents the control group (non-lockbox) mean. Panel A, Columns 2-4 present the coefficients from a regression in the form of Equation 2 but controlling for a binary variable of any health shock and the interaction term. Panel B, Columns 2-4 present the coefficients from an ANCOVA regression but controlling for a binary variable of any health shock and the interaction term. Robust standard errors clustered at the village level are reported in parentheses. ***, **, * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

Table 7: Households' Health Expenses (Conditional on a Health Shock)

	Control	Lockbox	Lockbox (ANCOVA)	
	Mean (s.d.)	Coeff (s.e.)	Coeff (s.e.)	Obs
	(1)	(2)	(3)	(4)
Panel A: Respondent Health Expenses				
Treated the last illness	0.87 (0.33)	-0.02 (0.02)	0.01 (0.03)	940
Amount spent on last illness	11452 (39440)	-32.89 (1,974.13)	-4,138.61 (2,982.73)	827
Did not pay some expenses	0.09 (0.28)	-0.00 (0.02)	-0.01 (0.02)	847
Used savings for expenses	0.43 (0.50)	0.03 (0.03)	0.04 (0.04)	848
Used livestock for expenses	0.14 (0.35)	-0.06** (0.02)	-0.04 (0.03)	848
Used a loan for expenses	0.25 (0.44)	-0.07** (0.03)	-0.07* (0.04)	848
Panel B: Child Health Expenses				
Treated the child's last illness	0.92 (0.27)	0.02* (0.01)	0.02 (0.02)	1175
Amount spent on last illness	4659 (15336)	-284.29 (1,579.75)	1,169.10 (2,011.19)	1013
Did not pay some expenses	0.04 (0.20)	-0.02 (0.01)	-0.03* (0.01)	1029
Used savings for expenses	0.45 (0.50)	0.02** (0.01)	0.04** (0.02)	1029
Used livestock for expenses	0.09 (0.28)	-0.02 (0.02)	-0.02 (0.02)	1029
Used a loan for expenses	0.17 (0.37)	-0.04 (0.03)	-0.03 (0.03)	1029

Notes: Column 1 presents the control group (non-lockbox) mean. Column 2 presents the coefficients from a regression in the form of Equation 2. Column 3 presents the coefficients from an ANCOVA regression. Robust standard errors clustered at the village level are reported in parentheses. ***, **, * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

Table 8: Wedding and Suna Expenditures by Health Shocks

	Control Group Mean (s.d.)	Lockbox Coeff (s.e.)	Illness Coeff (s.e.)	Lockbox*Illness Coeff (s.e.)	Obs
	(1)	(2)	(3)	(4)	(5)
Wedding					
Had a wedding	0.25 (0.43)	0.03 (0.04)	-0.04 (0.04)	-0.01 (0.06)	995
A daughter got married	0.44 (0.50)	0.11 (0.08)	-0.13 (0.09)	0.03 (0.12)	221
Amount spent (CFA) on the wedding	112125 (100085)	25,335.66 (20,678.15)	-36,369.77 (34,759.13)	18,817.68 (26,854.89)	221
Log(Amount spent) on the wedding		0.26 (0.19)	-0.04 (0.19)	-0.01 (0.27)	221
Used savings to pay for the wedding	0.81 (0.40)	0.11* (0.06)	-0.24** (0.10)	-0.08 (0.13)	221
Sunas					
Had a suna	0.90 (0.30)	0.00 (0.04)	0.01 (0.04)	0.00 (0.05)	384
Amount spent (CFA) on the suna	44414 (35651)	-3,375.53 (4,259.60)	-6,696.39 (4,535.08)	6,899.49 (6,151.61)	356
Used savings to pay for the suna	.77 (0.42)	0.11** (0.05)	-0.31*** (0.07)	-0.04 (0.09)	356

Notes: Column 1 presents the control group (non-lockbox) mean. Panel A, Columns 2-4 present the coefficients from a regression in the form of Equation 2 but controlling for a binary variable of any health shock and the interaction term. Panel B, Columns 2-4 present the coefficients from an ANCOVA regression but controlling for a binary variable of any health shock and the interaction term. Robust standard errors clustered at the village level are reported in parentheses. ***, **, * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

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**Sticky Little Institutions:
A Study of Older Savings Groups in Benin**

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Abstract. This paper presents the results of a qualitative study examining how Savings and Internal Lending Communities (SILC) savings groups in rural Benin changed after several years of independent operation. Focus groups and individual interviews were held with members of twenty-three 3- and 4-year-old SILC groups. Key findings regarding the characteristics of the study sample include that more than 80% of the 3- and 4-year old SILC groups were still active; savings share amounts, average savings per member, and share-out amounts increased over time; members of groups that meet weekly save more than members of groups that meet fortnightly; written recordkeeping was a challenge and the lack of a literate secretary is the stated reason that 80% of the inactive groups have stopped meeting. Additionally, using Qualitative Comparative Analysis (QCA), the paper analyzes configurations of conditions present among the 23 SILC groups and finds that for a group in the sample to become inactive, the lack of a literate secretary was a necessary condition.

Acronyms

ASCA	Accumulating Savings and Credit Association
CRS	Catholic Relief Services
NGO	Non-governmental organization
ROSCA	Rotating Savings and Credit Association
QCA	Qualitative Comparative Analysis
SILC	Savings and Internal Lending Communities
SG	Savings group

I. Introduction:

The savings group methodology is a financial services methodology that exists indigenously in many cultures, and that is promoted by international development NGOs to extend access to financial services to households unreached or underserved by the formal sector (Gash 2017, Wilson et al, 2010). Savings groups are informal member-owned and -managed institutions that provide savings, credit and insurance services to their members. In many cultures, they are ancient local grassroots institutions. For example, West African *susus* have existed for centuries and Korean *kyes* were first documented in a 1663 Korean census (Light and Bonacich, 1988). In Benin, the location of the study presented in this paper, 28% of adults save in a community-based savings method such as a savings group; this is on par with the average of 26% of adults throughout Sub-Saharan Africa (Demirguc-Kunt et al, 2018).

The services that savings groups provide are basic, but they have been shown to be safe repositories for savings and reliable sources of loans or insurance funds, and are often the only source of those services for their members (Gash 2017; Matthews et al, 2010; Wilson et al, 2010; Allen 2002; Johnson et al, 2010). The emphasis on savings is often deemed more appropriate than a focus on credit for poorer people (Rutherford, 2003). In Kenya, Dupas and Robinson found that those who had access to savings services, even informal savings services, were more likely to increase their investment in health and increase their productivity and income (Dupas and Robinson, 2009, 2011). Savings has been found to be a critical financial service for the poor, especially rural households who derive their income from agriculture as do the households in this study. Such households are especially vulnerable to food insecurity during the hungry season before the harvest, as they are liquidity-constrained and food prices tend to rise (MkNelly and Dunford, 1998). In her recent meta-analysis of savings group impact evaluations, Megan Gash determines that there is strong evidence that savings groups help to strengthen food security (Gash, 2017).

The most common indigenous savings group is a Rotating Savings and Credit Association (ROSCA) model in which the group's savings is disbursed to one member each time the group meets and saves (Rutherford, 2003; Wilson et al, 2010). The model currently promoted by NGOs like CARE, Catholic Relief Services (CRS), Oxfam/Freedom from Hunger, Plan, Pact, World Vision and the Aga Khan Foundation is more complicated and allows for savings to accumulate over time. These models are called Accumulating Savings and Credit Associations (ASCAs), and to track accumulated savings and loans most of these groups are trained in a written recordkeeping system (Vanmeenen and Bavois, 2010; Allen and Staehle, 2007). The NGOs promoting the ASCA methodology report more than 10 million members across 70 countries (Karlan et al, 2017).

CARE was the first international NGO to adapt indigenous savings group practices into an ASCA model, and they began this activity in Niger in 1991 (Helmre, Chidiac and Hendricks, 2009). The model developed slowly and iteratively through several years of intensive collaboration between CARE program staff and women in the savings groups (Allen, 2002). As Moira Kristin Eknes, the CARE program manager who led the project, recounted, 98% of the women in these early groups were non-literate and most groups did not have a single literate

member, and therefore the model was originally designed to operate from memory only and without written records (Helmre, 2010). Over time, the model has been standardized and a written recordkeeping system has become part of the training for the majority of groups (SEEP, 2018; Vanmeenen and Bavois, 2010; Allen and Staehle, 2007). The use of written systems may pose a risk to savings group persistence and the safety of member funds (SEEP 2018). A recent survey of savings groups in Rwanda, Burkina Faso, Tanzania and Madagascar found that “Almost all groups had their record maintained by a recordkeeper. However, 16 percent of surveyed groups reported that no member other than the recordkeeper was capable of maintaining group records” (SEEP, 2018; pg. 26).

Little is known about how savings groups evolve after they cease to engage directly with external support, how they meet members’ financial needs over time, if or how they meet the needs of other community members over time, and the rates at which they remain active or become inactive. Although research has shown that many groups exist years after external support ended and that some groups even form new groups without NGO support (Anyango et al, 2007), many groups do not persist, and cease to meet after NGO involvement comes to an end (Ashe and Aryal 2017, Hartley and Rijali, 2003; Allen and Hobane, 2004).

The ability of groups to persist (or the lack thereof) is significant, because although few longer-term studies of savings group performance have been conducted, available evidence suggests that groups that do continue to function for several years provide more benefit to more members over time; for example, a longer-term evaluation examining Oxfam’s Saving for Change (SfC) program after 36 months found that households in communities with access to SfC held on average \$120 more in livestock (a 13% difference), the equivalent of four goats or one calf (BARA and IPA, 2013). Several qualitative studies also suggest that measurable benefits to asset and income levels accrue to members over the longer term (see, for example, Allen and Hobane, 2004; Anyango et al, 2007).

This study aims to improve our understanding of older NGO-promoted groups by providing insight into how rural savings groups in Benin change after they become independent of NGO support, including whether the groups remain active, how members use the groups’ financial services, changes in group policies, and changes in member composition (including the number of members and the gender ratio of members). A qualitative study methodology is used, and is described in detail in Section III, to facilitate exploration of group characteristics and processes, and the ways that members utilize their services over time.

Building upon the qualitative results, this study also seeks to improve our understanding of conditions that undermine NGO-promoted savings group performance in rural Benin. Using Qualitative Comparative Analysis (QCA or Boolean analysis), the paper explores combinations of conditions related to the cessation of functioning of a subset of the savings groups.

The paper proceeds as follows: Section II presents the study context. Section III discusses data and methodology. Section IV presents results. Section V presents Boolean analysis on determinates of group persistence. Section VI concludes.

II. Study Context

In 2006, Catholic Relief Services (CRS) Benin began to focus its microfinance strategy on savings-led methodologies and became one of the first CRS country programs to implement the Savings and Internal Lending Community (SILC, pronounced “silk”) savings group methodology, an ASCA methodology described in detail below. The data analyzed in this paper was collected in partnership with Catholic Relief Services-Benin staff member Jerome Dadjo, the CRS-Benin SILC program manager.

The study took place in the Dioceses of Natitingou and Abomey in Benin, and the study process was aided by CRS partners Caritas Abomey and Caritas Natitingou. The field research was conducted in August 2011, in twenty-three rural villages.

The CRS country program in Benin was selected to host the study given: 1) CRS Benin’s long history of SILC implementation, which provided the opportunity to study groups in their third and fourth years of operation; 2) the country program’s commitment to learning about SILC; and 3) the fact that communities with older SILC groups had not yet received any other development assistance from CRS. CRS Benin planned to continue its work promoting SILC through its partner organizations was eager to better understand how older groups have—or have not—continued to function once independent of external support.

The households in rural villages in these areas of Benin are engaged in agriculture production, have low levels of literacy, and lack access to a range of safe, affordable financial services. Literacy rates in Benin are low. Only 22% of adult women and 45% of adult men nationwide are literate (UNESCO, 2012). In the villages visited, people were able to access loans from three formal sources including a government microcredit program called “Microcredit for the very poor” (Microcrédit aux Plus Pauvres, MCPP), an agricultural cooperative (which had just recently become defunct at the time of the study) and a local credit union (caisse rural). 76 percent of SILC members reported taking a loan from one of these sources before joining SILC, but only 11 percent of the active SILC members had a loan from an external source. Members who had an external loan before but not after SILC participation said that they preferred SILC terms and rates, they found it easier to repay SILC loans, and they preferred that the interest stays within the group rather than going to the loan provider. Members found that the solidarity group methodology used by credit unions, the requirement to put in mandatory savings before receiving a loan, and loan terms that were perceived as too short with interest rates which were too high made external loans unpreferable.

Not a single SILC member reported saving in any formal financial institution. SILC members reported that there were no formal savings services that they knew of and could access. They did not consider the mandatory savings required by the credit unions to access a loan to be savings, as it was used to pay down the loan, and you could not save in the credit union in any other way. The only savings options available to SILC members in these communities were informal services including tontines, SILC, or at home.

The SILC Methodology

The SILC model is designed to provide access to transparent financial services to people who are often excluded from formal financial institutions’ services because they are too poor or too remote from the institutions. SILC creates a secure savings system, with positive returns, and a

group-managed internal loan fund. It promotes the creation of a social insurance fund for emergency purposes, to which all members contribute regularly, and from which all can access in time of need.

At their initial formation, SILC groups are composed of 10-30 people who self-select into the group. The group meets on a regular basis, weekly or bi-weekly, to save small sums that are pooled to be able to offer loans to individual group members. All cash-on-hand is kept in a lockbox that is secured by three padlocks; the treasurer keeps the box in between meetings and three separate key keepers hold the padlocks' keys. The self-selected groups are trained to make their own group rules, known as the "constitution," and manage their own savings, loan, and emergency fund (known as the "social fund") transactions. All groups keep their own records using a written ledger system. Each group elects its own management committee which includes: the President, who manages the meetings; the Secretary, who keeps the records; the Treasurer, who is responsible for the lockbox; and the Money Counters, who count the cash of each transaction conducted by the group.

During the first cycle, the groups operate for about 12 months, after which the savings plus interest earned from the internal loans and any fees is returned to members in proportion to their savings contributions at a "share-out" ceremony. The share-out acts as an internal audit to ensure actual group finances match with the records. The groups are trained to elect new officers and re-start their savings programs immediately after the share out.

The only external inputs to the group are the training and supervision they receive from the partner organization. Groups are trained and supervised for the entirety of their first cycle by a field agent who is in turn supervised by a partner staff SILC Supervisor. Groups contribute towards the cost of their own equipment (the lockbox, 3 padlocks, and ledger books).

III. Data and Methodology

This study took place in the Dioceses of Natitingou and Abomey in Benin, and the study process was aided by CRS partners Caritas Abomey and Caritas Natitingou. The field research was conducted in August 2011, in twenty-three rural villages with the members of active and inactive SILC groups. The research team was composed of the author and Jerome Dadjo, CRS SILC program manager.

The study used a qualitative methodology of open-ended questions in semi-structured individual interviews and focus group discussions. An interview guide was used for individual interviews and focus group discussions. The decision to use a qualitative rather than a quantitative methodology was based on the desire to explore groups' characteristics and to listen to the groups' members. Given that so little research had been conducted with older groups, an exploratory approach was determined to be most appropriate for this research. The qualitative approach allowed for capturing the richness and the variety of different members' and groups' experiences.

The study sample was selected through random selection from all those groups that had been formed by Caritas Abomey and Caritas Natitingou that had graduated from external support at least one complete cycle previously, after stratifying by geographical area. (The exception is groups formed in the commune of Matéri. Communities in Matéri are very difficult to visit in August, and so were not included in the study sample.) Given logistical considerations, it was determined that twenty-four SILC groups could feasibly be visited during the field research, and so after stratifying by geographical area twenty-four groups were randomly selected from the master list of groups. Ultimately, focus groups and individual member interviews were conducted with twenty-three of the twenty-four selected groups; one group could not be visited due to heavy rains.

During the field research, data was collected through focus groups (n=23), qualitative interviews with SILC members or former SILC members (n=31), key person interviews with local leaders and partner organization staff (n=10), and field agent interviews (n=12). Interviewees from savings groups were randomly selected from the savings group member list. On two occasions, the selected interviewees were not available to be interviewed. In those cases, another respondent was selected at random. In total, the research team spent fourteen days visiting twenty-three active and inactive SILC groups in twenty-three different rural villages and spoke with 258 people.

Interviews were recorded on an MP3 player, and notes were taken. The questions regarding past saving, loan, share out, and emergency fund amounts and uses were asked beginning with recalling amounts from the first cycle, and moving forward one cycle at a time. Additionally, savings and share-out amounts were verified visually in the group ledger. Once the data were collected, all monetary values were recorded and analyzed using MS Excel. Qualitative data was recorded by respondent in MS Excel as well, including quotes of interest. Some qualitative data was coded for use in Qualitative Comparative Analysis (QCA). For these data, guidelines for coding variables as 0 or 1 were established ahead of time and the data coded accordingly. Detail on the QCA methodology is provided in Section V.

18 of the 23 SILC groups visited (or 78%) were active and 5 of 23 groups (or 22%) were inactive. Active refers to those groups which are still meeting and conducting SILC activities, and inactive refers to groups that have ceased to meet. All the active groups were in either their third (n=5) or fourth (n=13) cycle. The percentage of active groups in our sample was consistent with the numbers of active and inactive groups in the whole CRS-Benin portfolio, as reported by field agents and triangulated with supervisors, who conduct periodic site visits. Each of the 12 field agents interviewed were asked how many of the groups that they formed three or four years ago were still active; as most field agents live in the communities where they form groups, their knowledge regarding the groups' status was considered reliable. Field agents report that approximately 330 of 403 SILC groups that they originally formed, or 82%, were still active, and 73 of 403, or 18%, were inactive.

IV. Results

This section presents the results of qualitative analysis regarding if and how SILC groups had changed their policies over time, and if members were utilizing financial services in different ways since the first cycle.

Independence of the SILC groups

Given that we were interested in the operations of older groups that were operating independently, it was necessary to investigate just how independent the groups were from NGO support, which was done through interviews with partner staff and SILC management committees. Most of the groups were operating independently without support from Caritas, from their original field agent, nor from another NGO or governmental organization. However, approximately a third of the groups still called upon the field agent when they needed help. Common challenges that they asked the field agent to help resolve were loan repayment problems, share-out calculations, and strategizing how to get more money into the loan fund. This work on the part of the field agent was not compensated by Caritas or CRS, as the SILC project had been concluded. However, two of the groups said that they paid their field agent a small amount for the assistance. None of the groups was yet involved with another development project.

IV.A. Utilization of financial services

Savings policies and amounts

The average weekly savings amounts of members increased from 346 CFA (\$0.77) in the first cycle to 814 CFA (\$1.81) in the fourth cycle, an increase of 135%. At the time of the study, per capita annual income in Benin was \$825 (World Bank Open Data, 2019). All SILC members interviewed but two reported that their savings had risen over time. The first exception was an elderly woman who reported that she could no longer be as active, and so was not able to save as much as previously, although she still did contribute weekly savings. The second exception was a divorced woman with two young sons. Given the difficulty of her circumstances, her SILC group allowed her to join without the obligation to save. She attended all meetings, contributed to the social fund, and could take loans.

Regarding savings policies, all the SILC groups were trained to use a share system for their savings contribution, and 100% of active groups maintained the share system. No group decided to allow for completely flexible savings amounts. However, every group had adjusted their original savings policies by either increasing the value of a share or allowing members to save multiple shares (in the first cycle, only one share per member was permitted). In this way, the savings managed by all active groups had grown over time. Thirteen of twenty-three groups (or 57%) allowed members to save multiple shares. Of these thirteen groups, eleven (85%) did not allow members to change the number of shares they save during the cycle. In this subset of groups, members select the number of shares that they will save at each meeting for the whole cycle at the beginning of that cycle.

When the SILC groups were trained, withdrawing from savings during the cycle is not permitted. No group had made an adjustment to allow for withdrawals mid-cycle. If a member wanted access to cash during the cycle, they needed to take a loan.

Social fund policies

The social fund was very highly valued by members. When asked what they liked most about their SILC group, nearly all SILC members mentioned unprompted that the social fund the top one or two things that they liked best about their group. This was true even for those members who hadn't ever needed to use the social fund. The social fund rules generally stipulate that a member can access the fund when someone is sick or injured, or when an emergency occurs.

Over the cycles, SILC groups had made few changes to their social fund policies. Interestingly, and underscoring how much people value the service, no group had gotten rid of the social fund. In fact, many groups had increased the contribution that everyone must give at every meeting. The increase in contribution was driven in most cases by a realization that if several people needed access to the social fund during a cycle, there would be insufficient funds to meet their needs. Another change that groups have made is to permit a member to access the fund multiple times, rather than just once during the cycle. However, while all but two groups gave a grant to the recipient the first time, the second or third time that a member asks for assistance from the social fund, it was always given as a no-interest loan. Two groups always give their social fund assistance as a no-interest loan. Two other groups have also changed their policies to allow for access to the social fund between meetings, but only in the case of a serious illness or emergency. Should such a case arise, those groups would assemble a quorum of members, including the whole management committee and the key keepers, and open the lockbox to give social fund assistance.

Loans

The policies around loans changed very little since the groups began. Nearly all groups (96%) had maintained the interest rate at the 5 or 10 percent per month that they originally chose. One group had lowered the interest rate to 3 percent from 5 percent to make loan repayment less of a burden, but the other groups liked that the higher rates were earning a significant dividend for them at the end of the cycle. In addition, no group was lending directly to non-members; loans remained a service restricted to members of the group. However, in two groups (9%), members reported that they had taken loans and on-lent them to someone outside the group, for an additional rate. The other group members were aware of this activity and accepted it, because the group member was still liable for repaying the loan.

Members report that their loan sizes have grown slightly, from the range of \$5 - \$10 to \$20 - \$30 now. Members consistently stated that there was not sufficient capital in the loan fund for all loan requests at every meeting, and that they would take larger loans if there was enough money to go around.

Changes in the Share-out of Funds

As mentioned in the overview of the SILC methodology, at the end of every cycle of approximately 12 months, SILC groups are trained to "share-out" their accumulated savings and the dividends earned through fees and interest on loans. Each member received back his or her accumulated savings amount, plus a percentage of the group's revenue.

Share-out grew significantly on average over the cycles, allowing members to invest in their businesses and households. The lump sum received at the share-out was cited as a tremendous motivation to current members to save more, and for non-members to join SILC groups. It was frequently because of the share-out that people decided to increase the number of shares that they save. As one member said, "When I saw other members getting a lot of money at the end of the

cycle, I decided to save more.” Over three share-outs, the share-out amount had increased on average by 109 percent, from 13,590 CFA (\$30.34) to 28,420 CFA (\$63.44); \$63 is equivalent to 7.6% of per capita annual income.

The dividend received by members makes up a significant proportion of this amount. Given high demand for loans, the groups generated upwards of 40 percent return on members’ total savings each cycle. On average, the dividend was 51 percent of total savings in the first cycle, and 43 percent of total savings in the third cycle. While the dividend percentage for the third cycle is still high, the slightly lower rate indicated that the utilization of the loan fund was relatively less by the third cycle. In the first cycle, because the loan fund amount was relatively small, the groups mentioned that every CFA was lent out at every meeting and often the amount of loans requested was greater than the cash on hand to lend. By the third cycle, there was more cash on hand, so less than 100 percent of the loan fund was sometimes lent out at a given meeting.

Groups had begun to retain some of the share-out for group activities. For example, one strong group used their revenue to pre-purchase the manioc harvest of a nearby farmer. They had paid 75,000 CFA (\$167, equivalent to 20% of per capita annual income) for the production of 1000 manioc plants, which was a better price than what they would have paid after the harvest. The group decided to do this because the women in the group earn income from transforming manioc into manioc flour. While they purchased the manioc collectively, they then divided it up and individually continued the process of transforming and selling it. Also, two groups had decided to reserve some of their revenue to “seed” their loan fund for the following cycle. These groups realized that it took them several months at the start of their cycle to build up the loan fund again, and they wanted to be able to meet loan demand from the beginning of the cycle.

Use of the share-out across cycles

The use of the share-out by the members followed trends across the groups: during the first cycle, when the share-out amount was relatively less, members reported using the share-out to meet immediate household needs and for working capital or inventory, and by the third cycle share-out, the amount had grown so that they could often use it for investing in assets. Specifically, common uses of the first cycle share-out were: to pay school fees, to buy school materials, to purchase inventory for a business (often agricultural commodities), to purchase agricultural inputs (including fertilizer, labor and herbicides), to cover healthcare costs, for ceremonies like funerals and marriages, and to purchase bulk grain for reselling. These items continued to be common in subsequent cycles, but as the cycles passed, members were able to make some bigger investments in their home or business. Common uses of the second cycle share-out included constructing new rooms, improving the roof, purchasing cement to reinforce earthen house walls and floors, purchasing furniture, buying land, increasing the amount of agricultural inputs, and increasing the amount of bulk grain purchases. About half of the members stated that they have a clear goal for their share-out when they start the cycle. One group encouraged goal-setting by having everyone state their objective for the cycle at the first meeting.

One male group member was able to buy a parcel of land that he had wanted for many years with his second cycle share-out. He had joined SILC with the goal of saving up to buy the land, but the first cycle share-out amount hadn’t been large enough. He had put that money into inputs for his fields and then saved an extra share in the second cycle. At the end of the second cycle, he

had enough money to buy the land. With the money from his group's next share-out, he's planning to plant orange trees.

One woman was able to purchase a used motorized mill with her \$100 share-out amount from her third SILC cycle. She was planning to use the mill to process manioc, and to charge others in the area a fee to use it. The mill represents a massive time savings for women who transform manioc into manioc flour – a bushel of manioc that would take more than eight hours to hand grate, takes only minutes to process with a mill. A few men were able to buy a used motorcycle and used bikes, and were using them to transport goods for their respective businesses to and from the market.

IV.B. Group level changes in membership and policies

This section presents the qualitative results regarding changes in group membership, management processes, and policies.

Replication of groups

6 of 23 (or 26%) of the groups had formed a new group. This rate indicates a demand for SILC in the communities and the ability of groups to discover a process to form groups. None of the original SILC groups were trained in any process to form a new group nor encouraged to do so. Given that six new groups were formed by the groups in the study sample, while five groups in the sample became inactive, the net change in active groups is from twenty-three active groups at formation to twenty-four active groups in total now, or 104% of the original number of active SILC groups.

The self-replication process used by the groups was to grow their own membership for two or three cycles, until it was between 40-60 members, and then to split the group into two groups. The management committee of the original group either taught the new group's management committee how to conduct the meetings and keep records, or the two groups held concurrent meetings in the same area, for example under the same large tree. In this way, the new group observed the way the management committee acted and asked questions if they encountered any difficulty.

Three other groups mentioned that they would like to divide as their membership was getting large, but they said they could not because of the lack of a literate person to serve as secretary. In two of the six self-replicated groups (or 33%), the secretary from the old group was also the secretary in the new group. One of these two groups had again more grown their membership to nearly 60 people and wanted to divide into two groups, but they were not able to split as the secretary said she couldn't do the work of keeping records for three groups.

Men's participation in SILC groups

The CRS Benin SILC program focused on women's participation, and recruitment targeted women exclusively. During the first cycle, almost all male members were the husbands of other members or men were recruited to be secretaries because they were literate. But over time, men's participation has increased in number, from an average of 4 men per group during the first cycle to an average of 7 men per cycle in the fourth cycle. The rate of men joining SILC matched the rate of women joining – men comprised approximately 17% of members in both the first and fourth cycles. Men stated that they recognized that the methodology had value and was useful to

them, and that they were motivated to join SILC based on their observations of the women in the community and their household members. As one male SILC member said, “SILC was just for women at first, but I saw that saving 100 (CFA) francs [\$0.22] a week was worth it.”

One of the male field agents, Francois, was so impressed by the work that the women were doing in groups that he trained and supervised, that he decided to form an all-male SILC group and join it himself (this group is not one of the twenty-three groups in the study sample). His group was in its fourth cycle and had grown from 28 members (all men) to 45 members (43 men, 2 women). The members were nearly all farmers and often took loans and used their share-out for fertilizer, seeds, and hiring labor. Francois’ share-out amount increased from 15,250 CFA [\$34.04] in the first cycle to 30,550 CFA [\$68.19] to second cycle to 38,000 CFA [\$84.82] in third cycle (\$84 is equivalent to 10% of average per capita annual income). Over the years he used his share-out to increase the production of his fields, to buy cement to reinforce the walls of his house, to help his brother travel to find work, and to pay the school fees to send his son to parochial school.

Meeting Frequency

The most common meeting frequency of the groups was weekly. Fifteen of twenty-three groups (65%) chose to meet weekly, and eight of twenty-three (35%) chose to meet fortnightly or monthly. 100% of the groups trained by Caritas Natitingou met weekly compared to just a third of the groups trained by Caritas Abomey.

Only two active groups changed their meeting frequency since their first cycle. In both cases, the group was originally meeting weekly and decided to space out their meetings to fortnightly and monthly. The monthly group said that they made this change because they wanted each meeting to be an occasion that everyone would attend and that would take several hours; the group was a strong group and members had been happy with the change – attendance at the monthly meeting was consistently high.

Members of groups which meet weekly had a higher level of average savings (standardized to a weekly amount), 1330 CFA [\$2.96] on average, than members of groups which met fortnightly, 233 CFA [\$0.52]. Interviews suggest that members of fortnightly groups are not able to save up throughout the two weeks between meetings. Members expressed that it was very difficult to save at home given constant demands for money or the urge to spend on household necessities, and that SILC was useful both because they feel obliged to get their savings together for the meeting and because it removes the money from their immediate possession.

Use of external financial services by the group

Towards the end of each cycle, the cash-on-hand grew significantly as groups didn’t give out new loans and collected all repayments in anticipation of the end of cycle share-out. During this time, groups were especially cautious with the lockbox. One group had so much cash in their box at the end of the cycle, more than 450,000 CFA (approximately \$1000), that they had opened an account in the local *caisse rural*. Over the final months of their cycle, they added to the money in their account after each meeting and withdrew it just before the share-out ceremony.

All the groups were asked whether their loan funds were composed of their own savings or included some source of external financing, and whether they expected to receive any external financing. None of the groups currently had any external source of financing for their loan fund or other activities. Four of the groups stated that they expected external financing, and that they

expected it to come from Caritas, CRS, or a government agency. These four groups all expressed frustration that they had not yet been provided with external sources of capital.

Group level activities

A common group activity that groups had introduced over time was to purchase grain in bulk just after harvest when the prices were lowest, and to hold that grain as stock until the prices rose. A group would then sell the grain and put the money back into their loan fund. Five groups had moved the timing of their share-out to coincide with harvest time in September. The groups that had tried this were very enthusiastic about it and saw it as a low-risk and effective way to grow their loan fund. In addition, many SILC members engaged individually in this type of activity. They reported that holding the grain for three to six months allowed for a 50% return on their investment.

One group used bulk grain purchases in an interesting manner to help mitigate the effects of the hungry season. The group members recognized that the hungry season was always very difficult for them, and that they spent a great deal of money on purchasing food to make it through that time. This was a problem felt by all members of the group. The group decided to purchase sacks of manioc flour and peanut when the prices were low and to stock those until the hungry season. During the hungry season, the group shared out the food in equal parts. The previous hungry season, they had more food than they needed, and they chose to sell it at cost to other members of the community.

Recordkeeping over time

Nearly all groups reported challenges in keeping their own record books. The written record system in which they were trained was perceived as difficult to learn. Therefore, the secretary must be not only literate, but to have completed primary school and hopefully some secondary school. These requirements were prohibitively difficult for some groups – four of the five inactive groups stated that they ceased to meet only because they could not find a secretary with the necessary skills. Each of these four groups lost their secretary because the secretary left the community. (The secretaries left for work or education, or, in one case, a secondary school student stopped acting as the secretary because his father wanted him to focus fulltime on his studies.) Once the secretary dropped out, these four groups were compelled to stop meeting. Although the members of these groups all reported that they wanted their SILC to start up again, and that they have been searching for a replacement, they could not find anyone to take over the recordkeeping role of the secretary.

The communities where this had occurred were communities which were far away from a secondary school. In the other groups, if a secretary left, the group had recruited a secondary school student to take over. As noted previously, the dearth of potential secretaries also limited the replication of groups.

Members' knowledge of rules and rule enforcement

Questions regarding rules enforcement were an important part of all the interviews and focus groups conducted. Questions included how rules were developed, how they were remembered by the members and the management committee, methods for enforcing the rules, and consistency of rule enforcement. Eighteen of twenty-three groups (78%), including 14 of 18 active groups (or 78%) and 4 of 5 inactive groups (or 80%), described strict and consistent rule enforcement. This

included penalties for tardiness or absence from meetings, penalties for failing to save the agreed upon amount, and penalties for late loan repayment. These groups all stated that they enforced agreed upon penalties immediately and that it made the group stronger. As group president stated, “You must create solidarity in the group and make sure there aren’t absences from the meetings. You create respect for the rules through the process of talking it out, forming the rules together, and having everyone be involved. And when disagreements arise, you talk through it as a group.”

In contrast, five of the groups (four active groups (22%) and 1 inactive group (20%)) described lax rule enforcement or having rules that could not be enforced. In each of these groups, management committee members said that they let infractions slide and did not feel empowered to charge people fees for agreed upon violations (like tardiness, absence from meetings, late loan repayment). In one case, the management committee could not feasibly enforce their rules, because the previously agreed upon consequence of failing to repay a loan was not compatible with social norms: the written consequence of failing to repay a loan was that the group would send representatives to take possession of assets from the household of the person who failed to pay. But in practice, to do such a thing was unthinkable – although they had a great deal of difficulty with loan repayment, the group had never taken household assets from a member.

V. Boolean analysis on determinates of group persistence

In this section, Qualitative Comparative Analysis (QCA) is used to examine the 23 cases to better understand the role of three conditions – the lack of a literate secretary, expectation of external finance, and weak rule enforcement – in SILC group operation over time. QCA is used to systematically explore whether combinations of these conditions contributed to groups becoming inactive.

QCA is a set theoretic method based on Boolean algebra and uses binary coded data where 1 indicates a case meets criteria for the variable, and 0 indicates that it does not (Ragin, 1987). It has been developed for use in small to moderate-N studies to examine the conditions or configurations of conditions under which an outcome is achieved (Ragin, 2008). Outcomes and conditions of interest are identified ahead of time through stakeholder consultation, review of prior field work, and review of relevant literature, and are revisited and can be updated throughout the field work process. The QCA methodology is increasingly being applied to evaluation work and large-N studies (Pattyn 2019; Beach & Pedersen 2013).

A critical phase of the QCA method is transforming qualitative variables into binary values. Any condition or outcome to be included in the analysis must be coded in this way. As Pattyn writes, “Conditions or outcomes assigned a score of 1 should be read as present (or high, or large,...), while variables with a score of 0 are regarded as absent (or low, or small,...). The data in this stage are transformed into categories that express qualitative differences in kind” (Pattyn *et al.* 2019, pg.59). Once the data are coded, they can be presented in the “truth table” which includes all configurations of conditions that lead to an outcome of interest.

Configurations of conditions are then minimized using a process of “Boolean minimization” until the remaining condition or combination of conditions are determined to be sufficient or necessary for the outcome of interest to occur (Baumgartner, 2012). Specifically, the minimization process follows the “one difference rule”; as Pattyn *et al.* describe the process, “It is built upon the assumption that if two combinations differ on only one condition, but show the same outcome, this particular condition is redundant. Thus, it can be eliminated to obtain a simpler representation of the case (or group of cases). Applying this rule iteratively on all possible pairs of combinations until no further simplification is possible results in a series of sufficient paths to the outcome” (Pattyn *et al.* 2019, pg.60).

In QCA, it is advised to minimize the number of conditions being analyzed (Berg-Schlusser & De Meur 2009; Marx and Dusa 2011). Best practice for QCA dictates that the selection of conditions should be strongly based on discussion with stakeholders, theory, or on prior evaluations. Before field work begins, outcomes and conditions of interest should be discussed with key stakeholders; the discussion should continue as the field work unfolds (Pattyn 2019).

For this study, the selection of outcomes and conditions of interest was discussed with NGO partners from the beginning of the study design process. CRS’ technical advisors at headquarters and in Benin, and supervisors in the field were all interested in the key outcome of functioning groups as measured by the simple fact of groups continuing to meet, and in the conditions of expectations of external finance, literate secretaries, and weak rule enforcement. The stakeholders’ interest in these variables was largely motivated by prior qualitative evaluations and extensive field work which suggested that these conditions might undermine the functioning of groups over time.

Based upon the interests of the stakeholders, I turned to the literature on micro-institutions to validate the selection of these conditions of interest. In particular, I focus on the principles identified by Elinor Ostrom as critical to the sustainability and performance of grassroots institutions (Ostrom, 2000). Each of the 23 groups that participated in this research fulfilled several of the principles detailed by Ostrom: most users could participate in modifying operational rules, monitoring was done by the users themselves, users had access to low-cost arenas for resolving conflict, and users had the right to organize their own solutions unchallenged by external government authorities. Given that there was no variation in these principles across the groups studied, this research cannot comment on whether the lack of these principles would undermine mature savings group functioning.

Importantly, two of the principles which Ostrom presents are inconsistently present across the savings groups studied. Firstly, Ostrom stipulates that use rules must be appropriate to local conditions and sanctions should be graduated and carried out by other users. This was not always the case. In several instances, rules were weakly enforced, inconsistently applied, or not applied at all, and in other cases rules were not appropriate to the local context and so could not feasibly be enforced. Secondly, Ostrom states that the boundaries of the resource in question must be clearly defined. In several savings groups, the boundaries of the loan fund resource were fuzzy in practice. In theory, the limit of the loan fund is the amount of cash contained in the group’s collective fund, and the user group is defined as those individuals who are members of the group

and who make regular savings contributions and repay their loans. But several savings groups expected external finance, indicating that the boundaries of its loan fund were weakly defined. External finance is not part of the savings group methodology and is usually explicitly prohibited by the NGO.

Therefore, based upon discussions with stakeholders, prior evaluation and field work experience, and a review of the literature, the outcome of interest was determined to be continued group functioning, and conditions of interest were lack of a literate secretary, expectation of external finance, and weak rule enforcement.

Independent variables:

Lack of a literate secretary (*lacksec*): this variable is coded as 1 (PRESENT) when a group lacks a literate secretary. It is coded as 0 (ABSENCE) when a group has a literate secretary.

Expectation of external finance (*expeftfinance*): this variable is coded as 1 (PRESENT) when a group indicates that it expects external finance into its loan fund. It is coded as 0 (ABSENCE) when a group has no expectation of external finance and states that internal funds will be the only source of loan fund capitalization.

Weak rule enforcement (*weakruleenforcement*): this variable is coded as 1 (PRESENT) when a group weakly or inconsistently enforces or fails to enforce its rules. It is coded as 0 (ABSENCE) when a group strictly and consistently enforces its rules.

Dependent variable:

One outcome of interest will be examined, inactive groups.

Inactive groups (*inactive*): this variable is coded as 1 (PRESENT) when a group has stopped meeting and no longer considers itself a functioning group. It is coded as 0 (ABSENT) when the group continues to meet and considers itself a functioning group.

The first step in QCA is the construction of a raw data matrix in which the independent and dependent variables of interest are coded as present (1) or absent (0) for each of the 23 cases. The raw data matrix is presented as Figure 1 below.

Figure 1 : Raw Data Matrix

	SILC Group	<i>lacksec</i>	<i>expextfinance</i>	<i>weakruleenforcement</i>	<i>Inactive</i>
1	Takpinkpa	0	0	1	0
2	Yakibowa	0	0	0	0
3	Aruyè	0	0	1	1
4	Yin mari manguima	0	0	0	0
5	Titètè	0	0	0	0
6	Tchokané	0	0	0	0
7	Tétoman	0	0	0	0
8	Fétani	1	0	0	1
9	Enagnon	1	1	0	1
10	Missimawou	0	0	0	0
11	Kpondehou	0	0	0	0
12	Bidossèssi	0	1	1	0
13	Houénoussou	0	0	0	0
14	Hwénumabu	0	0	0	0
15	Ejlossè Tonafa	0	1	0	0
16	Agbléa	0	0	0	0
17	Gbénonkpo	1	0	1	1
18	Jlo Mawuton	0	1	1	0
19	Mawunyon	0	0	0	0
20	Ayissi	0	0	0	0
21	Fifonsi	0	0	0	0
22	Sèdogbèta	0	0	0	0
23	Gbèdomahussi	1	0	0	1

After all the relevant data has been coded, a truth table is constructed. A Boolean truth table displays all logically possible combinations of values of the independent variables per dependent variable, and each row represents all of the cases with that given combination of independent variables. The truth table and minimized Boolean equation for the dependent variables presented below.

Figure 2 is the Truth Table: Inactive groups. We are interested in three independent variables and so the truth table has $2^3 = 8$ rows, one for each logically possible combination of values on the independent variable.

Figure 2: Truth Table: Inactive Groups

Condition			Outcome	Number of
<i>lacksec</i>	<i>expextfinance</i>	<i>weakruleenforcement</i>	<i>inactive</i>	instances
1	1	1	NA	0
0	1	1	0	2
1	0	1	1	1
1	1	0	1	1
0	0	1	X	2
0	1	0	0	1
1	0	0	1	2
0	0	0	0	14

The truth table displays all combinations of values which result in an inactive group (*inactive* = 1). No cases are observed in which each of the three dependent variables is coded 1. There is one contradictory row (*inactive* = X) which indicates that cases with the same combination of independent variables achieved different outcomes.

Before I can conduct the Boolean combinatorial minimization needed to arrive at a simplified Boolean equation, the contradictory row must be dealt with. In this case, two groups with the same combination of values on the independent variables (a literate secretary, no expectation of external finance, and weak rule enforcement) achieved different outcomes – one group remained active while the other became inactive. The contradiction may be due to an omitted variable, or to randomness. It is customary in Boolean analysis to develop a threshold value for deciding if the combination tends to generate more inactive groups or active groups. I have chosen 50% as a threshold, which is a common level (Ragin, 2008); the 50% threshold means that if more than half of the cases with this combination of values produce inactive groups, then the combination will be included in our analysis. In this instance, the contradictory combination did not pass the threshold and so is excluded from the following analysis.

To obtain a simplified Boolean equation from the truth table, I conduct a process of combinatorial minimization following the fundamental rule that “if two Boolean expressions differ in only one causal condition yet produce the same outcome, then the causal condition that distinguishes the two expressions can be considered irrelevant and can be removed to create a simpler, combined expression” (Ragin, 2008; pg. 37-39). Ideally, the result of the minimization process would be an additive Boolean equation with simple (not multiplicative) components. Additive Boolean equations indicate that if $A + B = Z$, and $A = 1$ and $B = 1$, then $Z = 1$; or $1 + 1 = 1$. In Boolean addition, if any of the additive terms is satisfied (present), then the outcome is attained. This is the same as the logical operator OR. To revisit the example, if A equals 1 OR B equals 1, then Z equals 1. (Ragin, 2008).

The components of our additive equation are multiplicative, which indicates combinations of causes. For example, the term *lacksec*~expextfinance* indicates that both those conditions (lack of a literate secretary and no expectation of external finance) must be present for the term to equal 1. Unfortunately, by removing this row from analysis, we cannot reduce the simplified Boolean equation to simple components. The best we can achieve with this data are multiplicative components.

Therefore, the simplified Boolean equation for inactive is:

$$inactive = (lacksec * \sim expextfinance) + (lacksec * \sim weakruleenforcement)$$

The above equation indicates that two types of cases result in an inactive group: when a group does not have a secretary and does not expect external finance, and when a group does not have a secretary and strongly enforces their rules. Because *lacksec* is present in both terms, we see that this is a necessary condition for having the result of *inactive*. However, because *lacksec* appears only in combination with other factors, we cannot say that it is a sufficient condition to cause inactivity. More data would be needed to reach that conclusion. Therefore, in this sample, the lack of a literate secretary emerges as a necessary but not a sufficient condition for a group becoming inactive.

VI. Conclusion

This paper presents the results of a qualitative study examining how Savings and Internal Lending Communities (SILC) savings groups in rural Benin changed after several years of independent operation. Focus groups and individual interviews were held with members of twenty-three 3- and 4-year-old SILC groups. Key findings include that more than 80% of the 3- and 4-year old SILC groups were still active; members of groups that meet weekly save more than members of groups that meet fortnightly; written recordkeeping was a challenge and the lack of a literate secretary is the stated reason that 80% of the inactive groups have stopped meeting. Additionally, using Boolean analysis, the paper analyzes configurations of conditions present among the 23 SILC groups and finds that for a group in the sample to become inactive, the lack of a literate secretary was a necessary condition.

The qualitative results suggest that SILC members utilize their groups as reliable financial service providers, and that savings share amounts, average savings per member, and share-out amounts increase over time. The results also suggest that downstream effects of saving larger amounts such as improved food security and investment in productive assets may accrue over time, as members build on savings and previous investments, and groups take on certain additional activities like bulk grain purchase.

The results regarding the importance of a literate secretary suggest that a streamlined and simplified written recordkeeping system consistent with local norms could be introduced to new and old savings groups. By simplifying the system, more members would be able to perform the role of secretary, diminishing the likelihood that a group would find itself without a secretary capable of keeping the records.

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**Making Sense of the Signs:
What Do We Know About Learning in Adulthood?**

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Abstract: 750 million adults worldwide are classified as illiterate, with women and individuals in Sub-Saharan Africa and Southern Asia bearing the heaviest burden of illiteracy. Despite the potential for adult education programs to bridge this gap, as well as decades of investment, such programs are often plagued by low enrollment, high dropout and limited skills acquisition. While there is a relative paucity of economic research on adult learning as compared with primary and secondary schooling interventions, recent research in educational neuroscience and economics offers some insights into addressing the barriers to adult learning and some potential ways forward.

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750 million adults worldwide still cannot read or write in any language, with marked disparity by geographic region and gender (UNESCO 2017).² While policymakers and academics have focused on primary and secondary education programs worldwide, public sector spending on adult education programs -- specifically those that teach foundational literacy and numeracy - is significant. In India alone, the government has spent more than US\$1.4 billion on the national *Saakshar Bharat* adult literacy campaign since 2009 (DSEL 2016, CBGA 2018, UNESCO 2016b), with similar levels of spending on adult literacy programs in Brazil. The widespread growth of these programs over the past few decades has generated hope for achieving learning outcomes among adult learners, and for generating more immediate private and social returns as compared with investments in primary education (UNESCO 2009, World Bank 2010).

However, existing evidence suggests that adult literacy programs are often characterized by low and volatile attendance, high drop-out, limited skills attainment and rapid skills depreciation (e.g. Romain and Armstrong 1987, Royer et al, Diagne 1999, Rogers 1999, Abadzi 1994, Oxenham et al 2002, Ortega and Rodríguez 2008, Aker, Ksoll and Lybbert 2012).³ Many of these challenges are true for primary education as well, and so it is not clear is whether learning in adulthood is unique in ways which therefore require specific approaches to teaching and learning.

This paper seeks to provide insight into how adult literacy programs can improve their design and implementation to achieve better learning outcomes. Insights into program design will be generated through an analysis of the recent neuroscience and social science literature regarding adult acquisition of literacy and compared with existing adult literacy programs with special attention to programs in Africa.

The paper first examines the recent literature in the fields of neuroscience, economics and education to provide insights into how adults learn and to identify the unique challenges facing adult learners. We then compare this with the design of existing adult education programs to identify some of the potential and pitfalls to improving adult learning.⁴ We conclude with directions for future research

²Literacy is defined as the skills of: 1) “recording information of some kind in some code understood by the person making the record and possibly by other persons in some more or less permanent form; and (2) decoding the information so recorded.” Similarly, numeracy is defined as “the skill of using and recording numbers and numerical operations for a variety of purposes” (J. Oxenham et al. 2002). The data in the UNESCO report uses data from “around” 2000, which could be as early as 1995 and as recent as 2005 for particular countries.

³Abadzi (1994) found that the percentage of students passing exams in large-scale literacy programs ranged between 8% and 47%.

⁴ To conduct a thorough review of the neuroscience, education, cognitive psychology, and economic literature related to adult literacy from the past thirty years, we use the following approach: As a first step, the objective was defined as gathering evidence related to adult literacy acquisition, and the scope was defined as global but with a focus on curricula and programmatic detail from Africa. As a second step, the protocol for the literature review was established to include peer-reviewed articles, plus white papers from three key institutions involved in adult literacy programs: UNESCO Institute for Lifelong Learning, American Association for Adult and Continuing Education, and the ILO. The third step was to conduct searches for documents and data related to the objective and its scope. Search terms that were utilized include: adult literacy, adult education, adult learning, lifelong learning, educational neuroscience, adult brain plasticity, adult decoding. Platforms that were searched include the Tufts Library system Jumbo Search tool, Web of Science, and PubMed. After reviewing all documents and data, the evidence was

and outline necessary conditions and potential technological innovations for adult education programs to promote sustained learning.

I. How do adults learn, and what does this imply for adult education programs?

I.A. How the adult brain learns

A key element of learning in adulthood is “foundational learning”, defined as basic skills and learning strategies. Literacy and numeracy are the core skills in foundational learning. While other types of adult learning can occur without foundational learning – such as workplace, labor market or interpersonal learning (SRDC 2014) -- these skills be more challenging to develop without strong foundational skills.

If foundational learning is so important for adults, and literacy and numeracy are the core to foundational learning, why has acquisition of these skills received relatively little attention, especially in economics research? This may be due, in large part, to a longstanding (and outdated) assumption that adults are incapable of learning more complex skills. Since the 1970s, evidence from cognitive psychology and educational neuroscience has shown that the adult brain is capable of learning foundational skills, and that it even requires sustained learning in order to prevent declines in cognitive ability.

Empirical evidence in the fields of cognitive psychology and educational neuroscience shows that while adults *can* learn, it is more difficult, especially for foundational skills such as reading. All cognitive improvements require biological changes in the brain, and recent advancements in brain imaging have allowed neuroscientists to verify the theories developed by cognitive psychology within the structure of the brain (for example, Skeide et al, 2017). The human brain changes throughout life (called “brain plasticity”), responding differently to stimuli and environmental conditions over time. The brain is most responsive or “plastic” during “sensitive periods” in its development. Such periods are often defined as intervals when behavioral change can be maximally influenced by external stimuli, or in neural terms, when “functional plasticity is at its height and brain structure and function are most malleable” (Knowland and Donlan 2014). These periods can occur at different times and for different durations, depending upon the neural system involved (e.g. auditory, visual, critical thinking, etc.) (Knudsen 2004), but the brain is considered to be the most “plastic” during early and mid-childhood, suggesting that these are optimal periods for learning and skills acquisition (Cunningham et al 2014; Koizumi 2011).

While the optimal period for learning literacy and numeracy skills may be middle childhood, the brain remains plastic, to some extent, throughout adulthood (Skeide et al, 2017). The dominant theory is that “brain plasticity decreases as systems become increasingly specialized towards their adult functions” (Thomas and Johnson 2008). However, decreases in plasticity do not imply a *lack* of plasticity; despite decades of believing that individuals had their full set of neurons at birth, recent research has demonstrated that the adult brain is capable of making new neurons (neurogenesis), new synapses (synaptogenesis), and new capillaries (angiogenesis) if the

classified by intervention type and by key outcomes of interest. Then the evidence was synthesized to be presented in this paper.

proper stimulation is provided (Barnes and McNaughton 1985; Berkman et al 1993; Cameron and Gould 1994; Eriksson et al 1998; Schaie 1989).⁵ Plasticity has also been seen in the amygdala (Ohman 2002), an area of the brain involved in social cognition, in the sensorimotor cortex (Hamilton and Pascual-Leone 1998; Kujala, Alho, and Naatanen 2000) and in visual pathways (de Haan, Humphreys, and Johnson 2002; de Haan, Paascalis, and Johnson 2002).⁶

Literacy acquisition in adulthood can be a particular challenge, given the complexity of the task and the number of brain areas involved. For example, reading is not learned passively or automatically, as verbal language acquisition can be; it requires instruction and studying. In other words, “We do not learn [to read] just by absorbing it from the people around us ... Children who do not learn how to read remain illiterate until they do.” (Fern-Pollack and Masterson 2014).

Reading is complex because it involves multiple regions of the brain, beginning with areas responsible for visual recognition of letters and words (“decoding”) and culminating in brain regions that facilitate comprehension (Abadzi 2006). The neurological processes involved in each stage of reading are intricate (Fern-Pollack and Masterson 2014). For example, the initial stage of “decoding” involves changes in the left posterior brain region known as the “visual word form area” (McCandliss et al 2003). Beginner readers of any age begin with recognizing letters and syllables, and processing larger graphemic units (such as words) over time (Fern-Pollack and Masterson 2014). This has been shown to be the process in many languages (Frost 2005; Ziegler and Goswami 2006), and the neural networks involved are similar across orthographies (Dehaene and Cohen 2007, Dehaene 2009).⁷

The neuroscience confirms that initial stage of decoding is difficult for an adult brain, and the adult brain may require more practice and repetition to achieve fluency with decoding. Unlike children, adults who learn to read exhibit competition in the visual word form area between face and word

⁵ Fillit et al. (2002) show that learning is related to “long-term intensification of synapse connection in the hippocampus”.

⁶ For example, in a study of London taxi drivers, Maguire and Woollett (2011) showed that their intensive training and complex ongoing cognitive requirements were associated with growth of the posterior hippocampus, an area of the brain involved in spatial analysis. London taxi drivers are required go through an intensive 2-year training and learning period to be able to call London locations from memory. Neuroimaging confirmed that “drivers’ posterior hippocampi... grew significantly larger than that of control subjects.” (Maguire and Woollett 2011). While the comparison may have been subject to selection bias, the study suggested that the brain could remain plastic into adulthood.

⁷The general outline of the cognitive developmental theory has been evolving for a number of years, (e.g., Anderson 1983, 1990; Anderson and Lebiere 1998; Fodor 1983; Forster 1979; Kintsch 1988, 1998; Perfetti 1988, 1992; Royer 1985; Stanovich 1986, 1990; van Dijk and Kintsch 1983). “The general perspective provided by such cognitive developmental theory is that the acquisition of reading skills begins with the development of phonological awareness and the ability to identify letters. Having become conscious of phonemic elements in speech and developed the capacity to recognize letters accurately, readers then begin to develop the capability of mapping phonemes onto letters and letter combinations (or spelling patterns). This ability forms the foundation for the acquisition of word-identification skills. The ability to identify words progressively improves until the identification of certain words becomes ‘encapsulated’, thereby enabling their automatic identification with little expenditure of cognitive resources. Students who do not develop encapsulated word-identification skills inevitably also have comprehension problems. Difficulties may range from a complete inability to comprehend because of extremely slow word decoding to very slow reading rates created by the frequent need to reread because some words have faded from working memory.” (Royer et al 2004).

recognition (Dehaene et al 2010). While the visual word form area can be “activated” over the course of literacy acquisition in adulthood (Braga et al 2017), for many adults to decode letters and words they rely heavily on executive functions, resulting in a slow and effortful process at the decoding stage. This suggests “a limit on brain plasticity, supporting the notion that when a system has specialized...it becomes increasingly hard to re-specialize” (Knowland and Thomas 2014).

This presents a challenge to adult literacy acquisition, because strong decoding skills and word level accuracy are critical to achieving *automaticity* in reading, or “the ability to read quickly and fluently”. For a child or adult reader to understand a sentence, its letters and words must be decoded quickly enough to be held in the brain’s working memory, defined as a rate of one word per 1 - 1.5 seconds (Abadzi 2006). Research suggests that adults who learned to read in adulthood read more slowly than those who learned to read as children, even when they were as accurate in their decoding (Dehaene et al. 2010). This, combined with limits on brain plasticity, implies that adults may need more time and practice with decoding than children to achieve the same level of automaticity.

Automaticity -- and ultimately reading comprehension -- may also be affected by the *opacity* of the language, or the level of correspondence between written units and their sounds. For example, Spanish and Italian are considered to be very transparent, with “almost a one-to-one correspondence between the letters and their sounds”, while languages such as Hebrew, Chinese, and Japanese are considered to be extremely opaque (Hoare 2006). Learning to read an opaque language takes longer and requires more effort than learning to read a transparent language, regardless of age. Yet once literacy is gained, there are no significant differences in accuracy or speed across transparent or opaque languages (Fern-Pollack and Masterson 2014; Hanley, Masterson, Spencer and Evans, 2004).

Given the extra time and effort required to learn opaque languages, it is not surprising that dropout rates are higher for learners of opaque languages, whether adults or children. Research suggests that children with reading difficulties are more likely to give up learning to read an opaque language than a transparent one (Paulesu 2006), and those who persist may never achieve high levels of automaticity. For example, Fern-Pollack and Masterson (2014) found that young Welsh children were better readers than young English children (Welsh is a more transparent language), but that both sets of children achieved similar reading levels by age eleven. However, among the bottom 25% of readers, English children continued to perform more poorly than Welsh children (Fern-Pollack and Masterson 2014).

Beyond decoding and automaticity, comprehension is crucial for functional literacy. For this phase, metacognitive monitoring – also known as “thinking about thinking” – is critical, and helps the reader “to detect a lack of understanding so that it can be corrected” (Cromley 2005). While adults develop strong metacognitive abilities in daily life (e.g., problem-solving around work tasks), these skills do not automatically translate to reading comprehension, and is especially difficult if decoding and automaticity are not achieved.

I.B. What Neuroscience Implies for Adult Education Programs

The body of evidence demonstrates that adult literacy acquisition is possible, but adult literacy programs will be most successful when material is properly sequenced; adult learners are given more- and more flexible - practice; and reading is made relevant to adults' lives.

First, for adults to properly progress from decoding to automaticity to comprehension, each stage must be covered and given sufficient time. While this is not so different from learning in children, since brain plasticity diminishes with age, adults may need to “work harder” in order to “recycle” brain areas to perform a new task, such as decoding letters and syllables. This implies that explicit phonics instruction is important for adult readers, and that the curriculum should take into consideration the “opacity” of a language. More opaque languages will require more time to be spent at the decoding stage. If insufficient time is spent on early stages of literacy acquisition, then any gains acquired during class can be easily lost (Royer et al 2004). For example, existing research suggests that adolescents who struggle to read must receive a significant amount of instruction hours (up to 90) to master a new reading skill (Torgesen et al. 2003).

Second, and unsurprisingly, the neuroscience literature suggests that adult education programs should be specific to the needs of adult learners rather than a “one-sized fits all” approach for learners of any age. In a seminal work on andragogy, the teaching of adult learners, Kabuga (1977) identified three characteristics that are important to think about while teaching to adults: *self-concept*, which requires that adults be able to identify their own educational needs; *experience*, which requires that techniques such as group discussions and supervision be used to reinforce concepts; and recognizing the *time perspective*, as adults want to put immediate use to what they learn and use that learning to solve problems.

Third, given the limits of brain plasticity, exercises and practical applications become more relevant for adult learners. This means having different aids to assist with decoding and automaticity, as well as group discussions to assist with comprehension and evaluation. Longer instruction and additional practice in decoding may be critical to improve reading performance (Abadzi 2016, Sabatini et al 2011). Even the time intensive Kha Ri Gude program in South Africa may not offer sufficient instruction; program feedback suggests that even 240 hours over 6 months may not be enough (McKay 2015). Unfortunately, the dearth of research implies that we have little insight into how much time and practice is enough.

II. What else affects adult learning? Time, stressors, motivation and returns⁸

Unlike younger school-aged children, adults have competing demands on their time. These opportunity costs exhibit significant heterogeneity over time, economic activity and gender, and, as such, without immediate and concrete benefits – monetary or otherwise -- these programs may not be seen as valuable relative to work, home production or leisure activities (Wagner, 2000; Abadzi, 2003).

⁸Other factors that may affect adult learning – but are not necessarily specific to adults – are adequate nutrition and sleep, a “chaotic” home environment, the learning environment, noise and temperature. A substantial literature on the impacts of auditory noise on adults has found that noise of low to moderate intensity may in fact evoke substantial impairments in cognitive performance (Hellbrück and Liebl, [2007](#); Szalma and Hancock, [2011](#)).

A key question for andragogy is how to effectively motivate adult learners, whether intrinsically (“internally regulated”) or extrinsically (“externally regulated”).⁹ While extrinsic motivation may be linked with adults’ opportunity costs or uncertainty in returns, motivation is also related to how adults respond to difficult tasks. Existing research suggests that adult learners perform better when feedback is available and provided quickly; for example, Tricomi et al (2006) found that brain-level responses were similar when either feedback or financial rewards were provided.

Adult learners also face additional stressors that children and adolescents do not. While all learners must face work deadlines, examinations, and relationships with teachers and peers, adults must also balance family, work and educational pressures (Jones 2014). These stressors may diminish adults’ capacity to learn; a number of psychology studies suggest that cognitive performance increases with mild stress, until a point where stress begins to interfere with cognitive performance (Jones 2014).

Compounding the issue of the opportunity costs is the degree of uncertainty regarding the economic and social returns to adult learning.¹⁰ While this uncertainty is the case for all learners, in light of higher opportunity costs and the shorter time horizon through which to observe these benefits, these returns may be more salient for adult learners. Proponents of adult education programs cite a number of different pathways through which adult education could improve welfare: by helping learners obtain higher-paying jobs or helping them adopt new technologies; improving mental health, as learning and engagement with written material can stave off cognitive decline (Hoare 2006); positive inter-generational spillovers, as children’s health and learning outcomes are often correlated with improved adult education¹¹; and social returns, as the cost of adult illiteracy to developing countries’ has been estimated at over \$5 billion annually (Cree et al, 2012).

III. Adult Education Programs: What we do and do not know

III.A. Do Adult Education Programs Improve Learning?

⁹ “Intrinsic motivation is associated with curiosity, exploration, spontaneity, and interest...extrinsic motivation is associated with undertaken to attain an end state that is separate from the actual behavior...determined by some external contingency such as good marks or the avoidance of negative consequences.” (Muller, 2004) Adults are motivated by some external factors, such as promotions, salaries, and pressure from authority figures. However, internal motivators that help adults solve problems in their life, such as increased job satisfaction, self-esteem, quality of life, tend to be more powerful motivators (Knowles, 2005).

¹⁰As a result, one approach used in many adult education programs has been to provide information to adults on the potential socio-economic benefits of the program. As Rogers (1999) points out, “vigorous efforts are made to exalt the value of literacy and the disadvantages of being ‘illiterate’. Exaggerated (and in many cases clearly false) promises about the socio-economic benefits of ‘being literate’ are made to the participants—(leading)...the participants to assume that they will benefit directly from learning literacy skills in a classroom setting. But in practice, the socio-economic benefits which arise from literacy do not spring from learning literacy skills, but from using literacy skills in real life to achieve real goals set by the participants (ODA 1994).

¹¹In the “Impact of non-formal adult education in the Asia-Pacific Region: a four-country study.” By UNESCO Principal Regional Office. As adult education programs often include exposure to health information, potential immediate returns may include spillover effects into the health domain for the participant and household.

What do we know about the impacts of adult learning programs on learning outcomes, self-esteem and economic welfare? Earlier studies on the impact of such programs often relied upon self-reported literacy measures, small sample sizes and non-random placement. Yet a number of more recent studies have attempted to address these issues by using experimental and more sophisticated non-experimental methods and objective measures of learning. The majority of recent empirical research on adult education programs has focused on the impact on literacy acquisition of different andragogical approaches to learning (Alamprese et al 2011, Sabatini et al 2011, Aker et al 2012, Banerji et al 2014, Abadzi et al 2010, Aker et al 2012, 2016, 2018). Overall, these studies find that adult education classes have larger impacts on math skills as compared with reading skills, and, where there are impacts on reading, it is primarily on decoding as opposed to comprehension. Many of these studies have also found relatively small impacts in terms of magnitude; even if the impacts on decoding are statistically significant, few adults achieve the threshold of 1.5 words/second.

Adult literacy programs in Africa usually provide instruction in basic reading, writing and math skills in a classroom setting, usually in one's native language, in order to allow adults to decode in a language that they speak and understand. In some cases, although more rarely, these programs also transition to instruction in other languages, namely English, French and Portuguese (Rogers 1999). These classes typically last for 4-5 months, meeting five times per week for three hours per day over nine months, usually during a time of year that does not compete with major agricultural activities (Carron 1990, Okech et al 2001, Aker et al 2012). Thus, a typical adult education course would provide approximately 480 hours of instruction, a substantial time investment for busy adults. In terms of content, these classes primarily focus on *decoding* – namely, identifying letters, syllables and words, as well as numbers – with little focus on automaticity or reading comprehension, which are crucial for sustained learning (Abadzi 1992). In addition, many of these classes do not necessarily help literacy participants to “transfer the literacy skills they learn in the classroom... into use in their daily lives” (Rogers 1999, Lauglo 2000, Abadzi 1992).

There are several studies assessing the impact of different instructional approaches on adult learning, finding positive – yet varying gains on decoding (Alamprese et al 2011, Sabatini et al 2011 and Royer et al 2004). Alamprese et al (2011) conducted a randomized control trial (RCT) of a US adult education program, testing the impact of a curriculum that focused specifically on improving learners' decoding and spelling, as compared with the typical curriculum. Overall, they found significant gains in decoding skills as compared with the control group, but no statistically significant effects on word recognition, spelling, fluency or comprehension, which are crucial for sustained learning. Similarly, Sabatini et al. (2011) investigated the effect of explicit phonics and guided reading instruction for adults with limited decoding skills in the US. They found statistically significant gains in basic reading skills for students who completed the programs, yet the magnitude of these gains was modest. Using a RCT in Burkina Faso, Royer et al (2004) tested the impact of different learning approaches, including training in phonological awareness (PA), the rapid identification of reading material (RR) or both (PA + RR). While all three treatments increased reading skills relative to the normal adult education program, the treatments were the most effective in increasing adults' letter, syllable and word recognition, primarily in programs with longer cycles. Finally, in the US, Hock et al. (2011) conducted an RCT on the impact of different “metacognitive learning strategies” on adults' reading

comprehension and skills in the US, and found no statistically significant effects. They explained authors explained these non-results by “insufficient instructional intensity (dosage)” (Hock et al 2011).

Even if adult education programs are successful in improving reading, writing and test skills in the short-term, if adults are not able to use these skills in daily life, they may not be sustained. With the growth of information technology throughout sub-Saharan Africa, Aker et al (2012) tested the potential for using simple mobile phones as a pedagogical tool in adult education programs in Niger. Using an RCT, villages were randomly assigned either to the standard adult education program or a program that taught adults how to use simple operations on a mobile phone (ABC). Overall, the authors found that learning how to use the mobile phone increased writing and math skills by 0.18-0.25 s.d., with stronger effects for math. These results persisted six months after the program, as well as two years later, mainly because the mobile phone allowed adults to continue practicing outside of class, as well as integrate their newly-acquired skills into their daily lives (Aker and Ksoll, forthcoming). However, since the authors did not use tests designed to measure reading automaticity, a direct comparison of the impact of the program on decoding versus comprehension skills was not possible. Nevertheless, the absolute gains in learning were small, primarily focused on simple decoding of letters, syllables and words. In addition, since there was no pure control group, the authors were unable to assess the impacts of the adult education program alone.¹²

Increased flexibility through use of ICT tools in terms of when and where adult learners practice literacy skills may help address the need for additional practice and the high opportunity costs. In recognition of the high drop-out in US literacy programs, as well as the need to practice skills outside of the classroom, Aker et al (2015) assessed the impact of a mobile phone-based literacy curriculum on adults’ reading and self-esteem scores for low-literate Spanish speakers in Los Angeles. Using a standard Spanish literacy curriculum (*Leamos!*), the authors worked to transfer the different modules of the in-class curriculum on a mobile-based platform of over 400 micro-modules (*Cell-Ed*). Using a simple mobile phone, the platform enabled adults to receive a call, a text and an interactive quiz. The increase in *Cell-Ed* participants’ reading skills after four months was equivalent to the reading skills children acquire after two years of schooling. While the study had several weaknesses, the promising results suggest that more flexible learning may address some of the constraints of existing adult education programs.

Given high rates of teacher absenteeism observed in adult education programs, ICTs offer an opportunity to serve as a monitoring and pedagogical tool for teachers. Aker et al. (2016) conducted an RCT in Niger, whereby villages were randomly assigned to either the standard adult education program or a control; within the adult education program, villages were randomly assigned to a mobile phone-based monitoring program or the standard monitoring program. Teachers and students in the mobile phone-based monitoring treatment received calls asking about their classes and teaching, while those in the standard monitoring program received periodic site visits. Overall, the authors found that adults in the standard adult education program improved their letter, syllable and word recognition skills (“decoding”) significantly as compared to the pure control group, but less than 12 percent were able to complete any of the reading comprehension tests and less than 15 percent were able to reach

¹² As students in all villages received a “participation incentive” – namely, a bag of grain each month for attending 80% of classes – the authors did not assess the impact of the intervention or attendance or drop-out.

the reading threshold of 1.5 words/second. The mobile phone monitoring component increased reading and math skills significantly, almost doubling the learning results, primarily through its motivational effects.

In a separate approach, a study in India sought to improve outcomes for children as a way to motivate adults. Banerji, et al. (2014) used an RCT to assess the impact of a set of interventions designed to improve the “home learning environment” in India on children’s learning outcomes. Targeting women, 240 villages subdivisions were randomly assigned to one of three interventions: 1) an adult literacy program for mothers (ML); 2) training for mothers in how to support their children’s learning (CHAMP); and 3) a combination of both. The authors found that the three interventions resulted in statistically-significant improvements in mothers’ math and language test scores, with stronger effects on math. The interventions also had statistically significant impacts on children’s math scores. The latter suggests important spillovers and benefits for children. Yet similar to other studies, attendance was an issue; only 42 percent of mothers in the treatment groups reported ever having attended classes, and those who did attend only attended 1/3 of classes.¹³

III.B. Do Adult Education Programs Improve Other Measures of Well-Being?

In contrast to the substantial evidence on the economic returns to primary and secondary education, there is little evidence on the economic and social returns to adult education programs. As outlined above, most of the research in adult education has focused on the impacts on learning, rather than on economic outcomes (Rogers 1999, Aker and Ksoll 2012). Two key exceptions are Blunch and Portner’s study in Ghana (2011), which studied the impact of an adult education program on household welfare, and Aker and Ksoll’s study in Niger (2018). In Ghana, the authors found that adult education led to a 5% increase in consumption, similar to the returns to primary education (Canagarajah and Thomas 1997). Yet the adult education model studied was more akin to a vocational training program as it provided a package of income-generating interventions, in addition to basic literacy and numeracy.^{14, 15} In Niger, Aker and Ksoll (2018) found that adults who had higher learning outcomes were more likely to save, had more durable assets and lower food security two years after the program, but did not have any measurable impacts upon income-generating activities, wages or income earned from agriculture.¹⁶

¹³As the authors used an intent to treat estimate, the learning effects may have been larger once conditioning on those who attended the adult education program.

¹⁴One of the main features of the Ghana program was income generation, which aimed at equipping participants with occupational skills. The entire program took about 21 months, with classes meeting 2-3 times per week for 2-3 hours each session. For comparison, the Venezuelan “Mision Robinson” courses lasted only 7 weeks, and other standard adult education programs in West Africa last about 10 months.

¹⁵ The OECD found that: “stronger literacy skills, within the same level of education, are correlated with higher wages in developed countries, whereas stronger numeracy skills are correlated with a higher likelihood of employment and higher wages (OECD 2015). As a result, the OECD concluded that: “Improving the teaching of literacy and numeracy in schools and in programs for adults with poor skills and limited familiarity with ICT may provide considerable economic and social returns for individuals and society as a whole”

¹⁶For example, the technology adoption literature suggests that low education levels are correlated with low levels of agricultural adoption (e.g. Foster and Rosenzweig 2010, Rosenzweig 1995); as a result, improved education outcomes could potentially minimize some of the constraints associated with technological adoption. In addition, a key market failure for labor markets and agricultural markets is that of imperfect information, namely, individuals’ ability to get access to and analyze information. Existing evidence in Niger suggests that traders share market

While one of the key promises of adult education programs is improved empowerment, self-esteem and self-efficacy, few studies have assessed the impact of the programs on these outcomes. Focusing on mental health improvements, Aker et al (2018) found that those who participated in an adult education program in Los Angeles had higher self-esteem as compared with the control group, although a minimum threshold of learning needed to be achieved. Similarly, Banerji et al (2014) found that adult education interventions in India improved women's empowerment, as measured by an index of 19 variables including women's decision-making ability, ability to carry out tasks independently, involvement in household decision-making, and beliefs about education.

IV. What does this mean for future investments in adult education?

Overall, the results of the body of research in lower-income countries, including in India, Latin America and sub-Saharan Africa suggest that adult education programs can improve adult participants' reading and math skills, with stronger effects on math. In the area of reading, impacts are modest, although strongest in the area of "decoding" – i.e., recognizing letters, syllables or words – rather than comprehension. Furthermore, when statistically significant gains are found, the effect sizes are small to modest. While there is some evidence suggesting that these programs can improve consumption, asset accumulation, savings and self-esteem, the body of evidence is small.

What explains these relatively modest impacts on learning? This can potentially be explained by a number of factors. Models of adult education programs within sub-Saharan Africa can vary substantially both across and within countries, and it is difficult to obtain detailed information on the learning curriculum of many of these programs, however, many adult education programs on the continent share the following characteristics:

1. **Primarily focus on decoding**, as compared with automaticity and reading comprehension, which is required for sustained skills acquisition and usage
2. **Do not include concrete tools for transferring classroom-based literacy and numeracy skills into daily life**
3. **Are extremely intense and during particular periods of the year**; i.e., 4-5 months for 5 days per week and 3 hours per day, for approximately 240 hours per year.
4. **Have strict curriculum schedules**, which may or may not allow for repeated practice or be specifically adapted for less "transparent" languages
5. **Provide teacher training** that is not necessarily focused on comprehension or based in adult learning principles.
6. **Do not fully account for adults' opportunity costs or motivation**
7. **May have "noisy" learning environments**

Some of these characteristics may be necessary due to logistical issues and necessities associated with implementing adult education programs, especially in remote rural areas and with short-term, community literacy teachers.

information via mobile phones, and particularly text, which is cheaper (Aker 2008). Thus, improved learning outcomes could, in theory, allow farmers to access such market information in different ways.

While decoding is a natural pre-condition for achieving literacy, without pedagogical support in automaticity and reading comprehension, it can be difficult for adults to achieve a minimum threshold of learning which is crucial for comprehension and sustained literacy. Without this minimum threshold, this, in turn, limits adults' ability to practice their literacy skills in their daily life. Thus, in the absence of a specific curriculum or module teaching adults how to make this transition – which was the purpose of the ICT module in Niger (Aker et al 2012) – adults may quickly forget the skills learned in class. If those skills were not fully mastered, then any gains acquired during class can be easily lost (Royer et al 2004).

Adult education programs in sub-Saharan Africa are often offered during specific short periods of year, in an effort to minimize competing demands on adults' time during the agricultural season.¹⁷ These adult education classes can be extremely time intensive in short bursts, requiring an investment of 60 class hours per month. The intensity, combined with strict curriculum schedules, often means that adult students may not be able to sufficiently practice during the course, which is required due to limits on brain plasticity in adult brains (Thomas and Johnson 2008).

While significant resources are often spent on teacher training for adult education classes, such trainings often pay less attention to andragogy, or teaching to adults (Kabuga 1977). For example, the principles of adult learning – including the idea of self-concept, experience and the time perspective -- are not always included in adult education classes. This could be due to practical and logistical reasons, such as adults' time constraints, the number of curricular modules that need to be covered or the national scale of adult literacy campaigns. In addition, many adult education programs are taught by community literacy teachers, who may be paid or volunteers. While these teachers are often highly motivated, and may be more easily observed by the community, they also have competing demands on their time, and quality can vary.

Finally, many adult education programs often face challenges in addressing adults' motivation to participate in adult literacy programs, as reflected in low levels of attendance and high drop-out. In almost all of the studies cited above, dropout was high (ranging from 17% in Niger to 58% in India) and attendance was sporadic, even among those who persisted in the program until the end. Adults have competing demands on their time, and, without immediate and concrete benefits – monetary or otherwise -- these programs may not be seen as valuable relative to work, home production or leisure activities (Wagner, 2000; Abadzi, 2003). While some adult education programs have attempted to address these issues by providing financial compensation, either cash or in-kind transfers, the impacts of these incentives on enrollment, attendance and learning in adult education programs in developing countries has not been widely studied. Where these interventions have been studied– as it the case in the UK -- the results have been mixed. And while some programs provide information to adults on the potential socio-economic benefits of these programs, identifying the relevant costs and benefits to adults from participating in an adult education program is difficult, and less often studied.

¹⁷ In addition, many adult education programs in West Africa take place during the “hot” period – which is also the period when opportunity costs are lower -- where temperatures can reach more than 45 degrees Celsius. These conditions can further slow down the learning process (Shield and Dockrell 2008).

Certainly, more questions than answers result from our finding that few adult education programs accommodate the principles of adult learning, especially given the paucity of research in this area. For example, regarding the case of the seasonal adult education classes in West Africa, could the seasonality of agricultural wages still be accommodated but with a more flexible schedule for adult learners? Perhaps using mobile phones for practice during the course and to maintain skills during agriculturally intensive periods? Our analysis suggests promising approaches, which still must be tested.

V. Conclusion

Illiteracy remains an important challenge in many areas of sub-Saharan Africa and parts of Asia. Even though adult education is a neglected entry point in terms of educational investments, there is still significant investment in adult education programs – primarily literacy campaigns – in sub-Saharan Africa and South Asia. While there is significant research on the neuroscience of adult learning, specifically in developed countries, it is not clear that this research is being incorporated into existing adult education programs, which may partially explain their limited sustained impacts on adult learning. In addition, despite the prevalence of adult education programs worldwide, there is little research on adult education as compared with other educational investments. Research that does exist primarily focuses on learning in the short-term, rather than on the private or social returns to adult education. As a result, this makes it difficult to weigh the costs and benefits of such programs.

Nevertheless, the existing cognitive and empirical research on adult learning and education offers several insights into how such programs should be designed and evaluated. First, adult education programs need to be designed to address certain cognitive and environmental issues: 1) the specific learning needs of adult students, focusing on andragogical principles; 2) the intrinsic and extrinsic motivations of adult learners, which can be supported by external payments, information or the (easier) transition of such skills into daily life; and 3) the opportunity costs of adults' time, which may or may not be related to motivation. While each program must consider these areas in their context, recognizing that the needs of adult learners and the opportunity costs they face will differ from one area to another, the principles of andragogy may potentially be more applicable across contexts.

In terms of andragogy, existing research suggests that certain key aspects of curriculum design must be met for adult learners to learn in a sustainable way. First, any adult education curriculum (especially focusing on basic literacy and numeracy) should emphasize fundamentals, including decoding, automaticity and metacognitive skills, the latter of which are necessary in order to consolidate literacy skills. Second, practice and repetition are necessary for an adult brain to learn to read, and technology can play an important role in facilitating additional practice, especially outside of the classroom. And finally, programs must include *enough* instruction. Adults need more instruction and more practice than children – this takes time, especially for opaque languages. For example, even the time intensive Kha Ri Gude program in South Africa may not offer sufficient instruction; program feedback suggests that even 240 hours over 6 months may not be enough (McKay 2015). At the same time, this need for sufficient instruction and practice must be balanced with the opportunity costs for adult learners. Again,

this is where technology could play an important and strategic role, allowing adults to learn when and where it fits into their busy schedules.

In terms of motivation, the recommendations are a bit more nuanced, and there is little research or practice to support this. While concrete and accurate returns to adult education programs should be clearly communicated to potential learners, such returns have not been clearly identified or measured. In the absence of this information, adult education programs could potentially ensure that adult education programs provide skills that are relevant to daily life and allow adult students to quickly observe the impacts of their investments and hence remain motivated. This could either be linking the curriculum to daily activities – i.e., linking numeracy to savings group accounting, or literacy to the use of text messages.

Related to motivation is addressing and recognizing the opportunity costs of adults' time, which can be in direct conflict with sufficient instruction time. Adult learners face significant opportunity costs to participating in adult education programs. First, salient opportunity costs must be well identified in the program's context and among sub-groups of learners (by gender, by occupation). Once key costs are identified, steps can be taken to address them using monetary or non-monetary mechanisms. For example, classes can be planned for less busy times of the day or the year; in a rural agricultural context, this could be offered during the "off" season or in the evenings, whereas in an urban setting, classes may need to be offered at times of day or on days of the week that accommodate work schedules. In contexts where adult learners are also caring for young children, offering childcare may address a critical constraint, thereby allowing students to concentrate more fully on the class.¹⁸ Finally, financial incentives (e.g. conditional or unconditional cash transfers) might be necessary in some contexts, although the research on this is limited and ambiguous at best.

While most of the existing empirical research supports the recommendations shared above, more research is needed on adult education programs in general, and in particular areas in particular. For example, strategies for effectively motivating adults to participate in classes are poorly understood, including the role of financial incentives. In the area of curriculum design, there is little research on the efficacy of different metacognitive strategies for adults, a key step in consolidating literacy skills and achieving reading comprehension.¹⁹ This is also true for the amount of instruction required: More research is needed to address the basic questions the length and duration of classroom adult education programs (or class hours complemented with technology that supports home study) required for a motivated adult to gain reading proficiency. Finally, in order to better design programs that address adults' intrinsic and extrinsic motivation to invest in adult learning – as well as make recommendations to education policymakers – more concrete research on the economic and social returns to adult education in the short- and medium-term is needed.

¹⁸For example, given interest in pre-school programs, if investment in such programs is already happening, one possibility is to provide adult education programs as a complement to preschool programs.

¹⁹ In general, little is known about the prevalence of learning disabilities among adult and child learners in developing country in contexts. If dyslexia is prevalent among the population of adult learners in a particular context, then curricula should be adapted to the needs of those learners.

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