FINANCIAL SERVICES ASSESSMENT

Effects of Savings on Consumption, Production, and Food Security: Evidence from Rural Malawi

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Financial Services Assessment project can be found on the web at http://www.fsassessment.umd.edu/

ABOUT THE PROJECT

The *Financial Services Assessment* project is designed to examine the impact of financial services on the lives of poor people across the developing world. This project is funded by the Bill & Melinda Gates Foundation, which is committed to building a deep base of knowledge in the microfinance field. The IRIS Center at the University of Maryland, College Park, together with its partner, Microfinance Opportunities, will assess a diverse range of innovations in financial services. The results of this project will shed light on the design and delivery of appropriate financial products and services for the poor and the potential to scale up successful innovations to reach larger numbers of low-income households.

FUNDING

REPORT SERIES

This report is part of a series that will be generated by the *Financial Services Assessment* project. The reports are disseminated to a broad audience including microfinance institutions and practitioners, donors, commercial and private-sector partners, policymakers, and researchers.

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ABOUT THE AUTHORS

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Dr. Geetha Nagarajan is Associate Director at the IRIS Center, serving as Research Director, Economist and Monitoring and Evaluation Specialist. She designed and directed this study in Malawi for the Financial Services Assessment project. Dr. Nagarajan is a highly experienced researcher, advisory assistance provider, and author of several peer reviewed publications. She has worked in 21 developing countries in Asia, Africa and Eastern Europe. Dr. Nagarajan has evaluated economic development programs, and conducted field based research to identify causes of poverty to design policy and programs to address them, especially in conflict and disaster affected environments. An expert in small and micro and small enterprise development, and rural and microfinance, she has a wide range of experience in developing, measuring, and implementing activities to ensure program effectiveness to reach the target population.

ABSTRACT

Formal savings programs are increasingly being considered as policy instruments for supporting household food security in rural areas. Yet there is currently limited evidence about whether and in what ways that policy proposition may be true. Using a randomized encouragement trial in rural Malawi, this paper assesses evidence on how formal savings may indirectly enhance longer term food security through affecting a household's ability to smooth consumption across time, to adopt higher risk but higher return production, and to upgrade existing production processes. We find that formal savings enables households to assume incrementally greater risk and grow more crops. In particular, savings seems to support households in diversifying their agricultural production and in moving towards more lucrative cash crops.

ACKNOWLEDGEMENTS

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ACRONYMS

BMGF	Bill & Melinda Gates Foundation
CGAP	Consultative Group to Assist the Poor
FBPAs	Field-Based Promotional Assistants
FINCOOP	Finance Cooperative Ltd.
HFIAP	Household Food Insecurity Access Prevalence
HFIAS	Household Food Insecurity Access Scale
MFIs	Microfinance Institutions
MIS	Management Information Systems
MK	Malawi Kwacha
MRFC	Malawi Rural Finance Company
NGO	Non- Governmental Organization
OIBM	Opportunity International Bank in Malawi
PAT	Poverty Assessment Tool
PPP	Purchasing Power Parity
SACCOs	Savings and Credit Cooperatives

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Executive Summary

Objective

Until recently, policy for supporting rural households, their livelihoods, and their food security has essentially concentrated on three instruments: inputs, credit, and training. Each of these has shown some limitations. Subsidization of agricultural inputs has proven costly and of unclear efficacy[1]. Microcredit has shown more modest impacts than initially believed[2]. Training has proven expensive to fund and modest in its results[3].

Consequently, the attention of policymakers has recently turned to formal savings as a potential policy instrument for sustainably supporting the rural poor. Yet limited evidence currently exists on whether and how savings supports behaviors and productive abilities associated with sustained food security.

Using a field experiment funded by the Gates Foundation and implemented by Opportunity International Bank of Malawi (OIBM), this paper assesses evidence on how formal savings may indirectly enhance longer term food security through affecting a household's ability to smooth consumption across time, to adopt higher risk but higher return production, and to upgrade existing production processes--that is, to access food throughout the year more easily and to produce more food more readily.

Methodology

To capture the possible connection between formal savings and food security behaviors, this study relies on a data set that is uniquely designed, by its structure and its content, to address the topic. First, the data set is a panel, whose first wave preceded the savings intervention and whose second wave occurred two years later. This structure provides a robust framework for analyzing the extent to which savings changed behavior. Second, the data set captures detailed information on formal savings utilization, household food acquisition, and household production decisions in the agricultural and non-agricultural sectors. It collects information on which means were used to procure food, which crops were grown, which inputs were purchased, and how much was spent and earned, among other things.

To isolate the role of formal savings in any observed changes in food security behaviors, this study relies on a field experiment implemented in partnership with OIBM. Unable to randomize provision of savings accounts at the household level, this study instead randomizes information about savings at the village-cluster level. Through this strategy, the study both encourages uptake of savings accounts and provides a strong instrument for causal identification of impact.

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[1] See Dorward, Chirwa, and Jayne (2010) for both a balanced overview of the overall evidence on subsidy programs, and a detailed analysis of the program in Malawi.
[2] See Banerjee et al. (2010) and Karlan and Zinman (2010) for two recent rigorous evaluations that find only modest impacts of access to credit.
[3] See Waddington, Snilstveit, Hombrados, Vojtkova, and White (2011) for a review of evidence for farmer field schools.

Key Findings

Does access to formal savings facilitate household decisions that are apt to enhance household security over the longer term? This study suggests that the answer is yes. Indeed, savings does so in one particularly important way. It enables households to assume incrementally greater risk and grow more crops. In particular, savings seems to support households in diversifying their agricultural production and in moving towards more lucrative cash crops.

Overview

Until recently, policy for supporting rural households, their livelihoods, and their food security has essentially concentrated on three instruments: inputs, credit, and training. Each of these has shown some limitations. Subsidization of agricultural inputs has proven costly and of unclear efficacy[4]. Microcredit has shown more modest impacts than initially believed[5]. Training has proven expensive to fund and modest in its results[6].

Consequently, the attention of policymakers has recently turned to formal savings as a potential policy instrument for sustainably supporting the rural poor. Yet limited evidence currently exists on whether and how savings supports households' coping ability, livelihoods, and food security.

The existing literature on savings suffers from four shortcomings. First, much of the research on savings relies on small samples. Udry (1995) relies on a panel of 200 farmers in Nigeria. Dupas and Robinson (2011) draw from daily diaries of 279 entrepreneurs in Kenya.

Second, many studies focus exclusively on in-kind rather than monetary savings. Dercon (1996) focuses on savings held in livestock. Udry (1995) considers grain stocks and durable assets. Kazianga and Udry (2004) consider grain and livestock as the primary vehicles of saving.

Third, many studies focus on the savings impacts for fairly narrow sub-populations and contexts. Dupas and Robinson (2011) limit the scope of their analysis to (mainly) female entrepreneurs in a peri-urban Kenyan town. Brune *et al.* (2011) study tobacco farmers in one region of rural Malawi.

Fourth, all studies focus on a single mechanism for savings to transmit its impact. Dercon (1996) and Dercon and Christiaensen (2007) concentrate on savings' role in helping households take greater production risk. Udry (1995) and Kazianga and Udry (2004) only consider households' ability to cope with shocks. Dupas and Robinson (2001) investigate whether savings improves a household's ability to make productive business investments.

This paper makes two contributions to the existing literature. First, it uses a relatively large sample of rural households in central Malawi, thereby providing evidence that may have larger external validity than previous studies. Second, this study investigates the role of savings through several potential channels of impact, and thereby makes no *a priori* assumptions about the channel(s) through which savings might operate.

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[4] See Dorward, Chirwa, and Jayne (2010) for both a balanced overview of the overall evidence on subsidy programs, and a detailed analysis of the program in Malawi.
[5] See Banerjee et al. (2010) and Karlan and Zinman (2010) for two recent rigorous evaluations that find only modest impacts of access to credit.
[6] See Waddington, Snilstveit, Hombrados, Vojtkova, and White (2011) for a review of evidence for farmer field schools.

The remainder of this paper is organized as follows. The first section provides a motivation for the study. In the second, we discuss the study's conceptual framework. The third outlines the methodology and empirical framework for estimating impact. In the fourth, we present findings for each potential causal channel of savings. Finally, we conclude with a summary of the study's findings.

Motivation of the Paper

How might savings affect food security? Since food security is defined as a household's access to adequate food at all times[7], savings should affect food security through its impact on access to food--that is, through mechanisms that affect a household's ability to purchase and/or produce food. The literature suggests three potential channels.

The first is through consumption smoothing. In rural Malawi, poor households receive few and strongly seasonal injections of income, have few and inefficient means of storing their earnings, yet face an annual and acute period of penury--the "hungry season"--when money is most urgently needed for food. To the extent that incomes are essentially agricultural, rural households receive revenue only when reaping their harvest--in May for the main maize harvest, and in April for tobacco. This means that their income--whether in-kind (i.e., harvested food crops) or monetary (i.e., sold crops)--are received in large lump sums at harvest, and must be made to last until harvest next year.

Yet households have limited means of storing their incomes from one harvest to the next. For in-kind income, most villages lack reliable granaries to store maize (or other food crops) for consumption later in the year[8]. For monetary income, most rural areas have few viable savings options. Formal savings vehicles--such as banks--are too distant, too expensive, or too difficult to use (McGuinness, 2008). Informal vehicles--such as storing money at home, with friends, in the assets like livestock--may not be liquid when savings are needed.

Compounding this problem, the "hungry season"--which lasts roughly from January to March--puts a household's capacity for consumption smoothing to a cruel test. With the next maize harvest still a few months away, agricultural households have no new income, apart from casual labor or petty trading. Without a new harvest, households start to deplete their remaining food stores. When food stores fail, households procure food from the market, and pay the highest annual food prices to do so.

Formal savings could provide households a mechanism for accumulating funds during good times and drawing it down quickly during bad times that is more reliable and efficient than informal options (Zeller and Sharma, 2000). In particular, formal savings should better enable households to spend income from an earlier harvest for food purchases during the lean season, when food household stocks have been depleted.

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[7] See USAID's policy determination document for more details on the commonly used definitions of food security.
[8] http://www.aec.msu.edu/fs2/gisama/GISAMA_PS_2.pdf

The second mechanism is through bearing greater risk. Poor rural households are risk averse by necessity. The least error in decisions about income-generating activities could have large ramifications for household welfare. A failed crop could mean the household has less--and perhaps next to nothing-- to eat. A failed business could mean having less or money on hand for purchasing food, particularly during the hungry season.

Conscious of these potentially disastrous outcomes, poor households adopt low-risk, low-return income-generating activities, planting crops or operating businesses that produce low but reliable returns. In other words, poor households avoid riskier but otherwise potentially profitable activities for fear of their downside risk.

Formal savings could provide a superior self-insurance mechanism for bearing greater risk and reaping greater returns (Dercon, 1996; Dercon and Christiaensen, 2007; Zeller and Sharma, 2000). More liquid than informal vehicles, formal savings can be accessed quickly to cope with the pressing needs of production failure. More secure than informal alternatives, formal savings offer a buffer with certainty against downside risk that occurs with some probability. Combined, these attributes could induce households to take more risk.

The third mechanism is through upgrading production. Poor rural households face pecuniary obstacles in investing in the inputs for their income-generating activities. For a variety of reasons--whether because of self-control or demands from others--households may be unable to accumulate adequate funds for purchasing necessary inputs, or may be unable to maintain their balance until inputs must be bought.

Formal savings could furnish a safe place for households to amass money for making the large lump-sum payments required for many productive inputs. In particular, formal savings accounts could protect household savings from theft or loss in a way that informal savings options simply do not.

Smoothing consumption, bearing risk, or upgrading production--savings could affect household behavior though one or many of the aforementioned mechanisms. This change in behavior could result in material changes in livelihood or consumption smoothing such that households may enjoy improved food security due to savings.

In particular, changes in these behavioral mechanisms should translate into changes in food security indicators. Improvements in a household's consumption smoothing ability should lead to less frequent and/or less severe food insecurity episodes.

Increased ability to bear risk should result in households intensifying agricultural activities by growing more types of crops and/or diversifying into non-agricultural business. Growing more types of crops would result in a possible rise in the dietary diversity. Diversifying income sources away from highly season farm production could lead to a smoothing of income across the year and thus to a potential decline in the frequency and/or severity of food insecurity problems.

Increased ability to upgrade production, other things being equal, should result in higher yields and higher income. This may translate into more food and more income to buy food. Those incremental increases, in turn, may reduce the frequency and/or severity of food security problems.

Methodology and Empirical Framework

The Context

Most households in rural Malawi are unbanked. According to the 2008 FinScope Survey, 55% of households are engaged neither in formal nor informal finance. Of the remaining portion, only 45% have access to formal financial services.

There are at least three reasons for the low penetration of formal financial services in rural areas of Malawi (Meagher, 2010). First, many rural households are physically distant from formal financial institutions that are mostly located in urban and semi-urban locations. Yet the majority of the Malawian population lives in rural areas.

Second, rural households face substantial financial and administrative obstacles to opening a formal bank account. Most formal institutions have account terms—such as relatively large minimum balances—that set formal financial services out of the reach of rural populations. Many banks also require formal identification cards—such as a passport or other government ID—that rural populations may not have and may find prohibitively expensive to procure.

Third, households lack information regarding formal financial services.[9] Focus group discussions conducted in early February 2008 by the IRIS Center among villagers in the areas serviced by the mobile van found that information was largely spread through word of mouth followed by limited exposure to mass media such as radio.[10] There was demand for improved access to accurate and specific information on financial services. Many suggested that easy and continuous access to information on terms and conditions of the products and methods to access them would improve take up of financial services (Nagarajan and Adelman, 2010).

The Intervention

In recognition of these constraints, Opportunity International Bank of Malawi (OIBM), a savings led institution, with funding from the Bill and Melinda Gates Foundation (BMGF), developed an innovative approach to address these impediments to financial inclusion. The first part of this approach was simply to bring banking services closer to their potential clients though a "bank on wheels"—a bus offering full-service banking—that stopped at select call points in rural Malawi. This is expected to enable rural clients travel less in order to conduct their financial transactions.

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[9] There was misinformation and misunderstanding about financial services due to the low education level of rural residents. It was not uncommon to hear reports that "banks have enough customers and do not want any more" or "the bank's computer system is full and they cannot take any new customers" even from community leaders (McGuinness, 2008).

[10] Word of Mouth Advertising Media (WOMAM) was the primary mode of information dissemination in interior areas.

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The second part of OIBM's intervention was to make its savings products better suited to rural populations. This involved creating accounts with low minimum balances and, importantly, allowing alternative forms of identification for opening account[11] (see Stuart et al., 2011 for more details).

The "banks on wheels" started operating in August 2007 and stopped at a total of six call points along the roads from Lilongwe to Dedza and from Lilongwe to Mchinji. All of these six call points are located at trading centers. Four of the call points were areas that were not served by any other financial institution. Two call centers faced competition from other formal service providers.

The Experimental Design

This study aims to evaluate the impact of opening an OIBM savings account on changes in rural livelihoods that may lead to longer term food security, and therefore requires identifying the effect of savings and isolating it from other possible causes.

In principle, a randomized control trial (RCT)—which randomly assigns a part of the population to a savings product and randomly withholds that product from the rest—provides the ideal identification strategy. In practice, an RCT is not always logistically feasible or ethically desirable. It may not be possible, for example, physically to exclude portions of the population from a product that serves a geographic area or desirable ethically to bar potential clients from taking a product that should help them.

Such is the case for this study. For both operational and ethical reasons, it was not possible to deny savings product to potential clients of OIBM. Operationally, it was prohibitively difficult to accept applicants only from areas randomly selected to receive OIBM services. Since OIBM was a new entrant in the region, it was also important to increase outreach rapidly and significantly in order to become competitive and viable. Ethically, it was impossible to deny households a service that one has every reason to believe should help them.

Therefore, this study applied a randomized encouragement trial (RET) framework to supply information about savings products offered by OIBM. Recognizing that information is a constraint to take-up for savings accounts, this study designed and implemented an intensive information campaign—which simply explained the terms, conditions, and application process for a savings account—to some areas and withheld that campaign from others. It randomly encouraged some areas to take up OIBM's savings product and randomly withheld the information from the others (see annex 1 for more details).[12]

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[11] Most other financial institutions require government issued IDs. In contrast, OIBM worked accepted a letter of reference from village authorities as a form of identification.

[12] A randomly chosen 56 pairs of clusters (enumeration areas - EAs) were matched by population size and by distance from the major trade centers where formal financial providers including OIBM operate to provide financial services. Utmost care was taken to ensure that control clusters were located at least four kilometers away in every direction from the treatment clusters to avoid the dissemination of the information from treatment areas to control areas. Within each of the 56 matched pairs, we then

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The information campaign serves a twofold purpose for this study. First, it increases the likelihood of account take-up for households in areas served by the intensive information campaign. Using data from OIBM's management information systems, Nagarajan and Adelman (2010) show that take-up is substantially higher in encouraged areas (933 new clients) than in non-encouraged ones (489 new clients). Our survey data from 2,006 households is also consistent with this observation: 60 new OIBM accounts in encouraged areas compared to 23 in non-encouraged areas. While there is up-take in non-encouraged areas, the number of new OIBM savers is roughly twice as high in encouraged areas overall. In table 1, results shown in columns 1 and 2 indicate that the information campaign affects the probability of take-up in a positive and statistically significant way. The results shown in column 3 and 4 also indicate that the intense information campaign only increased the uptake on OIBM products and not other formal institutions or informal providers.

Table 1: Number of New OIBM Clients (April 2008 to April 2010), by Information Campaign Status

Items	Intensive information (Treatment)	Non-intensive information (Control)	Total
OIBM administrative data	933	489	1,422
IRIS study sample	60	23	83

Source: OIBM; IRIS Panel Data.

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randomly assigned the provision of intense information campaign to boost outreach for formal finance, especially for OIBM products.

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Table 2: Intense Information Campaign Increases the Probability of Take-up

	OIBM		Other formal providers	Informal providers
	Overall	Controlling for Lilongwe		
	(1)	(2)	(3)	(4)
Treatment (intense information campaign dummy)	0.0362**	0.0488***	0.00881	0.000146
	(0.0117)	(0.0113)	(0.0179)	(0.0115)
Lilongwe(dummy)		0.0565**		
		(0.0189)		
Treatment*Lilongwe		-0.0510		
		(0.0327)		
Intercept	0.0231***	0.00931**	0.0683***	0.0533***
	(0.00605)	(0.00322)	(0.00947)	(0.00857)
N	2,006	2,006	2,006	2,006
r2	0.00827	0.0157	0.000287	0.000000106
F	9.533	10.13	0.241	0.000161

Note: Clustered standard errors are given in parentheses; ***, ** and *, respectively, represents significance at the 0.1% 1%, and 5% levels. Treatment represents the dummy variable for receiving the intensive marketing campaign. Lilongwe denotes a household being located in the Lilongwe district. The interactive term captures the differential effects of being in a treatment area in the Lilongwe district. This latter term is not statistically significant at any commonly acceptable level but does have a p value of 0.121, and thus borders on statistical significance.

Second, the information campaign offers a strong instrument for identification of causal impact. In effect, it created circumstances that are essentially the same as those of a randomized control trial. Since information was provided to households in randomly selected clusters from the pool of all eligible clusters, households from areas that randomly received the intense information campaign are, on average, no different than their counterparts in areas that were randomly withheld that same campaign. Therefore, households from areas that randomly received the information campaign are expected, in the absence of this intervention, to fare much the same as households in areas that did not. Any difference between these two sets of households can be attributed to savings alone.

The Data

This study relies on a data set that is uniquely designed, by its structure and its content, to inform how savings may support consumption, production, and household food security. First, the data set is a panel, whose first wave preceded the intervention and whose second wave occurred two years later. This structure provides a robust framework for analyzing the extent to which savings changed behavior.

Second, the data set captures detailed information on household food acquisition and household production decisions in the agricultural and non-agricultural sectors. It collects information on which means were used to procure food, which crops were grown, which inputs were purchased, and how much was spent and earned, among other things.

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How Food is Procured and How Withdrawals are Made

The survey contains two sections that inform the consumption smoothing hypothesis. The first asks whether and how often households used each of a set of actions--from selling livestock or harvesting immature crops to using cash or borrowing from any source--in order to access food with the past 30 days (i.e., during the hungry season). This provides information on the extent to which households procure food in a way that is consistent with consumption smoothing.

The second set of questions, embedded with a larger section on usage of financial instruments, inquires about how often and how large a cumulative sum of money households withdraw over those same past 30 days (i.e., during the hungry season). These questions provide more detailed data on the source, size, and frequency of withdrawals that households may be making in order to smooth consumption to cope with the strictures of the season of scarcity.

Taken together, this data allows an assessment that traces a straight line from food procurement to financial access.

Which and How Many Crops Were Grown, Which and How Many Businesses Run

The survey also captures two sections of detailed data to inform the risk bearing hypothesis. The first carefully catalogues which crops were grown in the last season and on how much land. This allows an exacting understanding of whether households are growing more crops or dedicating more land to those they grew prior to the information campaign.

The second section offers a no less complete analog for non-agricultural businesses. It asks whether a household has run a business in the past 12 months, and if so what type of business. This facilitates an understanding of whether households are opening businesses or operating businesses of a particular sort.

Capturing comparable information across these two sectors of activity provides the study with a rich understanding of whether and in which domain households may be taking incrementally more risk, without making any assumptions about which sector that should be.

How Much was Spent on Agricultural Inputs and Business Expenditures

The survey also collects extensive information on the number, type, and cost of productive investments. For agriculture, the instrument elicits which inputs were used last year and how much was spent on each. For business, questions concentrate on expenditures for comparable inputs such as labor, raw materials, and items for resale.

This granular detail on input expenditure, equally detailed across both sectors, provides rich potential for tracing through which expenditure pathways, if any, savings may influence upgrading production.

The Empirical Strategy

To determine whether savings affected consumption and production behavior linked to food security, this study will compare the outcomes of savers and non-savers, and then attribute any differences between the groups to savings.

To do so, this study will estimate the impact of OIBM savings on the mechanisms of preserving and improving household food security through three complementary calculations, taking each as offering some degree of evidence about the savings-food security relationship. In the first, we will compare the average behavioral outcomes between areas where OIBM savings accounts were encouraged through intense information campaigns and those where they were not, thus estimating the intention to treat (ITT)—that is, the average impact of savings on mechanisms related to food security for those areas encouraged to save. This estimate will be calculated using ordinary least squares.

In the second, we will compare changes between comparable new OIBM savers and non-savers, thus estimating the average treatment effect on the treated (ATT)--that is, the average effect of saving for those that save with OIBM. This quantity will be estimated using propensity score matching, which uses relevant observable characteristics to match similar households in treatment and control groups.

In the third approach, we will focus our analysis on those households whose savings behavior could be changed by the intense information campaign, yielding the local average treatment effect (LATE)—that is, the average treatment effect for those households whose take up of OIBM savings is predicted to be due to the intensive information campaign, and would not have opened an OIBM savings account otherwise. This quantity will be estimated for compliers using an instrumental variables method, which first predicts savings take-up using the instrumental variable and then compares compliers against their counterparts who were not nudged into saving by the instrument.

To understand how savings impacts the mechanisms for preserving or enhancing food security, we will investigate three causal channels in turn. We will first explore whether access to savings improve a household's ability to smooth consumption over time, and in particular to utilize previously accrued savings to meet food needs during the hungry season. We will then evaluate whether savings enables households to bear the greater risk of intensifying or diversifying their income-generating activities. We will lastly explore whether savings facilitates increased purchase of productive inputs for the household's agricultural or non-agricultural activities.

Findings

Consumption smoothing

Rural households in this study, mostly farmers, receive the majority of their annual income after harvest. The food they grow is what they have to eat. The money they earn through crops sales is largely what they have to spend (Carletto et al., 2007).

The hardest period of the year is the hungry season, the period immediately before the next harvest and during which this study occurs. By this point in the year, many households have depleted their food stores from the prior harvest. To feed themselves, these households must purchase food from the market and face peak food prices.

Having cash to make hungry season food purchases is not a matter to be taken for granted. Money can be hard to earn in this period of economic stupor, and would need to be in hand or gotten by liquidating savings. This observation highlights a potentially strong role for savings: as a means for storing proceeds from the prior harvests for use in feeding the household immediately before the next harvest. Savings, in other words, should aid households smooth the fruits of lumpy income out over the year, and conserve a potentially considerable share of it for hungry season needs.

We thus expect households to use their new OIBM accounts for consumption smoothing during this period of intense food security pressure—in particular, to use savings from their formal accounts to buy food, and to make more frequent and/or more sizeable withdrawals to procure food during the period.

Table 3: Checking the Baseline Balance of Consumption Smoothing Behavior

	T	C	Difference	
			C-T	
How households access food				
Use cash savings, from any source	71.118%	75.980%	4.862%	*
	(0.014)	(0.014)	(0.020)	
Borrow, from any source	28.882%	28.141%	-0.742%	
	(0.014)	(0.014)	(0.020)	
Liquidate assets	23.739%	23.015%	-0.724%	
	(0.013)	(0.013)	(0.019)	
Rely on gifts, charity	2.374%	1.508%	-0.866%	
	(0.005)	(0.004)	(0.006)	
Restrict consumption	22.552%	23.015%	0.463%	
	(0.013)	(0.013)	(0.019)	
Forage	10.979%	12.663%	1.684%	
	(0.010)	(0.011)	(0.014)	
Relocate hhold, or members	9.397%	9.648%	0.002516	
	(0.009)	(0.009)	(0.013)	
How much households use savings				
Number of total withdrawals	0.5231788	0.357143	-0.166036	+
	(0.068)	(0.066)	(0.097)	
Total amount withdrawn, in MK	8357.311	3404.464	-4952.847	
	(5059.443)	(920.648)	(5930.728)	

Note: The final column of the table above indicates whether each baseline characteristic differs significantly across areas that received the information campaign (treatment) and those that did not (control) ***, ** *, + represents statistically significant differences at the 0.1% 1%, 5% and 10% levels, respectively. Standard errors are given in parentheses.

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Table 4: Using Cash Savings to Buy Food

Dependent variable: Independent variables:	Change in likelihood of buying food with cash savings drawn from any source		
	ITT	PSM	LATE
	(1)	(2)	(3)
Intensive information campaign	0.0272 (0.0620)		
Opening a new OIBM savings account		0.048193 (0.107)	0.751 (1.645)
Intercept	-0.156** (0.0475)		-0.173* (0.0801)
N	2,006		2,006
r2	0.000415		.
chi2			0.208
F	0.193		

Note: The significance of coefficients is denoted by ***, ** *, +. These symbols represent 0.1% 1%, 5% and 10% levels of statistical significance, respectively. Clustered standard errors are given in parentheses below coefficient estimates. Each column reports a different quantity and estimation method. The first column uses OLS to estimate intention-to-treat (ITT). The second uses propensity score matching (PSM) to estimate the average treatment effect. The third employs 2SLS to compute the local average treatment effect (LATE).

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Estimates in Table 4 show that households that save with OIBM are no more likely to use cash savings for purchasing food than their closest counterparts that do not save with OIBM. While analysis does suggest OIBM savers to be marginally more likely to use cash savings to purchase food during the hungry season—an indication of consumption smoothing—those likelihood estimates are not statistically significantly different than the likelihood for their non-OIBM peers. Households with OIBM savings accounts, in this regard, behave statistically identically to households without OIBM accounts.

Table 5: Making More or Larger Withdrawals

Dependent variables: Independent variable:	Change in the number of withdrawals			Change in the total amount withdrawn		
	ITT	PSM	LATE	ITT	PSM	LATE
	(1)	(2)	(3)	(4)	(5)	(6)
Intensive information campaign (dummy)	0.186 (0.193)			-675.7 (820.7)		
new OIBM savings account (dummy)		-0.916 (1.815)	5.146 (5.574)		10861.470 (10822.133)	-18649.4 (23921.7)
Intercept	0.0945 (0.0945)		-0.0245 (0.199)	172.3 (266.9)		603.4 (699.0)
N	2,006		2,006	2,006		2,006
r2	0.000453		.	0.000314		.
chi2			0.852			0.608
F	0.931			0.678		

Note: The significance of coefficients is denoted by ***, ** *, +. These symbols represent 0.1% 1%, 5% and 10% levels of statistical significance, respectively. Clustered standard errors are given in parentheses below coefficient estimates. Each column reports a different quantity and estimation method. The first column for each dependent variable uses OLS to estimate intention-to-treat (ITT). The second uses propensity score matching (PSM) to estimate the average treatment effect. The third employs 2SLS to compute the local average treatment effect (LATE).

Analysis of changes in hungry season savings account activity, shown in Table 5, provides no clear evidence of consumption smoothing through considerable withdrawals from savings. There is no strong, statistically significant pattern of greater withdrawals in control than in treatment areas (columns 1 and 4), amongst those that save with OIBM (columns 2 and 5), or amongst those whose up-take decision was motivated by encouragement (column 3 and 6). Nevertheless, the sign of the estimated coefficients do provide some suggestive evidence that two relatively weak trends might be at play. Opening a savings account with OIBM may be associated with a greater frequency of withdrawals during the hungry season, but also with a drop in the cumulative size of those withdrawals[13].

But in the strictest of senses, there is no evidence that saving with OIBM is facilitating consumption smoothing. This is a puzzling finding that runs contrary to expectation.
This is not, however, to say that there is clear evidence that consumption smoothing is not taking place. Why might this be so?

There are two potential stories consistent with these facts, both potentially encouraging ones. The first is that these households, being forward looking, may withdraw money for food

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[13] The PSM estimate break with this trend, but also has a higher standard error than coefficients from other estimation methods.

needs earlier than the recall period in our survey instrument, and that savings previously stored in their formal accounts is stored at home at the time of data collection. In other words, households may indeed be using their formal savings for consumption smoothing, but doing so just before the period about which we inquire.

The second potential story is that those with new OIBM savings accounts may have more income and thus more cash on hand at any given time to use for food. This might be true only if households are indeed, as we investigate later, producing and earning more as a consequence of savings.

Yet interpreted with the utmost caution, these findings do not allow us reject the null hypothesis that no consumption smoothing is taking place through depletion of savings. And, if true, this should not be too surprising. First, households could well be depleting other assets than financial ones to smooth consumption. For example, households may be selling livestock and using the proceeds, rather than monetary savings, as a buffer stock. This mode of smoothing has not yet been investigated.

Second, households may have increased their consumption smoothing ability through savings, but may prefer not to exercise that ability for cultural reasons. They may simply accept the hardships of the hungry season as facts of life, and not seek to cope with mild food insecurity. Alternatively, they may prefer not to smooth consumption, for fear of standing out from their neighbors in the village or for fear of signaling their wealth to others.

Bearing More Risk

Poor rural households are risk averse by necessity. The least error in decisions about income-generating activities could have large ramifications for household welfare. A failed crop could mean the household has less to eat. A failed business could mean not having money to meet dire needs.

Accordingly, poor households minimize the risk of their income generation activities. They raise crops or operate businesses that reliably generate low revenues (rather than endeavors that generate higher revenues but with higher risk). However, this risk-minimizing strategy comes at the cost of foregone returns. Households fail to reap the financial rewards of export crops or opening a business.

Why do households minimize risk? The answer lies in their ability to cope with the downside of risk— that is, with their capacity for absorbing the possible failure or under-performance of their income-generating activity. The answer, in other words, has to do with the reliability of their self-insurance mechanism.

Formal savings could provide exactly the self-insurance mechanism that rural households need. To see this, consider two features of formal savings. First, formal savings are liquid. Unlike other savings vehicles, formal savings can be accessed at any time. Households can draw down savings as they need it in order to cope. By contrast, livestock can only be liquidated when there is a buyer; money kept with a friend can only be utilized when the friend has those funds available.

Second, formal savings are secure. Unlike other savings mechanisms, formal savings will be present with certainty when the need arises. The same cannot be said for traditional savings vehicles. Livestock die; assets get stolen; and friends may misuse money entrusted into their keeping. Formal savings offer a buffer with certainty against downside risk that occurs with some probability.

We thus expect that improving access to savings should result in increased risk taking, and that households induced into taking up OIBM savings services should take more risk in particular.

In the following section, we investigate whether OIBM's savings product induces households to bear greater risk in its income-generating activities. We will first look at agriculture to see whether savings with OIBM enables households to grow more and engage more in non-agricultural business.

Table 6: Checking Baseline Balance of Agricultural and Non-Agricultural Income-Generating Activities

	T	C	Difference: C-T	
Agricultural production				
Number of crops grown	2.925	2.972	0.047	
	(0.043)	(0.043)	(0.061)	
Number of consumption crops	2.584	2.566	-0.018	
	(0.038)	(0.037)	(0.053)	
Number of cash crops	0.341	0.406	0.065	**
	(0.016)	(0.017)	(0.024)	
Percentage growing tobacco	13.452%	16.985%	3.533%	*
	(0.011)	(0.012)	(0.016)	
Percentage growing groundnuts	52.720%	57.688%	4.968%	*
	(0.016)	(0.016)	(0.022)	
Percentage growing soy beans	20.376%	22.915%	2.539%	
	(0.013)	(0.013)	(0.018)	
Non-agricultural business production				
Percentage that operate a business	26.014%	25.025%	-0.989%	
	(0.014)	(0.014)	(0.019)	
Number of businesses	0.320	0.281	-0.039	
	(0.019)	(0.017)	(0.025)	

Note: The final column of the table above indicates whether each baseline characteristic differs significantly across areas that received the information campaign (treatment) and those that did not (control) ***, ** *, + represents statistically significant differences at the 0.1% 1%, 5% and 10% levels, respectively.

The initial income-generating activities of households in treatment and control areas are not significantly different. There are comparable levels of engagement in agricultural and non-agricultural activities in areas that received the intensive marketing campaign as in those areas that did not receive it. Treatment households grow the same average number of crops as control households. Control households operate the same average number of non-agricultural businesses.

There are, however, discernable baseline differences between these groups. Control households are more engaged in cash crops—in particular, in tobacco and groundnut. But the baseline differences are of relatively small economic magnitude—on the order of a few percentage points or a small fraction of a crop. These differences, then, are not such that they would undercut analysis, or that they could not be corrected in analysis. The study, thus, still provides a balanced enough sample for reliable analysis.

Table 7: Growing More Crops

	Changes in the number of total crops grown		Changes in the number of consumption crops planted			Changes in the number of cash crops planted		
	ITT (1)	LATE (3)	ITT (4)	PSM (5)	LATE (6)	ITT 7)	PSM (8)	LATE (9)
Intensive information campaign	0.255*		0.176+			0.0825**		
	(0.113)		(0.103)			(0.0311)		
new OIBM savings account		7.050+			4.855			
				0.1445783			0	2.276*
	(0.281)	(3.916)		(0.237)	(3.308)		(0.103)	(1.096)
Intercept	-0.0141	-0.177	-0.115		-0.227	0.102***		0.0489
	(0.0764)	(0.160)	(0.0729)		(0.143)	(0.0220)		(0.0427)
N	2006	2006	2006		2004	2006		2006
r2	0.00594	PSM	.	0.00360		.	0.00408		.
chi2		(2)	3.240			2.154			4.315
F	5.121			2.897			7.045		

Note: The significance of coefficients is denoted by ***, ** *, +. These symbols represent 0.1% 1%, 5% and 10% levels of statistical significance, respectively. Clustered standard errors are given in parentheses below coefficient estimates. Each column reports a different quantity and estimation method. The first column for each dependent variable uses OLS to estimate intention-to-treat (ITT). The second uses propensity score matching (PSM) to estimate the average treatment effect. The third employs 2SLS to compute the local average treatment effect (LATE).

Savings seems to improve a household's ability to tolerate the risk of growing more crops. However, this revealed improvement in risk tolerance is not always and everywhere strong. While savings is associated with a greater positive change in the number of crops planted (columns 1-3), this aggregate result is less strong when broken down by type of crop (columns 4-6 and 7-9). The impact savings on the relatively weak on changes in the number of consumption crops (columns 4-6). In contrast, savings is much stronger in helping households plant more cash crops (columns 7-9). In both cases, the magnitude of change in crops planted is rather modest. But the association between savings and increased crop

diversity holds up relatively well under different estimation strategies (i.e., OLS for ITT, PSM for ATT, and 2SLS for LATE).

This result sketches a significant potential pathway from savings to food security. Households that save are more able to bear the risk of actually growing more crops. These households may see an improvement in food security as a consequence. If these crops are consumption crops, the improvement in food security may well be in the form of increased dietary diversity, on the assumption that additional crops cover different food groups than those currently grown. If these crops are cash crops, as appears more likely the case from the above analysis, the welfare improvement may come from increased income that can be spent on food.

Table 8: Opening a New Business

	Change in the number of businesses			Probability of starting a business at endline		
	ITT	PSM	LATE	ITT	PSM	LATE
	(1)	(2)	(3)	(4)	(5)	(6)
Intensive information campaign	-0.0341			-0.0200		
	(0.0323)			(0.0740)		
Opening a new OIBM savings account		0.036145	-0.938		-0.01205	-0.556
		0.108584	(0.899)		0.049498	(1.994)
Intercept	-0.0402+		-0.0185	-1.224***		-1.205***
	(0.0210)		(0.0372)	(0.0527)		(0.135)
N	2003		2003	2006		2006
r2	0.000819		.			
chi2			1.090	0.0730		0.0778
F	1.114					

Note: The significance of coefficients is denoted by ***, ** *, +. These symbols represent 0.1% 1%, 5% and 10% levels of statistical significance, respectively. Clustered standard errors are given in parentheses below coefficient estimates. Each column reports a different quantity and estimation method. The first column for each dependent variable uses OLS to estimate intention-to-treat (ITT). The second uses propensity score matching (PSM) to estimate the average treatment effect. The third employs 2SLS to compute the local average treatment effect (LATE).

Whereas savings seemed to facilitate increased risk-taking in agriculture, the same cannot be said for non-agricultural activities (columns 1-3). The data do not provide any evidence of savings' association with operating a larger number of businesses or a higher probability of starting a new business. If anything, the data may provide suggestive evidence that OIBM savers are moving away from business or are less inclined to start a new enterprise, as evidenced by the negative sign of estimated coefficients (columns 4-6).

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This story does defy expectations of the canonical savings and entrepreneurship story, but may not be entirely inconsistent with the hypothesis that savings enables households to bear greater risk. The relative retreat from non-agricultural business could be motivated by a desire on the part of households to concentrate their efforts in potentially higher performing agriculture. This story, though ultimately speculative, would indeed involve households assuming a higher degree of covariant risk from agriculture, but standing also to realize higher returns through specialization.

Opening a new OIBM accounts has indeed enabled households to take greater production risk. But this has not been the case on all fronts. Savings has enabled households to grow more crops, and more cash crops in particular. Savings has not been instrumental, however, in facilitating entrance into new non-agricultural businesses--and may even have facilitated a modest exit from microenterprise.

Savings appears, then, to have enabled households to intensify those activities that may feed them directly or indirectly rather than those that result in purely cash income. Accordingly, on the basis of these results, one might expect savings to help households improve their dietary diversity, particularly if the new crops grown are ones that expand the variety of diets. It is also possible that this crop diversification could yield higher returns, produce greater agricultural profits, and thereby alleviate the frequency and/or severity of food insecurity well after the harvest. The evidence is less strong for this latter assertion.

Upgrading Production

Rural households face serious obstacles in purchasing productive inputs for upgrading their agricultural production. They receive their annual income after harvest and must preserve some portion of it until planting season for the next harvest in order to buy inputs.

Households face serious demands on their money in the interim. Their support network may ask for money (Platteau, 2000). Other needs, some frivolous, may also arise (Banerjee and Duflo, 2006). Faced with these demands, particularly when money is kept at home, households may fritter away funds they could have otherwise spent later in the year on productive inputs. There may also be a self-control problem in preserving money to buy inputs (Duflo, Kremer, and Robinson, 2010).

Formal savings offers a solution for these problems that other mechanisms do not. Keeping money at home, hidden under the mattress, could help households save the sums needed for input purchases. But that money could get lost, stolen, or captured by the demands of a household's support network or a household's impulsive purchases. Informal savings offers households an external storage place, but suffers some of the same problems as money at home and some of its own. Money kept with friends, for example, may still be known to a household's support network and potentially be partially captured by them. Money kept with a savings club, say, may not be accessible when the household needs it for input purchases. Formal savings, like those offered by OIBM, offer an external place to store savings that is far enough from grabbing hands in the village (including the household's) and that makes funds available when they are needed. A savings account with OIBM should thus enable

households to accumulate and draw down the funds needed for purchase of productive inputs.

We therefore expect that households' savings should permit households to increase the number of agricultural inputs they use and increase their usage of two particularly productive inputs: fertilizer and improved maize seed.

Table 9: Checking the Baseline Balance of Productive Investments in Household Agricultural and Non-Agricultural Activities

	T	C	Difference: C-T	
Agricultural inputs				
Inputs				
Number of inputs used	2.492	2.384	-0.108	***
	(0.027)	(0.028)	(0.039)	
Expenditure on input purchases	10384.540	7291.639	-3092.902	*
	(1438.350)	(633.747)	(1580.320)	
Better maize use				
Percentage using any better maize seed	41.543%	37.085%	-4.458%	*
	(0.016)	(0.015)	(0.022)	
Percentage using improved maize seed	2.473%	2.211%	-0.262%	
	(0.005)	(0.005)	(0.007)	
Percentage using hybrid maize	39.070%	34.874%	-4.196%	+
	(0.015)	(0.015)	(0.022)	
Percentage using local maize	63.501%	67.136%	3.634%	+
	(0.015)	(0.015)	(0.021)	
Fertilizer use				
Percentage using chemical fertilizer	85.064%	81.910%	-3.155%	+
	(0.011)	(0.012)	(0.017)	
Expenditure on fertilizer, in MK	7858.089	5551.137	-2306.952	+
	(1104.523)	(447.127)	(1198.050)	
Quantity of fertilizer used	135.574	105.667	-29.907	+
	(16.669)	(5.704)	(17.730)	
Business inputs				
Expenditure on input purchases, in MK	2180.428	1489.764	-690.665	
	(608.236)	(466.564)	(768.204)	
Expenditure on all non-labor inputs, in MK	2013.086	1410.367	-602.719	
	(530.202)	(413.346)	(673.637)	
Expenditure on labor inputs, in MK	167.342	79.397	-87.945	
	(92.236)	(58.136)	(109.411)	

Note: The final column of the table above indicates whether each baseline characteristic differs significantly across areas that received the information campaign (treatment) and those that did not (control) ***, ** *, + represents statistically significant differences at the 0.1% 1%, 5% and 10% levels, respectively.

Households seem reasonably balanced between treatment and control areas in terms of their agricultural and non-agricultural input use. However, more so than in other dimensions, there are baseline differences between these groups. Yet those differences are of a reasonably small order of magnitude and occur mostly for variables that have a naturally high variance (e.g., expenditure).

Table 10: Expenditure on Agricultural Inputs

	Changes in the number of inputs			Changes in expenditure on inputs, MK			Adoption better maize seeds at endline		
	ITT	PSM	LATE	ITT	PSM	LATE	ITT	PSM	LATE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Intensive information campaign	-0.0363			309.3			-0.0755		
	(0.0594)			(1775.2)			(0.0670)		
Opening a new OIBM savings account		0.144578	-1.002		4020.2	9107.2		0.048193	-1.903
		(0.169)	(1.701)		(6027.481)	(51582.6)		(0.073)	(1.581)
Intercept	-0.0191		0.00406	7908.1***		7694.2***	-0.642***		-0.544***
	(0.0482)		(0.0840)	(970.3)		(1912.7)	(0.0498)		(0.164)
N	2006		2006	1971		1971	2006		2006
r2				0.0000156		0.00309			
chi2			0.347			0.0312	1.272		1.448
F	0.373			0.0304					

Note: The significance of coefficients is denoted by ***, ** *, +. These symbols represent 0.1% 1%, 5% and 10% levels of statistical significance, respectively. Clustered standard errors are given in parentheses below coefficient estimates. Each column reports a different quantity and estimation method. The first column for each dependent variable uses OLS to estimate intention-to-treat (ITT). The second uses propensity score matching (PSM) to estimate the average treatment effect. The third employs 2SLS to compute the local average treatment effect (LATE).

There appears to be no drastically differential expenditure on most agricultural inputs between information campaign and non-information campaign areas (columns 1, 4, and 7). Households that adopt OIBM savings accounts are using no more inputs (column 2), making no larger expenditures (column 5), or opting for no better seed varieties (in this case, of improved maize seeds) (column 8) than comparable households that do not open an OIBM account. The same is true when comparing the subset of households whose take-up decision was influenced by the information campaign and those households that would have taken up had they been exposed to the campaign (columns 3, 6, and 9).

Table 11: Fertilizer

	Change in expenditure on fertilizer, MK			Change in amount use of fertilizer, kg		
	ITT	PSM	LATE	ITT	PSM	LATE
	(1)	(2)	(4)	(5)	(6)	(7)
Intensive information campaign	229.8			6.257		
	(1317.6)			(19.34)		
Opening a new OIBM savings account		-3102.69	6332.2		259.8313	172.7
		5554.413	(35948.0)		(202.343)	(529.0)
Intercept	6207.0***		6060.7***	9.073		5.082
	(785.1)		(1434.3)	(6.103)		(15.30)
N	2005		2005	2006		2006
r2	0.0000155		0.00294	0.0000604		0.00152
chi2			0.0310			0.107
F	0.0304			0.105		

Note: The significance of coefficients is denoted by ***, ** *, +. These symbols represent 0.1% 1%, 5% and 10% levels of statistical significance, respectively. Clustered standard errors are given in parentheses below coefficient estimates. Each column reports a different quantity and estimation method. The first column for each dependent variable uses OLS to estimate intention-to-treat (ITT). The second uses propensity score matching (PSM) to estimate the average treatment effect. The third employs 2SLS to compute the local average treatment effect (LATE).

What is true of other inputs is essentially true of fertilizer too. There is no clear statistical link between saving and increased fertilizer purchase or use of fertilizer. However, in clearer fashion than for other inputs, there is a suggestive trend between savings and the purchase and use of fertilizer. Thought not in a statistically significant way, expenditure on and use of fertilizer is higher amongst the encouraged and/or OIBM saver populations. The computed coefficients are positive and often of notable size, particularly for the models that estimate the change in the amount of fertilizer used.

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Table 12: Expenditure on Business Inputs

	Change in total input expenditure, MK			Change in labor expenditure, MK			Change in non-labor expenditure, MK		
	ITT	PSM	LATE	ITT	PSM	LATE	ITT	PSM	LATE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Intensive information campaign	-223.1			41.32			-264.4		
	(884.8)			(148.2)			(840.7)		
Opening a new OIBM savings account		8405.5663	-6156.7		719.27711	1140.4		3586.3	-7297.1
		(6432.893)	(24733.4)		(961.456)	(4084.6)		(3303.8)	(23643.6)
Intercept	410.1		552.5	33.97		7.608	376.2	94.54	544.9
	(597.7)		(1063.4)	(37.10)		(110.1)	(577.7)	(416.8)	(1024.7)
N	2006		2006	2006		2006	2006	2006	2006
r2	0.0000353		.	0.0000384		.	0.0000561	0.00164	.
chi2			0.0620			0.0780			0.0953
F	0.0636			0.0778			0.0989	1.178	

Note: The significance of coefficients is denoted by ***, ** *, +. These symbols represent 0.1%, 1%, 5%, and 10% levels of statistical significance, respectively. Clustered standard errors are given in parentheses below coefficient estimates. Each column reports a different quantity and estimation method. The first column for each dependent variable uses OLS to estimate intention-to-treat (ITT). The second uses propensity score matching (PSM) to estimate the average treatment effect. The third employs 2SLS to compute the local average treatment effect (LATE)

For business as for agriculture, the data do not detect any significant impact of savings on input expenditures. If anything, the suggestive evidence, in line with earlier results, may point towards relative drops in business input expenditures.

Contrary to expectation, then, savings seems not to enabled households to relax their liquidity constraint and make productive input investments that, for lack of money on hand, they would not have otherwise made. In agriculture, households with OIBM savings accounts have neither bought nor used more inputs, nor spent any more on total inputs than their peers. In non-agricultural business, households that are OIBM savers have spent no more on their businesses—and, indeed, may have spent less—than their counterparts. Access to OIBM savings accounts, in other words, has not allowed households to upgrade or expand their factors of production.

Conclusion

Even if access to savings does not directly affect food security, do savings enable households to engage in behavior that should over the long run result in food security? This study suggests that the answer is yes. Indeed, savings does so in one particularly important way. It enables households to assume incrementally greater risk and grow more crops. In particular,

savings seems to support households in diversifying their agricultural production and in moving towards more lucrative cash crops.

Growing more crops should, over the long term, result in an increase in food security. This is so in two ways. First, in diversifying their crops, households spread their production risk, and thereby guard incrementally more against catastrophic crop failure (which, except in the case of drought, may only affect one crop). Second, in moving into cash crops, households can expect to earn a potentially higher income than by growing consumption crops alone, by integrating with external markets that may command higher prices than domestic ones. Whether through reduced risk or increased income, growing more crops should contribute, in the long run, to better household food security for those that use formal financial services.

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ANNEX: PREVIOUS STUDIES UNDER THE PROJECT

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