**Biometric and Financial Innovations in Rural Malawi: A Field Experimental Approach**

**Grant Proposal**

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## Proposal Overview

The incomes of Malawian smallholder farmers are severely constrained by the low productivity of their crops, which is due to their failure to apply improved agricultural inputs such as seed, fertilizer and, in some cases, insecticides. Higher value cash crops, such as tobacco, cotton and paprika, offer the prospect of larger returns to investments in improved inputs. Yet input purchases remain constrained by the high cost and limited availability of credit.

The efforts of agro-industry to promote the use of credit have in turn been constrained by low repayment rates. A large proportion of farmers fail to repay their loans due to the ease of side marketing and the lack of sanctions for default. These problems are particularly difficult in Malawi because of the absence of a national identification system.

Biometric identification has been identified as a means of screening potential borrowers, ultimately in conjunction with a national credit bureau. This system should also allow any business to link loan disbursement with repayment through stop order as crops are sold. With time, biometric identification can link loans and repayments with savings accounts, allowing farmers to accumulate savings that can supplement institutional credit supply.

This project aims to demonstrate how biometric technology can help improve the functioning of rural credit markets in Malawi. In particular, the project will ask whether fingerprinting of borrowers coupled with the use of fingerprint-based credit history databases can help lenders withhold credit from past defaulters, as well as expand credit to borrowers who have proven reliable.

The project will explore a series of interlinked questions. How does biometric identification affect the decision to take out a loan? What impact does biometric identification have on farming practices, such as input utilization, use of family labor, and

use of hired labor? Finally, and of ultimate interest, what impact does biometric identification have on repayment? The follow-on stage of the project will investigate innovative methods of encouraging farmers to deposit their crop proceeds in formal savings accounts. The combination of credit with savings should have a multiplier effect on farmers' abilities to finance future farm inputs.

We currently have firm commitments with two key partners on the project. First, the Malawi Rural Finance Company (MRFC) has agreed to provide a substantial number of small production loans to farmers wishing to expand their output of paprika (a profitable export crop). Second, Cheetah Paprika, Ltd., a private contract farming and export firm, will identify roughly 4,000 paprika farmers seeking new loans for fertilizer and other inputs. The partners have agreed to and are currently implementing a cooperative project to test the impact of biometric identification on loan repayment.

This proposal seeks funding to pay for the costs of study design, data collection, and impact evaluation. Total costs are estimated at $81,030 for 2007 and $197,561 for 2008. Project activities will begin in August 2007 and will continue through at least December 2008. If funding can be secured, a multi-year monitoring program could be highly valuable because the impact of biometric identification on loan repayment is likely to be larger in subsequent years once farmers observe how lenders use biometrics in practice.

## Motivation and Context

### *Relevance for the economy and economic policy in Malawi and elsewhere*

Approaches that can be shown to improve the repayment rates of rural borrowers can have important influences on the economy and on economic policy in Malawi. Higher loan repayment should lead to broader provision of credit in rural areas, and at lower cost (credit interest rates should fall due to reductions in lenders' default losses). The expansion of credit supply can be reinforced with the establishment of a national credit reporting agency that uses a fingerprint as the unique identifier.

This improved access to credit has the potential to dramatically improve the ability of Malawian smallholder farmers to raise crop yields and to expand their participation in commercial agricultural markets. Gains for farmers can be increased even further if the expanded credit is complemented with improved formal savings facilities. An initial loan for inputs may raise farm income, which can then be saved so that in subsequent planting seasons farmers can either pay for inputs without borrowing, or can raise their input levels by combining savings with new credit. In addition, formal savings can serve as collateral and make farmers eligible for more and larger loans.

By showing how expanded financial services in rural areas can help farmers afford fertilizer and other inputs on their own (thereby raising their own incomes), the project can identify alternative government policies that would raise Malawian food security and the well-being of poorer farmers. The evidence generated by the project could help build support for scaling down or eliminating the fertilizer subsidy and replacing it with more market-based solutions to rural poverty.

*Potential for a multi-year monitoring program*

The 2007 component of the project could become the beginning of a multi-year research program examining a host of issues related to strengthening rural financial markets in Malawi. A multi-year monitoring program would be beneficial, first of all, because the effect of biometrics on loan repayment could become magnified over time as farmers realize that the benefits and threats associated with biometrics are real (i.e., as they observe some farmers excluded from future loans due to default, and others receive expanded credit because of good repayment).

In addition, following farmers over multiple years would allow the project to test other innovations that could be complementary to the credit intervention, such as in the area of savings. Rural areas often lack formal savings mechanisms that would allow farmers to accumulate resources for agricultural inputs on their own. Compounding the scarcity of formal bank branches in rural areas, the lack of official identification documents often keeps farmers from opening formal savings accounts.

In addition to its role in improving enforcement of credit contracts, biometric technology can also help expand access to formal savings in rural areas. Fingerprints can serve as a unique identifier when individuals open and use savings accounts, eliminating the need for official government documentation.

One specific area which we would very much like to explore in subsequent work is automatic deposit of crop proceeds into bank accounts. The intervention would involve offering farmers the option of having their crop proceeds directly deposited into individual bank accounts (after extraction of the loan balance). Farmers would lose this option if they were to default on their loans, so this option may also raise loan repayment.

In this context, it will also be useful to explore special savings facilities that allow farmers to commit their savings in advance to future input purchases. We could examine the impact of a "commitment" savings account that gives farmers the option of pre-committing a certain amount to be spent on future input purchases. The details of the commitment savings option will depend on discussions with the participating institutions, but one possibility is that the bank freezes access to a portion of the account funds, and then disburses the funds on a pre-specified date prior to the planting season directly to a supplier of agricultural inputs. The inputs are then released directly to the farmer.

We are currently in discussions with the partner institutions (mainly MRFC) about incorporating such a savings component to the project (no agreement has been reached yet, so this proposal focuses on the biometric component). There is still some possibility that an agreement could be reached on a savings component and included in the current study, because the savings accounts would not have to be opened until crop sale in June-July 2008. Farmers could be offered the opportunity to open the accounts somewhat before then (in March or April 2008). Questions of interest in this area include:

- Does offering farmers the ability to directly deposit crop sale proceeds into bank accounts raise loan repayment?
- When farmers are offered a convenient way to start a bank account (direct deposit of crop sale proceeds), what impact does this have on savings balances and input use in the subsequent planting season?

- Do savings and future input use rise more when the savings accounts come with "commitment" savings features?

*Review of academic literature: asymmetric information and imperfect enforcement in credit markets*

The lack of access to credit has long been considered a major obstacle to economic development in rural areas, hindering farmers from adopting higher-yielding or more profitable crops and from using optimal levels of inputs. The following quote from 1973 by Robert McNamara when he was the World Bank president exemplifies this view: "The miracle of the Green Revolution may have arrived, but for the most part, the poor farmer has not been able to participate in it. He simply cannot afford to pay for the irrigation, the pesticide, the fertilizer… For the small holder operating with virtually no capital, access to capital is crucial." In addition, see Bencivenga and Smith (1991), Banerjee and Newman (1993) and Lloyd Ellis and Bernhard (2001) as examples of theoretical models of growth with credit market imperfections.

A vast literature in economics emphasizes that the functioning of credit markets is limited by asymmetric information and imperfect enforcement. The problems that arise can often be characterized by a borrower's inability to commit to fulfilling a debt contract. Debtors cannot credibly reveal their borrowing type truthfully (adverse selection), promise to exert effort so that their production enterprise does not fail (ex-ante moral hazard), report their production output honestly (ex-post moral hazard), or promise to repay the loan even when output was sufficient (opportunistic default).

Stiglitz's (1974) study of moral hazard in the context of tenant/landlord relationships in developing countries was the seminal piece that also highlighted the moral hazard issue in the context of credit and other areas. The subsequent theoretical literature is too voluminous to cite, but textbook treatments include Laffont and Martimort (2003), Macho-Stadler and Perez-Castillo (2001), and Salanie (1997). An emerging empirical literature has examined various aspects of the limited commitment problem in credit markets. Chiappori (forthcoming) surveys the literature related to developed countries. Gine and Klonner (2003) document that asymmetric information on Tamil Nadu fishermen's ability affects their access to credit for technological innovations. Karlan and Zinman (2006) conduct a field experiment that shows the significant role of adverse selection and moral hazard in loan defaults in South Africa. Ligon, Thomas and Worrall (1999) and Paulson and Townsend (2003) provide empirical evidence on opportunistic default in India and Thailand respectively. Visaria (2006) documents the positive impact of expedited legal proceedings on loan repayment among large Indian firms.

The research proposed here will estimate the impact of biometric identification (fingerprinting) on loan repayment in a context—rural Malawi—where credit supply has been limited due to difficulties in enforcing sanctions against defaulters. Fingerprinting raises the effective cost of default for borrowers because it makes it easier for financial institutions to withhold new loans from past defaulters, and to reward responsible past borrowers with new and expanded credit. This potentially reduces the various types of limited commitment problems outlined above and therefore raises repayment. Adverse

selection should be reduced, because individuals with private information that they have a low likelihood of repaying should intentionally refrain from borrowing. Borrowers should have greater incentives to exert effort on their plots (lower moral hazard), and—in the case where output is good—should be less likely to default intentionally or opportunistically.

For all the recent empirical work on the imperfections in credit markets in developing countries, to our knowledge this would be the first research that directly estimates the impact of improved enforcement on loan repayment in rural areas. Such an estimate would be highly valuable from a theoretical standpoint in clarifying (or perhaps ruling out) the extent to which imperfect enforcement contributes to high default rates (and thus low supply of credit) in rural areas. In addition, by estimating the effect of a practical policy with known (or estimable) costs, it will be possible to make an assessment as to the cost-benefit ratio of biometric identification.

A broader practical consequence of this research is that, by demonstrating the impact of biometric identification on loan repayment, it could catalyze the establishment of a national credit bureau in Malawi (and elsewhere) to centralize such information and that uses fingerprints as the unique identifier. In discussions of potential public policies that can help increase the supply of credit to rural areas, an often-cited central priority is the establishment of institutions such as credit bureaus that can effectively create public information on a borrower's past borrowing history (Conning and Udry 2005, Fafchamps 2004).

A related theoretical as well as practical issue is that competition among crop purchasing organizations can undermine the effectiveness of a loan-recovery arrangement that is linked to sales of a particular crop (as we are proposing here). In this project, loan recovery will take place when farmers sell the crop to Cheetah at harvest time; loan balances will be extracted and forwarded to the lender (MRFC) and farmers will be given the remainder in cash. If, however, farmers have many opportunities to "side-sell" their crop to other intermediaries, we could experience low repayment overall and the effectiveness of biometric identification could be lowered (or eliminated entirely). Jaffee (1994) has emphasized the importance of these issues in Kenya, where such "leakage" led to the collapse of a horticultural credit scheme. Runsten and Key (1996) provide corresponding evidence for Mexico. Petersen and Rajan (1995) point out similar problems in the context of US small-business lending, showing that loan sizes are larger when banking business is more concentrated (i.e., when local banks face less competition). Conning (1996) documents that agricultural credit in Chile is available more widely in industries with more concentrated buyers.

It is therefore important that we propose providing credit for this study with a contract farming firm, Cheetah Paprika, which is a near-monopsony buyer of the crop of interest. By their own account, Cheetah purchases some 85% of the paprika grown in the country. This fact makes paprika an ideal context for this study because side-selling of the crop to other buyers is reduced, maximizing our ability to enforce repayment of the loan at the time the crop is sold.

## Description of Lending Program and Experimental Design

### *Lending program*

The loans will be for up to 8000 Malawi kwacha (approximately $57), enough to pay for a basic input package for 1/2 to 1 acre of paprika. Sixty percent of the loan goes towards fertilizer; thirty-three percent covers the cost of chemicals; and the remaining seven percent are for the purchase of seeds. In total, the package covers 150 kg of fertilizer, nine bags of chemicals, and 0.4 kg of seed. Expected yield for farmers using this package on one acre of land is between 400 and 600 kg, compared to 200 kg with no inputs. (Yield is computed under the conservative assumption that farmers will divert 50 kg of fertilizer towards maize cultivation.) While larger quantities of inputs would result in higher output for experienced paprika-growers, the package described here was designed by Cheetah extension experts to maximize expected profits for novice, small-holder growers. In keeping with standard MRFC practices, farmers will be expected to raise a 20 percent deposit, and will be charged interest of 33 percent per year (or 30 percent for repeat borrowers). Loans will be made to farmers in clubs of 15 to 20 members, and members will be jointly liable for each others' loans (also standard MRFC practice for microloans).

### *Biometric technology investments*

The project will require investments in biometric hardware devices and software programs. The main hardware unit required for this project would be a fingerprint scanner that can be connected to a laptop computer or a stand alone unit that can capture the fingerprint data. The units will be used to collect the fingerprints of farmers who will receive loans in the treatment group in October. The scanners will again be used during the repayment phase of the project in mid-2008 to collect fingerprints of farmers who sell paprika and match them to verify outstanding loans. During the repayment phase, field extension officers from Cheetah Paprika will purchase paprika at eight collection centers. When the farmers sell paprika to Cheetah Paprika they will be fingerprinted and checked for any outstanding loan. If a farmer has a loan, Cheetah paprika will extract the loan amount before making the payment.

During the repayment phase, specialized software will help identify and match a specific fingerprint to loan borrowers in the database. The software program will connect to the server and match the fingerprints of farmers with loans.

Technology investments will be the responsibility of the implementing partner organizations (MRFC and Cheetah Paprika).

### *Experimental Design*

To isolate the impact of a particular intervention from other confounding factors, the statistical gold standard is to perform an experiment with randomized treatment and control groups. Each farmer club will be randomly assigned to either the treatment or the control group. Random assignment allows us to identify the *causal* effect of the interventions, as opposed to differences between clubs that are due to other factors.

Farmer clubs in the study will be selected by lottery to be biometrically identified. 50% of farmer clubs will be selected by lottery to have their fingerprints recorded at the time of loan disbursement. Fingerprinted farmers will be administered an educational module that explains how their fingerprint will uniquely identify them for credit reporting to all major Malawian rural lenders. The training will emphasize that defaulters will face exclusion from future borrowing. The control group will not be fingerprinted, but will also receive an analogous training emphasizing the importance of one's credit history and how it influences one's future credit access (this helps distinguish the impact of the fingerprinting itself from the impact of the training).

To ensure that clubs in the treatment and control experimental conditions are similar to one another in terms of basic baseline characteristics, randomization will be stratified according to the following variables: age of the club, distance from an urban center, mean years of experience with paprika, mean landholdings, and fraction of club members that have previously had access to production loans. (In practice, this means defining groups of clubs that are similar in terms of these stratification variables, and then randomly assigning 50% of the clubs in each group to the treatment condition.)

## Analytical Framework

### *Key Questions and Hypotheses*

The key questions and hypotheses that the project will address are the following:

- *How does biometric identification affect the decision to take out a loan?* If farmers believe that biometric identification raises the cost of default, it should deter some farmers from borrowing in the first place (specifically, those with private information that their likelihood of default is high).

- *What impact does biometric identification have on farming practices, such as input utilization, use of family labor, and use of hired labor?* When the consequences of default are higher, farmers may use more inputs and exert more effort to reduce the probability of having to default on the loan.

- *What impact does biometric identification have on repayment?* This is the most obvious area of impact—farmers should be more likely to repay if the consequences of default are higher. A credible experimental estimate of this effect can be used in cost-benefit analyses of investments in biometric technology by rural lenders.

### *Estimation*

Because the treatment (biometric identification) is assigned randomly at the club level, its impact on the various outcomes of interest (say, repayment) can be estimated via the following regression equation:

(1) $Y_{ij} = \alpha + \beta B_j + \gamma X_j + \varepsilon_{ij,}$

where $Y_{ij}$ = repayment decision for individual $i$ in club $j$ (1 if repaying and 0 otherwise), $B_j$ is biometric identification (1 if fingerprinted and 0 if not), and $X_j$ is the vector of baseline characteristics used for stratification (age of the club, distance from an urban center, mean years of experience with paprika, mean landholdings, and fraction of club members that have previously had access to production loans). $\varepsilon_{ij}$ is a mean-zero error term. Treatment assignment at the club level creates spatial correlation among farmers within the same club, so standard errors must be clustered at the club level (Moulton 1986). Inclusion of the vector $X_j$ of baseline stratification characteristics can reduce standard errors by absorbing residual variation, and is legitimate (i.e., alleviates concerns about data-mining) because the variables are decided on at the outset (Duflo, Glennerster, and Kremer 2006).

The coefficient $\beta$ on the biometric treatment status indicator is the impact of being fingerprinted on repayment, and answers the question "How much does biometric identification raise loan repayment?"

It is also possible to examine the interactions between the randomized treatment and baseline characteristics. For example, it may be the case that previous experience with production loans raises the impact of biometrics on repayment, perhaps because previous knowledge of loans raises farmers' understanding of the importance of one's credit history. To test this question, the following regression equation is useful:

(2) $Y_{ij} = \alpha + \rho(B_j * E_j) + \beta B_j + \chi X_j + \varepsilon_{ij,}$

$E_j$ is a variable representing the club's previous borrowing experience, such as the fraction of club members who have ever been given a production loan from a formal-sector financial institution (its main effect is included in the vector $X_j$). The coefficient $\rho$ on the interaction term $B_j * E_j$ is the impact of previous borrowing experience on the impact of biometric identification on repayment. Other analogous interaction terms can establish the impact of wealth (proxied by landholdings), age of the club, distance from urban center, etc. on the impact of biometrics on repayment (and in fact can be included in the same regression equation).

*Sample Frame and Sample Size*

The study must include a sufficient number of units so that the treatment group can be statistically distinguished from the control group. In this context, the unit of analysis will be the farmer club because it is likely to be problematic for within-club group dynamics to administer a treatment to some farmers and not others within the same club.

Our power calculation indicates that the study will require 260 farmer clubs of 15 members on average, for a total of 3,900 loans. When a binary repayment indicator is the dependent variable, assuming that we would want to statistically distinguish an effect size of 5 percentage points from zero (e.g., an increase in repayment from 85% to 90%) at the 95 percent confidence level, 260 clubs of 15 members each would yield approximately

80% power (an 80% likelihood of finding an effect of that size if the effect were truly present).[1]

Our project partners, MRFC and Cheetah Paprika, have agreed to carry out the project among paprika farmers in four districts of central Malawi: Kasungu, Dowa, Mchinji and Dedza. Each of these areas has a well-functioning branch of MRFC as well as sufficient numbers of paprika farmers to be enrolled in the study.

In July 2007, Cheetah Paprika will notify farmers who live in these four areas about the loans. Farmers will be told to organize themselves into clubs of 15 to 20 members. Many of these clubs are already in existence, primarily to ease delivery of Cheetah extension services. In order to secure 3,900 loan customers in 260 clubs, approximately 300 clubs will be notified about the loan program to account for the possibility that some clubs may not be approved for loans by MRFC or may decide not to take out the loans in the end.

*Data*

The project will implement surveys of borrowers to measure the impact of the various interventions. These data will complement internal administrative data of the partner institutions.

Biometric identification increases the credibility of lenders' threats to exclude defaulters from future loans. The offer of the savings options may also increase repayment incentives if farmers lose access to them upon default. At least three types of outcomes may be affected and will be tracked:

1. Credit demand – Farmers who know they will be biometrically identified (and thus more easily sanctioned upon default) may be less likely to take out the loan.
2. Input use, farmer effort, and other farm decisions – Farmers may take greater care with their crops (so as to repay the loan) if they know the consequences of default are greater.
3. Repayment rates – Conditional on taking out the loan, how much higher is repayment when farmers are biometrically identified? It is theoretically possible that if unreliable borrowers screen themselves out of borrowing at the outset, there may be little or no difference between farmers who are and are not biometrically identified. (The main benefit of the biometrics is thus the initial screening.)

Follow-up rounds of the survey (post-harvest 2008) will continue to track savings, input use, and agricultural decision-making more generally. It will also be important to collect data on broader measures of well-being in households, such as income, nutrition, health, and child schooling.

[1] This assumes a 95% plausible interval for "control" take-up of [60%, 99%] across clubs, which is the range of repayment across districts in which MRFC operates.

Partnering Organizations

*Cheetah Paprika Ltd.*

Cheetah Paprika, Ltd. (CP) will supply agricultural extension services and a ready market for paprika farmers in this study. CP has a 12-year history in Malawi, and currently purchases approximately eighty-five percent of the one million kilograms of paprika produced annually in the country. They estimate that Malawi's share of the 120-million kilogram world market in paprika could increase to up to eight million kilograms, if farmers could access the necessary inputs to enter the paprika market or expand production. CP can commit to a guaranteed minimum price of $0.70/kg average across the three grades of paprika, and expects global markets to remain strong such that the price will be above $0.80/kg.

CP offers high-quality paprika seed at a subsidized price to all growers in the country, and has an approximately $250,000 budget for extension services. Extension services are provided to farmers by a team of six extension officers and 15 field assistants. The extension officers are CP employees, while the field assistants are consultants chosen by other farmers who receive training, support, and incentive pay from CP in return for offering technical advice and informing other farmers about meetings, marketing days, and other opportunities. Extension services consist of preliminary meetings to market paprika seed to farmers and teach them about the growing process, additional group trainings about farming techniques, individual support for growers provided by the field assistants, and information about grading and marketing the crop. Cheetah reports that it has the capacity to serve some additional farmers with current staffing levels, and that adding additional field assistants entails relatively little expense. Additional extension officers are relatively more costly because in addition to salary, extension officers must be supplied with motor-bikes.

CP is well positioned to identify participants for this study. They maintain a database of all current and past paprika growers, which includes 3,600 farmers in Kasungu, 2,200 farmers in Mchinji, 1,400 farmers in Dowa, and 2,400 farmers in Dedza. Additionally, field assistants are regularly tasked with recruiting new paprika growers, and their incentive-pay system encourages them to identify farmers who are likely to be successful with the crop.

*Malawi Rural Finance Company*

Malawi Rural Finance Company (MRFC) is a government-owned microfinance institution with a 490,000,000 MK (approximately $3.5 million) agricultural loan portfolio. The institution has a small and medium business program of roughly the same size. MRFC has operated in Malawi since 1993.

MRFC has the most extensive field system of any microfinance provider in Malawi, with 123 field officers and 20 supervisors working out of six branches that cover the entire country. This project will work with the Kasungu and Lilongwe branches, which have particularly strong staff and performance records. The organization boasted loan recovery rates upwards of ninety percent in the late 1990s, but recently experienced

lower loan repayment linked to poor tobacco harvests and prices. Tobacco currently accounts for more than 98 percent of MRFC's agricultural lending portfolio, and the organization is eager to diversify into other crops.

MRFC leverages its field staff in an extensive screening and monitoring program. Potential borrowers must pass two hurdles: they cannot have defaulted on past loans with MRFC, and they must meet field officers' standards for behavior, character, and demeanor. MRFC also makes efforts to cross-reference potential borrowers with other lending institutions, as a rudimentary credit check. Borrowers who do default on MRFC loans are ineligible to borrow unless loans are repaid in full, and our interviews with over 200 farmers suggest that farmers take MRFC's threat of sanction seriously.

To facilitate identification and improve customer service, MRFC has invested in a card-less biometric system that is being phased in starting in July 2007 and should be fully operational across the country within 12 months. The system, combined with GPRS technology scheduled to be introduced by cellular service provider Celtel, will allow farmers to make loan payments and access small sums of money at branches or by meeting with field officers in remote locations.

MRFC is well positioned to participate in this project because of its well-developed field operation and its internal biometrics initiative. It has both the loanable funds and the staff necessary to support the scale of this project. Further, increasing the agricultural portfolio and diversifying away from tobacco fit into MRFC's business plan. Similarly, the use of biometrics to improve rural credit markets is a natural extension of the company's existing plan to incorporate biometrics into all of its accounts.

*Bunda College of Agriculture*

The project will include researchers and students at Bunda College of Agriculture, University of Malawi. Bunda is the premier agricultural educational institution in the country with a long history of research on agriculture and rural finance in the country. By building local capacity and exposure to cutting-edge empirical methods in development economics, this link will help ensure that the project yields lasting benefits for a local Malawian institution. In addition, the consultancy will ensure that the project design takes account of the specific conditions relevant for rural finance in Malawi.

The project plans to hire as a consultant an academic from Bunda College of Agriculture. We have met with and have elicited strong interest from Franklin Simtowe, a researcher at Bunda's Center for Agricultural Research and Development (CARD). Dr. Simtowe has a Ph.D. in agricultural economics from the University of Hohenheim (Germany) and his academic area of focus is rural microfinance.

The project has also allocated funds to pay for two students from Bunda College of Agriculture to be research assistants on the project. The funds could also be used to pay the expenses on any individual research projects the students may wish to pursue in the context of the project activities.

*University of Michigan*

For several decades, the University of Michigan has been a national and international leader in interdisciplinary social science research involving the collection or

analysis of data from scientific sample surveys. Through institutions such as the Institute for Social Research, Michigan has been a pillar of empirical social science, and has sought to bring empiricism to bear on problems that are of both social and scientific importance. The university has also sought the development, refinement, and propagation of the scientific method of survey research through teaching and training. Representing the disciplines of psychology, political science, economics, anthropology and public health, Michigan researchers have directed some of the longest-running and most widely cited and utilized studies in social science worldwide.

Dean Yang is Assistant Professor of Public Policy and Economics at the Ford School of Public Policy and Department of Economics, University of Michigan. His research concerns the role of financial services in enhancing the well-being of households in developing countries. In 2006, he was a principal investigator in the experimental evaluation of the impact of weather insurance on credit demand in Malawi. Ongoing field experimental research examines the impact of access to innovative savings mechanisms for Latin American migrants in the United States on the well-being of their families back home. He has also studied the role of international labor migration and remittances in developing countries. In work on the Philippines, he has shed light on how migrant earnings promote child schooling and small enterprise investment, and on the insurance role of remittances. Recent research has examined the impact of hurricanes on international financial flows to developing countries (in particular, foreign aid and migrants' remittances). Other activities have included consulting work for the IMF, the World Bank, and in El Salvador and Peru. During 2006-2007, he was a visiting assistant professor at the Woodrow Wilson School of Public and International Affairs, Princeton University. He attended Harvard University for his B.A. and Ph.D. degrees, both in economics.

Jessica Goldberg is a Ph.D. student at the Gerald R. Ford School of Public Policy and the Department of Economics, at the University of Michigan. Her areas of interest are in development and labor economics. She holds a Bachelor's degree in economics and political science from Stanford University, and a Master's in Public Affairs from Princeton University. Jessica spent two years as a research assistant at the Center on Budget and Policy Priorities in Washington DC, where she focused on unemployment insurance and welfare reform.

<u>Key point persons in partnering organizations</u>

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|---|---|
| Bunda College of Agriculture | Franklin Simtowe |
| Cheetah Paprika Ltd. | Sander Donker |
| Malawi Rural Finance Company | Weston Kusani, Kondwani Shaba, Josephine Kalimbara |
| University of Michigan | Jessica Goldberg, Dean Yang |
| World Bank, Consultant | Santhosh Srinivasan |
| World Bank, Development Economics Research Group | Xavier Gine |
| World Bank, Malawi Country Office | David Rohrbach |

Timeline

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| July 2007 | Cheetah Paprika informs farmers about loan availability, and provides list of farmers and clubs to be included in study.<br>Experimental protocols finalized, and logistics for field visits planned. Educational module and survey instrument field tested. |
| August - September 2007 | Orientation meetings with farmers. Loan applications and brief survey forms are filled out. |
| September - October 2007 | Deposits collected (deadline October 31). |
| November 2007 | Loans disbursed |
| December 2007 | Inputs purchased with loans are used on paprika plots (transplanting season). |
| Apr - July 2008 | Assessment of impact on loan repayment (using internal MRFC data). |
| Nov - Dec 2008 | Farmer survey to assess longer-run impacts on agricultural decision-making and input use. |

Individuals and organizations consulted in proposal development

The current proposal emerged out of field visits and a set of focus groups with farmers funded by a World Bank DECRG Research Preparation Grant. The grant funded a mission to Malawi in May-June 2007 by Dean Yang (University of Michigan), Jessica Goldberg (University of Michigan) and Santhosh Srinivasan (World Bank STC). The mission involved extensive and iterative working sessions with David Rohrbach (senior agricultural economist, World Bank Malawi Country Office) and with in-country stakeholders such as farmers, organizations involved in rural finance, and aid organizations (see table below).

**Key Stakeholders Met During May-June 2007 Mission**

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| Farmers in Lilongwe North, Kasungu, Mchinji, and Nkhotakota | 10 focus groups, ~200 farmers |
| National Association of Smallholder Farmers (NASFAM) | Duncan Warren (farmer services and training director)<br>Joshua Varela (general manager, NASFAM commercial)<br>Frank Masankha (head of agricultural extension)<br>Several field officers |
| Malawi Rural Finance Company (MRFC) | Weston Kusani (head of operations)<br>Josephine Kalimbara (loan portfolio manager)<br>Stain Soko (former head of lending)<br>Kondwani Shaba (head of lending) |
| Opportunity International Bank of Malawi (OIBM) | David Walker (head of operations)<br>Claudia McKay (head of microfinance banking)<br>Gift Livata (agricultural microfinance coordinator) |

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| Cheetah Paprika Ltd. | Sander Donker (managing director)<br>Charles Chikopa (head of extension services) |
| USAID Malawi | Mark Visocky (team leader for sustainable economic growth) |
| CARE Malawi | Sophie Chitedze (village savings and loan coordinator) |
| Concern Worldwide | Fiona Edwards (director) |
| DFID Malawi | David Woolnough (infrastructure and growth advisor) |

Stakeholders quite unanimously agreed that an intervention with extremely high potential would be to use new technology—biometrics—to ameliorate asymmetric information problems in credit markets by allowing lenders to reward well-performing borrowers and to sanction poor-performing ones. In particular, stakeholders were attracted to the idea that an empirically well-implemented demonstration of the impact of biometrics could be a catalyst for the establishment of a national credit bureau to centralize information on borrowers.

Budget

The project is projected to cost US$278,591 ($81,030 in 2007 and $278,591 in 2008). The detailed budget breakdown is as follows (in US dollars):

**2007**

| | |
|---|---|
| Field manager compensation | 15,000 |
| Field testing | 1,417 |
| Credit history orientation meetings and fingerprinting | 30,832 |
| Field supervision | 2,296 |
| Telecom and other incidentals | 3,060 |
| Data entry | 2,925 |
| Consultant, Bunda College of Agriculture | 3,000 |
| Research grants for students, Bunda College of Agriculture | 500 |
| Travel to Malawi for principal investigators | 8,000 |
| Consultant, University of Michigan | 14,000 |
| **2007 subtotal** | **81,030** |

**2008**

| | |
|---|---|
| Field manager compensation | 30,000 |
| Savings orientation meetings | 30,832 |
| Follow-up survey | 101,400 |
| Field supervision | 6,429 |
| Telecom and other incidentals | 5,400 |
| Consultant, Bunda College of Agriculture | 1,000 |
| Research grants for students, Bunda College of Agriculture | 500 |
| Travel to Malawi for principal investigators | 8,000 |
| Consultant, University of Michigan | 14,000 |
| **2008 subtotal** | **197,561** |
| **2007-2008 grand total** | **278,591** |

The field manager salary is $2,500 per month (6 months in 2007 and 12 months in 2008). The costs of field testing assume 8 days of work for two interpreters at $35/day, and vehicle costs of $107/day (mileage and gas included).

Costs of credit orientation meetings in 2007 assume a field staff of 14 people working 356 person-days at $35/day plus costs of travel and incidentals at $12/person-day. The costs for the savings orientation meetings in 2008 are assumed to be the same.

Field supervision costs assume vehicle costs of $107/day (mileage and gas included) for 21 days in 2007 and 60 days in 2008. Telecom and other incidentals are

costs of gas, cellphone airtime, and internet connections for principal investigators and the field manager.

Data entry costs include supplies, photocopying, and labor involved in administering survey forms (alongside loan application) and entry of data into electronic format.

Research grants for students from Bunda College of Agriculture will pay for research assistantships for students interested in research and field work related to the project.

Fees for the Bunda College of Agriculture consultant assume $200 per day (15 days in 2007 and 5 days in 2008). Fees for the University of Michigan consultant(s) assume $350 per day (20 days in 2007 and 20 days in 2008).

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