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RURAL FINANCIAL POLICIES FOR FOOD
SECURITY OF THE POOR:
METHODOLOGIES FOR A MULTICOUNTRY RESEARCH PROJECT

Manfred Zeller, Akhter Ahmed, Suresh Babu,
Sumiter Broca, Aliou Diagne, and Manohar Sharma

ABSTRACT

The objective of IFPRI's multicountry research program on rural financial policies for food security of the poor is to identify policies and institutional arrangements that help the poor integrate themselves into sustainable savings and credit systems such that they have an increased capacity to invest, bear risk, and smooth consumption. The focus of the research on policy and program design and their effects on household investment and consumption requires field data collection at the institutional and household level. This paper presents the underlying conceptual framework and various methodological approaches that have been reviewed and tested by the team at IFPRI and at collaborating institutions. Methodologies are presented for analysis at the institutional level, mainly focusing on the determinants of the formation of financial institutions and the analysis of effects of program design on institutional conduct and performance, and at the household level, thereby addressing determinants of access to and participation in financial markets and related effects on household welfare.

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1. INTRODUCTION

The purpose of the paper is to take stock of the development of methodologies under the International Food Policy Research Institute's (IFPRI) multicountry research program (MP5) on "Rural Financial Policies for Household Food Security for the Poor" (Zeller et al. 1994a).

The paper is structured as follows. Section 2 presents an overview of MP5. The first part of Section 2 highlights the major policy questions asked, and describes the conceptual framework used and the resulting main research tasks and questions. As the research program also uses data from country studies that have been implemented before the commencement of the MP, the structure and content of the data are not congruent across all nine country cases. The second part of Section 2 gives a brief overview of the evolution of this MP, and highlights major differences in the data that make it necessary for earlier country cases to employ somewhat less preferred methodological approaches for addressing the set of common research issues. In Section 3, the main methodologies for analysis within the scope of the multicountry project are given. The first section presents methodologies for an analysis of research questions at the institutional level, while the latter sector focuses on the household level.

2. OVERVIEW OF MP5

OBJECTIVE, POLICY QUESTIONS, CONCEPTUAL FRAMEWORK,
AND RESEARCH TASKS

Objective

The objective of MP5 is to contribute to the identification of policies and institutional arrangements that help to integrate the rural poor into sustainable savings and credit systems. This integration is not only expected to improve income levels, but also to stabilize the consumption of food and basic nonfood items by poor households.

Policy Questions

Policy instruments for improving food security are manifold. Given the determinants of household food security, these can be systematized into policies that aim to (1) increase the household's income; (2) stabilize or lower food prices; or (3) improve the household's access to intertemporal markets.

The first two policy sets are geared towards increasing household's income and purchasing power—either in particular seasons or years or as part of long-term strategies. Key policy instruments for achieving long-term food security are the transfer of technology and investments in agriculture and infrastructure, combined with extension and research. Such policies are key components of any development strategy. Policies to directly address problems of income and purchasing power during specific periods are the stabilization of key commodity prices and targeted interventions, such as income transfers, food subsidies, or public works projects.

This multicountry program addresses the third set of policies, that is, to investigate costs and benefits of policy options that potentially enhance the household's ability to intertemporally smooth consumption and investment by

improving the access of poor households to savings and credit services. In contrast to the policies stated above, the immediate goal is not to directly influence the household's income in a particular period, but to enable households to make more cost-efficient intertemporal adjustments of disposable income.

The project addresses the following policy questions:

- What is the scope for enhanced access and participation of the poor in formal and informal credit and savings arrangements?
- How can the direct and indirect effects of access to credit and savings schemes on poor household's income, consumption, and nutrition be improved?
- How can formal financial institutions for the poor be improved, and can formal institutions be linked with informal savings and credit systems to create a sustainable rural financial system?

These questions attempt to identify policies and design features for financial schemes that respond to the demand of poor households for financial services and that provide for sustainable linkages with existing informal systems.

Conceptual Framework

This multicountry research program aims at analyzing the relationship between food security of the rural poor and access—or the lack thereof—to financial services. The research involves two levels of analysis: households and financial institutions.

At the institutional level, the research program focuses on the structure, conduct, and performance of financial institutions that provide financial services at the retail level to smallholders and other poor rural households.

At the household level, the research program analyzes the determinants of access to and participation in financial markets. It further aims to quantify benefits of access on household income, consumption, nutrition, and welfare. Finally, by combining institutional- and household-level analysis, costs of supply of financial services and benefits from such services at the household level are being compared to arrive at an economic cost-benefit-criterion of public investments in financial institutions for the poor.

An overview of the conceptual framework is given in Figure 1. Exogenous factors in this framework include shocks, agroecological and socioeconomic conditions, and the macroeconomic and sectoral policies. These factors shape institutional arrangements in financial markets. It is hypothesized that the formation of formal and informal financial institutions, and their structure, conduct and performance, is partly determined by the agroecological and socioeconomic conditions at national, regional, and community levels. These conditions include the climate; the availability, quality, and distribution of land; the state of infrastructure and technology; the population density; the level of urbanization; and the availability and skills of the labor force. Furthermore, macroeconomic and sectoral policies determine the level of prices, wages, and formal interest rates in the banking sector. These prices—conditioned by community and household characteristics—in turn affect the demand for savings and credit services and the costs of supply of such services at the retail level.

Specific policies within the financial sector define the regulatory framework under which formal financial institutions at the retail level can develop and conduct

Figure 1   Access to financial services and its effects on household food security

their business. However, the socioeconomic and agroecological conditions as well as the macro and sector policies are expected to influence the structure, conduct, and performance not only of formal financial institutions, but also of informal financial institutions, including households acting as lenders or moneykeepers.

In order to increase the efficiency of the financial sector, and to address the perceived problems of access, in particular, by rural smallholders, various policy options exist to reduce transaction costs and risks in financial markets (Bhatt 1988; Huppi and Feder 1990). These include

- policies of financial market liberalization, such as elimination of interest ceilings and direct sectoral credit allocations;
- government guarantees for savings deposits or loans in cooperatives and rural banks;
- flexible regulatory framework to allow for region- and community-specific adaptations of financial services;
- public investment in financial pilot schemes, in extension services for banking by the poor, in providing institutional linkages between community groups and the formal sector, and in covering the initial fixed cost of acquiring, adapting, or extending financial technology such as group-based programs; and,
- other public investments in hard and soft infrastructure to increase information flow and reduce transaction costs.

Such policies affect the formation, structure, conduct, and performance of the rural financial institutions, including informal institutions at the community level. The policy questions outlined above lead the overall research task to evaluate public investments in innovative, member-based financial institutions at the retail level (such

as village banks, group-based lending, and cooperatives) by quantifying their benefits at the household level and comparing those with the economic costs of public investments in financial institutions.

Framework for Institutional Analysis

For the institutional analysis, the conceptual framework basically follows the theoretical work by Williamson (1985), Bardhan (1989), Hoff and Stiglitz (1990), and Besley and Coate (1995). Three major constraints to the formation of financial institutions have been identified: information asymmetries between market partners, lack of suitable collateral, and high transaction costs as a result. The research will analyze how various forms of contractual arrangements in financial institutions at the community level circumvent or ease these constraints.

According to Hoff and Stiglitz (1990), imperfect information of the lender concerning the ability and willingness of potential borrowers to repay the loan basically leads to three problems:

- Screening. Borrowers differ in the likelihood that they will default, and it is costly for the lender to determine the default risk of each borrower. There exist "information asymmetries" between borrower and lender as the borrower knows his probability of default while the lender does not.
- Incentive. It is costly to ensure that borrowers take those actions that make repayment more likely.
- Enforcement. It is difficult to compel repayment.

It is hypothesized that it is the market's responses to these three problems that explain many of the observed features of rural credit markets, and that they must

therefore guide the policies and institutional innovations. Similar problems exist for insurers and for savers who are entrusting their funds to a third party.

Lenders attempt to overcome these problems by demanding collateral, which they can seize in case of loan default (Binswanger and Rosenzweig 1986). Because the rural poor lack such collateral, informal lenders use collateral substitutes, such as

- tied contracts (specific credit cum labor, cum land, or cum marketing arrangements in which the lender gains control over part of the output or the production resources of the borrower)[1];
- third-party guarantees;
- threat of loss of access to future borrowing opportunities; and,
- social sanctions of household members, extended family, informal groups, or the community at large.

A major impediment to increased household access to credit and savings services are transaction costs, which are either incurred by the financial institution delivering the service or by households demanding the service, or both. Transaction costs include any costs involved in an exchange of assets or services other than the price of the asset or service. The price of borrowing is the interest. Transaction costs are costs resulting from an information search and market entry and exit costs for borrowers, savers, and financial intermediaries. Since transaction costs have the character of fixed costs, smaller transactions (that is, smaller loans and savings deposits) have ceteris paribus higher unit transaction costs.

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[1]There already exists an extensive literature on interlinked contracts; see, for example, Bardhan (1989), Bell (1988), Bhaduri (1977), Esguerra and Meyer (1992), Mitra (1983), and Kotwal (1985).

Recent research shows that high transaction costs due to information asymmetry appear less of a hindrance in networks of close social interaction (Platteau 1992). Indigenous group-based systems may not only link with formal savings and credit systems, but may also assume functions of insurance—at least for idiosyncratic risks.[2] Udry (1995) finds that some form of coinsurance is even found between informal lenders and borrowers: the level and timing of debt repayment in Nigeria has been found to be contingent on whether a borrower or lender experienced shocks to income or not.

Research Areas at the Institutional Level

At the institutional level, the conceptual framework leads to the following research areas. As a starting point in understanding the structure of the rural financial market and the relative importance of particular financial institutions and their services, a descriptive account of the underlying agroecological and socioeconomic conditions for each country is given. The policy framework, in particular, the regulations affecting the formation and conduct of member-based financial institutions, are reviewed for each of the country cases in order to identify weaknesses and strengths in providing a conducive policy environment for bottom-up development of rural financial institutions.

The second research area relates to the structure of rural financial markets under different socioeconomic, agroecological, and policy conditions in various case study countries. Knowledge about the market volume and relative importance of informal and formal financial institutions across countries with different agroecological and socioeconomic conditions, such as level of infrastructure, population density, and

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[2]See Hazell (1991) for an interesting example of community-based groups in Japan. The information cost advantage of locally-based groups may be exploited not only for credit and savings, but also for some types of insurance services.

level of economic development, is very limited. The initiation and expansion of member-based financial institutions at the community level is hypothesized to increase the volume in loans and savings deposits, and to change the structure of the market by reducing the share of high-cost informal lending. The analysis of market shares is expected to provide insights into the scope for the transformation of rural financial markets through bottom-up development of financial institutions.

The third research area relates to the conduct and performance of selected formal institutional arrangements that aim to provide credit to poor households without requiring collateral. In a particular country case study, the research task is to describe the types of savings and credit services provided by the institution, and to provide a review of the contractual arrangements, such as interest rates, loan conditions, and entry and exit barriers for borrowers and savers. In case countries where data at the level of formal credit and savings groups are available, an analysis of the determinants of repayment, as one possible criteria for performance, is expected to yield recommendations for key design features in the process of group formation and conducive external rules for the conduct of groups.

The overriding objective of the third research area is to identify comparative advantages and deficiencies of selected financial institutions in providing the types of financial services demanded by poor households vis-à-vis informal institutions offering financial services. A major working premise is that learning from, building on, and adapting to informal systems of credit and savings will lead to the identification and design of sustainable formal savings and credit systems that complement the informal services.

Framework for Household-Level Analysis

Given that a particular informal or formal financial institution is known by a household, the household's access to its credit and savings services will depend on

various characteristics of the household. These characteristics determine the institution's perception regarding household eligibility criteria, such as the reputation, savings potential, and creditworthiness of the household. Whether a household uses its potential access to a particular credit or savings service is dependent on its demand for such services. The demand for a financial service is hereby hypothesized to be a function of the household's initial endowment in physical and human capital, input and output prices, wages, interest rates and related transaction costs, and costs of financial services that can serve as substitutes.

Thus, while access is entirely determined by the financial institution that screens potential clients, the decision to participate in savings and credit arrangements is made by the household, or, to be more precise, by the members of the household.

The hypothesized linkages between access to credit and savings options and household's food security are conceptualized in Figure 1 (Zeller et al. 1994a). Three pathways are conceptualized through which access to and participation in financial markets is hypothesized to affect household food security:

- Pathway I: via income generation;
- Pathway II: via asset (dis-) investment strategies to smooth disposable income over time at sufficient food consumption levels; and,
- Pathway III: via the direct use of credit to finance immediate consumption needs.

In Figure 1, the process is depicted by linking a number of boxes. Each box indicates a subcomponent of the overall process of altering a household's food security through improved access to credit and savings options. Although time subscripts are not shown, the process is perceived to be dynamic. A change in access to credit or saving options through financial markets induces changes in the level and

composition of a household's equity and debt or in the level and composition of its assets, or both. These changes, in turn, cause the household to alter the level and composition of expenditures on consumption, production, and investment in durables. Improved access to credit and savings options have both short-term impacts, e.g., increased food consumption by poor households in the hungry period, as well as long-term impacts, e.g., by allowing physical assets to be built up over time.

Pathway I: Improved Income Generation. The traditional rationale for credit policy is that loans provide additional capital on a temporary basis that can be used to enhance the level of the household's productive physical capital. For farm households, in particular, the demand for credit and savings arises out of the requirements of the agricultural cycle. Expenditures must be incurred on agricultural inputs during the planting and the vegetative growth periods of crops, while returns are received only after the crops are harvested several months later. Therefore, to finance the purchase of inputs, the farm household must either dip into its savings or obtain credit. Borrowing may also allow the household to take advantage of potentially profitable investment opportunities that are too large to finance out of its own resources. Furthermore, easing potential capital constraints through credit will reduce the opportunity costs of capital-intensive assets relative to family labor, thus encouraging labor-saving technologies and raising labor productivity, a crucial factor for development, in particular, in many African countries (Delgado 1995).

A second, indirect effect on factor income to be measured in our analysis is that derived from access to credit, and not from borrowing. Access to credit, i.e., unexhausted credit lines, is expected to increase the household's risk-bearing ability. Just the knowledge that credit will be available to cushion consumption against an income shortfall if a potentially profitable, but risky, investment should turn out badly

will induce the household to bear the additional risk. The household may therefore be willing to adopt new, more risky technologies (Eswaran and Kotwal 1990).

Compared to households that are not rationed in their credit demand by lenders, it is hypothesized that (controlling for other factors influencing resource use, such as wealth and education) credit-constrained households will have

- a lower intensity of modern input use;
- more income diversification to minimize risk; and,
- less capital-intensive, income-earning activities.

In summary, while actual participation in credit and savings markets are expected to have a direct effect on income generation through investment in agricultural and off-farm enterprises, the access to credit is hypothesized to have an indirect effect on factor income through increased risk-bearing ability and resulting changes in the portfolio of risky enterprises.

Pathway II: More Cost-Efficient Assets and Liabilities. Improved access to credit and savings schemes may make it possible for the household to smooth consumption at lower costs compared to traditional strategies. It is hypothesized that improved access to credit and savings options induces the following changes in the household's composition of assets and liabilities:

- A decrease in the holding of assets with lower risk-adjusted returns. Traditional forms of savings such as cash, jewelry, grain, or livestock are exposed to various risks (inflation, theft, loss, or disease). Households will substitute away from them if they can have less risky savings options.

- A reduction in the level of assets held for precautionary savings (Deaton 1991).

- An increase in the level of assets held for speculative purposes, such as storing of grain for a longer period in order to profit from higher prices in the next preharvest season.

- A decline in the level of credit obtained at high costs from informal sources, including forward sales of standing crops.

- A decline in the level of asset sales at low prices.

Pathway III: "Consumption" Credit. Households attempt to smooth their consumption by adjusting their disposable income. If factor income is insufficient because of shocks, households may augment their nonfactor income by using some or all of the strategies described above, or by borrowing for consumption. Credit and savings facilities may be especially needed in environments with considerable seasonal and interannual income fluctuations.

Consumption credit is still a controversial issue in policy and program design. Most formal programs do not offer credit for consumption smoothing. Informal systems of savings, self-help, and insurance, as well as high-cost lending, appear to have comparative advantages for covering idiosyncratic shocks, but may not be an efficient institutional response to covariate risks (Townsend 1994). MP5 aims to assess the scope for providing formal credit and savings services for consumption smoothing and to assess the scope to increase the supply of informal credit for consumption smoothing, i.e., the linkages between informal and formal markets.

Formal and informal credit options, various forms of informal saving, loans given by the household, gifts (given and received), and other forms of informal insurance are perceived in our framework as "financial commodities," being *imperfect substitutes*. That is, after controlling for differential implicit or explicit interest rates

and transaction costs as well as supply constraints, a typical household will have a preference among these different types of financial commodities. In other words, even if all households were equally endowed and faced the same interest rates, transaction costs, and credit constraints, they would choose different *mixes* and *levels* of the types of financial commodities (loans/savings/gifts), depending on their respective preferences.

In summary, it is hypothesized that improved access to credit and savings services either augments factor income generated by the production process or reduces costs for smoothing consumption at sufficient levels. The latter effect, i.e., smoothing disposable income by borrowing for consumption or by saving in highly liquid, but less remunerative, assets, including the accumulation of claims to neighbors and friends through reciprocal gift exchange, is expected to be relatively more important for households that face the risk of transitory or chronic food insecurity. The hypothesized differences in the relative importance of the three pathways for wealthy versus poor households may also explain the observed differential patterns in the borrowing and savings behavior of households in the case studies of MP5.

Survey data from most of the nine case countries of MP5 show that at least some sample households are borrowers and lenders as well as gift takers and gift givers at the same time. This suggests that a given amount of a financial commodity of a certain type can be traded (i.e., substitutable) at a *finite* premium, with a financial commodity of a different type having a less preferred vector of "noncost"-attributes (i.e., attributes that do not include the level of interest rate, transaction costs, and supply constraints, and which are attached to each type of financial commodity). This also suggests that some of the financial commodities may, in fact, be complements rather than substitutes. Those households who choose not to borrow by preference, regardless of cost considerations, may, instead, save (sometimes with negative

returns) in anticipation of possible liquidity constraints, and engage in reciprocal gift giving (including giving away interest-free loans) as an insurance scheme.

The Research Tasks at the Household Level

The conceptual framework at the household level outlines three potential pathways through which access to financial services and participation in borrowing and saving can have effects on household food security and on the level of education and nutritional status of its members. The three pathways are interconnected and dynamic.

Based on this framework, the household-level analysis is grouped into three major research areas. The first area relates to the access of households and individual members to financial services, in particular, to informal and formal credit from various institutions, including other households. In general terms, access is defined as the ability of the household or its members to enter into contractual arrangements for savings and credit services. For example, some households may not be able to borrow from banks because of collateral requirements, whereas most of the households found in the MP5 case studies are able to borrow from at least some informal lenders. Within this research area, the MP aims to (1) measure access and (2) to quantify policy-relevant determinants of such access. Both research questions need to be further differentiated by type of financial institution offering the credit, by type of loan, and by type of household or individual member having access to a particular credit from a particular institution.

The second area relates to the analysis of participation of households in formal and informal savings and credit markets. As noted above, participation is observed when a household applies for and successfully enters into a contractual arrangement for a credit or savings service. Thus, participation is dependent on access and on the demand for the service. While the former is decided by the financial intermediary, the

latter is determined by the household or its members. Based on this framework, some households may have access to a service, but do not demand it. Such households are therefore observed as nonparticipants. Another group of households does not have access, but demands the service. This group is also observed in surveys as nonparticipants. Within the research area related to participation, the MP aims (1) to measure the occurrence of participation and its extent, i.e., the amount borrowed or the savings deposited; and (2) to identify the underlying determinants of participation in informal and formal markets. Again, these questions are addressed for different segments of the financial market, and for different groupings of households and individuals. Furthermore, the research attempts to quantify the costs of participation, i.e., explicit as well as implicit interest charges and transaction costs.

The analysis of policy-relevant determinants of access and of participation will yield insights related to the scope for enhanced access and participation of the poor, as this is envisaged by the first policy question of this MP.

The third research area at the household level aims to quantify the benefits of access to and participation in financial markets on household food security. Based on the three pathways, gains in welfare can result through an increase in income and, consequently, increase in consumption; or through reduction in costs for smoothing of consumption. Under certain conditions, participation in specialized credit programs (such as group-based targeted credit programs for the poor with education and training components) can also have direct beneficial outcomes such as improved health and nutrition, and positive social change. Within this research area, the MP addresses the following research questions. First, the research seeks to quantify the effects of access and of participation on (1) income; (2) level and seasonal fluctuations in consumption expenditures and calorie intake; and (3) nutritional status of preschoolers. Second, the program seeks to quantify the degree of substitution between informal and formal financial services. Third, in some of the case studies

where a complete enumeration and long-term recall for assets and participation in credit markets has been done, the research aims to analyze long-term effects on the level of human and physical capital of the household.

The major research question within the third research area is to find out how much economic benefit (either measured by disposable income, consumption expenditure, or bettered by monetary measures of welfare), on average and at the margin, can be generated from one yuan, taka, peso, franc, kwacha, or rupee of credit. This information is highly relevant for evaluating public investments in the initiation and expansion of credit programs for the rural poor, as financial and economic costs of such interventions can be readily approximated, given the availability of data from balance sheets and profit and loss statements from financial intermediaries.

However, since public resources are scarce, a full answer to the efficiency of investing in rural financial institutions in a specific country context can only be given when costs and benefits of investments in financial institutions are compared with costs and benefits of alternative policy interventions, such as income transfer programs, price stabilization programs, and liberalization in input and output markets.

In Table 1, the major research areas and research questions of the multicountry program are summarized. Furthermore, it gives an overview of the country case studies for which data have been collected to address part or all of these questions.

DATA SOURCES

Six out of nine MP5 country cases (Bangladesh, Malawi, Madagascar, Ghana, Mali, and Nepal) focused on group-based lending approaches. A seventh country case, Cameroon, included informal savings and credit associations as the unit of analysis. However, data on conduct and performance of group-based approaches is currently available only for Madagascar, Bangladesh, and Cameroon.

This project focuses on two levels of analysis: households demanding and institutions supplying financial services within their communities or regions.

Extensive household surveys are required to capture the degree of participation in informal and formal credit and savings markets, and to trace the effects of financial intermediation on the asset portfolio, income, consumption, and nutrition.

In principle, the surveys contain an enumeration of the stock of assets possessed or used by the household, the investment/disinvestment flows during the recall periods, the stock and flow of the household's debt, and the various income flows during the recall periods (including gifts and other transfers), the household's food consumption and nonfood expenditures, and anthropometric measures. Time costs and other transaction costs for obtaining credit and depositing savings need to be enumerated. For some modules, that is, asset ownership, income, gifts, and credit, it may be preferable—depending on country conditions—that individual household members are interviewed.

The collected information also includes issues on selected traditional coping strategies that are identified as important through rapid appraisal techniques and interviews with key informants. For example, the sale of standing crops may be quite frequently observed in one case country, while it may not be found in other cases. It is also preferable that questionnaires address some long-term recall data on the build-up and sale of key assets (such as land), major shocks, and corresponding coping strategies during the household history.

Multiple survey rounds in the hungry, harvest, and postharvest seasons are required to be conducted for capturing seasonal linkages between participation in financial markets and factor income generation, nonfactor incomes (gifts, credit, asset disinvestment), consumption expenditures, and savings (change in assets net corrected for debt).

Table 1   Research areas and research questions of MP5

Research Area	Research Question	Data Available
A. <u>Institutional-Level Analysis</u>		
Policy framework and exogenous conditions	Conducive policy and regulatory framework for bottom-up development of rural financial market	All countries
Structure of rural financial market	Volume and sectoral shares in loans and savings deposits of households	Based on household-level data from all countries
Conduct and performance of rural financial institutions (in particular, group-based)	Process of formation of groups	M, B, Ca
	Structure of groups	M, B, Ca
	Conduct of groups (services and their contractual arrangements)	M, B, Ca, N, C, Mw
	Loan repayment performance in groups	M, B, Ca
	Transaction costs of and dependency on subsidies by rural financial institutions	Available from registered financial institutions
B. <u>Household-Level Analysis</u>		
Access to formal/informal credit	Measurement of access	Ca, M, Mw, P, B
	Determinants of access	Ca, M, Mw, P, B
Participation in credit markets	Measurement of participation	All countries
	Determinants of participation	All countries
Effects of access/participation on household food security and welfare	Effects on . . . • Factor income • Consumption • Nutrition	Ca, M, Mw, B, P All countries All countries, except C, N

Note: Ca = Cameroon, C = China, M = Madagascar, Mw = Malawi, Ml = Mali, G = Ghana, B = Bangladesh, P = Pakistan, N = Nepal.

Questions on assets and debt cover extremely sensitive and personal topics. The organization of the field survey therefore allows for sufficient time for testing of questionnaires, for training of survey personnel, and for confidence building between survey personnel, communities, and respondents. The sensitivity of the topic, the necessity of multiple rounds, and the required depth of data call for a small sample size, because a large sample size is likely to be prohibitively costly. Furthermore, for the country cases already implemented, budget considerations have usually restricted us to conduct the household-level survey only in communities where the formal credit and savings programs are located. Households were then randomly selected among participants and nonparticipants of the credit and savings programs of interest. Pitt and Khandker (1994) rightly point out that effects of credit programs are best assessed by comparing participants with nonparticipants who live in villages without program interventions, as there are potential spillover effects in program villages on the welfare of nonparticipants. However, effects measured in MP5 country studies cannot control for these presumably positive spillover effects on nonparticipants, and therefore may somewhat underestimate the welfare effects of participation in credit and savings programs.

Surveys at the institutional level focus on the structure, conduct, and performance of selected group-based informal and formal institutions that provide financial services. Emphasis is put on surveying innovative institutional arrangements, and on understanding the socioeconomic conditions under which they work. Survey components include the organization and member characteristics of the groups, and their transaction costs, including entry and exit barriers that may inhibit access by the disadvantaged.

Surveys at the community level in various regions collect data on hypothesized determinants of the demand and supply of financial services. The survey includes topics on village infrastructure, demographics, and existence of formal and informal

groups and other institutional arrangements that provide credit, savings, or insurance services. Additional data on infrastructure and other characteristics of regions and communities is being obtained from secondary sources. The communities are randomly selected, whereby the population is to be stratified along exogenous driving forces for financial market formation, such as infrastructure, population density, and agroecological conditions.

Rapid appraisal surveys at the project level (cooperatives, rural banks, nongovernmental organizations, agribusinesses extending credit) obtain selected information on management objectives, rules of conduct for savings and credit services, performance incentives and training, costs of financial intermediation, and outreach.

Table 2 provides an overview of the country case studies within the scope of MP5. In 1995, researchers at IFPRI and at collaborating institutions have conducted data analysis and collection at household and institutional levels for the Bangladesh, China, Cameroon, Mali, Malawi, Ghana, Nepal, Pakistan, and Madagascar country cases.

Since MP5 is a multicountry project with six out of nine case studies being initiated before 1993 (Ghana, Mali, Pakistan, Madagascar, Cameroon, Nepal), not all of the case studies have the required survey data as described above.

Table 3 shows differences in survey modules across country cases. For example, four of the nine country cases (Ghana, Mali, Pakistan, Nepal) lack information at the level of financial institutions and, thus, some of the research tasks of MP5 at the institutional level cannot be universally addressed.

Most of the data sets have the key information to address the questions at the household level. However, survey data for measuring access and participation are not congruent across the countries, as the earlier studies did not obtain information on the occurrence of voluntary nonborrowing and of nonborrowing because of rejections by

lenders. Also, most studies, with the exception of Madagascar, Bangladesh, and Malawi, did not elicit information on access and participation at the member level, but only at the household level, so that the scope for intrahousehold and, in particular, gender-differentiated analysis is limited in most countries. The incongruence of household-level data forces us to employ less preferred methodological approaches if we want to apply the same methodology for all countries.

Furthermore, except for Ghana and China, the data sets comprise multiple rounds, so that effects of access to credit and savings options on intertemporal consumption smoothing and income generation can be analyzed.

In conclusion, it is important to note that many of the country cases do not allow for a synthesis of comparable analytical results related to *all* policy questions, but only to *a subset* of research issues of MP5.

Table 2   Summary of actual country case studies (as of October 1995)[a]

Researchers	Implementing Institution	Case Study Country	Project Phases Proposal Accepted	Survey Completed	Country Reports
Franz Heidhues, Gertrud Schrieder	IFPRI/Univ. of Hohenheim/ CamCCUL/CAC	Cameroon	Y	Y (1992)	Y
Ellen Payongayong, Lawrence Haddad Hugo de Groote, Eileen Kennedy	IFPRI, FFH	Mali	Y	Y (1992)	Y
Ellen Payongayong Lawrence Haddad	IFPRI	Ghana	Y	Y (1992)	Y
Manohar Sharma	Cornell University/IFPRI	Nepal	Y	Y (1992)	N
Sohail Malik, Sumiter Broca, Manzoor Gill	IFPRI	Pakistan	Y	Y (1994)	Y
Joachim von Braun, Zhu Ling, Jiang Zhong Yi	IFPRI/Univ. of Kiel/Chinese Academy of Social Sciences	China	Y	Y (1995)	Y
Manfred Zeller, Akhter Ahmed, Manohar Sharma	IFPRI	Bangladesh	Y	Y (1995)	Y
Manfred Zeller, Henri Abel-Ratavo, Bjorg Colding	IFPRI/CNRE/FOFIFA	Madagascar	Y	Y (1992)	Y
Aliou Diagne, Manfred Zeller, Charles Mataya, Suresh Babu	IFPRI/Bunda College of Agriculture	Malawi	Y	Y (1995)	Y

[a]   Additional cross-country analyses are planned on the basis of existing data sets from other collaborating institutions, e.g., the University of California at Berkeley for the case of survey data on Mexico.

Table 3　Survey modules of MP5 country case studies

Survey Modules	Bangladesh	Cameroon	Ghana	Mali	Madagascar	Nepal	Pakistan	China	Malawi
1. Village level	Y	Y	Y[c]	Y	Y	N	Y	Y	N
2. Group level	Y	Y	Y	Y	Y	N	N	Y	Y
3. Household level							Y	Y (Secondary data)	
Number of rounds	3	3	1	3	3	4	Overall 15, credit in 6 rounds	1	3
Demography	Y	Y	Y	Y	Y	Y	Y	Y	Y
Agricultural income	Y	Y	Y	Y	Y	Y	Y	Y	Y
Nonagricultural income	Y								
-Wage, self-employment	Y	Y	Y[b]	Y	Y	Y	Y	Y	Y
-Rental Income, individual individual lending	Y	Y	Y[b]	Y	Y	Y	Y	Y	Y
-Gifts received	Y	Y	Y[b]	Y	Y	Y	Y	N	Y
-Borrowing	Y	Y	Y[b]	Y	Y	Y	Y	Y	Y
-Asset disinvestment	Y	Y	Y	Y	Y	Y	Y	N	Y
Consumption expenditure (including food consumption)	Y	Y	Y	Y	Y	Y	Y	Y	Y
Asset investment	Y	Y	Y	Y	Y	Y	Y	Y	Y
Time allocation	Y	Y	Y	Y	Y	N	Y	N	Y
Anthropometry	Y	Y	Y	Y	Y	N	Y	N	Y
Transaction costs in borrowing and lending	Y	Y	Y[c]	Y	Y	N	Y	N	Y
Loan rationing	Y	Y	Y	Y	Y	Y	Y[d]	N	Y

[a]　N = No, Y = Yes
[b]　Only for 1st Ghana survey.
[c]　Only for 2nd Ghana survey.
[d]　Only in two rounds.

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3. METHODOLOGIES FOR MP5 ANALYSIS

Based on the research objectives, the conceptual framework and data available from the nine country cases, Chapter III presents the methodologies for our analysis. The first section discusses the approaches for analysis at the institutional level. The second section focuses on household-level analysis.

METHODOLOGIES FOR ANALYSIS AT THE INSTITUTIONAL LEVEL

In the following, our approaches in addressing the research tasks at the institutional level are described. We begin this with the analysis of policy framework and exogenous conditions influencing rural financial markets, then focusing on the structure, and then on the conduct and performance of financial institutions.

Policy Framework and Exogenous Conditions

Institutional formation depends on demand and supply factors, and transaction costs for the market partners play a crucial role. From the viewpoint of the financial intermediary, transaction costs must be covered by an appropriate interest spread between interest rates for savings and loans. For the borrower, the net economic gain is the difference between the return on capital and the interest paid as well as the transaction costs incurred for obtaining and repaying the loan. For providing attractive savings options, similar reasoning holds.

A market, or a particular financial institution, will only be sustainable if transaction costs are low enough to ensure the economic viability of its transactions, both from the viewpoint of supply and demand. One can conceive exogenous conditions under which markets will be missing, thin, or only seasonally working, and, on the other hand, under which they are well-integrated. Policies and programs

to enhance rural financial markets have to take into account these conditions. Some may be efficiently altered by policies, others cannot.

The formation or innovation of financial institutions is hypothesized to depend on a range of factors that affect either supply or demand or both. Theoretical frameworks explaining the formation or innovation of institutions due to relative scarcity of factor endowments (Hayami and Ruttan 1985; Binswanger and Rosenzweig 1986; Binswanger, McIntire, and Udry 1989) and due to market failures requiring collective action (Ostrom 1994) lead to the following hypothesized determinants apart from public policy and interventions by nongovernmental organizations:

- level of commercialization of the economy;
- relative scarcity of land and labor;
- population density and education levels;
- level of hard and soft infrastructure;
- level of technology;
- and, for member-based institutions, the degree of social cohesion (Robison and Schmid 1988) between households living in the same community or region, which may enhance community self-help action;
- degree of seasonality and interannual instability of major income sources;
- type and degree of idiosyncratic and covariate risks that households, communities, or regions are exposed to; and
- existence and structure of markets for collateral, that is, land.

As a starting point in understanding the policy framework influencing the formation of rural financial institutions and their structure, conduct, and performance in a particular case country, the current state of macroeconomic and financial sector

policies is described (McKinnon 1973, 1988). Particular emphasis will be given to the legal framework that regulates the banking sector, such as interest rate restrictions for savings and deposits, deposit insurance, loan guarantee funds, and guidelines for sector-specific loan targeting, etc. (Villanueva and Mirakhor 1990). Since the focus of the multicountry program is on member-based financial institutions operating at the community level, such as cooperatives, group-based programs, and village banks, the regulations guiding the formation of such institutions and affecting their conduct and performance are reviewed. This analysis will help to identify constraints to the liberalization and decentralization of financial markets. For the case of Egypt, for example, the government's regulation that the parastatal agricultural development bank is not allowed to offer checking accounts to their rural customers, is an important impediment for the bank to diversify and expand its financial services and clientele (Aly, Malik, and Zeller 1994). The analysis of the current state of policies is further expanded by a chronology of policies affecting the rural financial market, and by relating those policies to changes in time series data of formal interest rates for savings and loans and of lending volume by economic sector or by type of financial institution. However, it is beyond the scope of this multicountry program to explain the historic development of interest rates and market volumes in a quantitative framework.

Apart from the policy framework, socioeconomic and agroecological conditions of the case country govern the development of rural financial markets, of which only some can be altered by government policy. Following the above hypothesized determinants of the formation of financial institutions, a descriptive account of the following conditions for each country is given: agroclimatic zones, population density and level of urbanization, endowment and quality of land, endowment with labor, land tenure system, level of economic development, level of education of labor force, frequency of occurrence of covariate risks (drought, floods, price fluctuations of

major inputs and outputs, etc.) and of idiosyncratic risks (morbidity rates, life expectancy, level of nutritional status, etc.), and degree of seasonal fluctuations in agricultural production.

Structure of the Financial Market

The second research area relates to the structure of rural financial markets under the different socioeconomic, agroecological, and policy conditions in the various case study countries.

The descriptive analysis begins with an overview of informal and formal financial institutions that provide savings and credit services in rural areas. The following formal and informal financial institutions are therefore differentiated: private banks; parastatal banks, including agricultural development banks; savings and credit cooperatives; member-managed village banks; formal group-based savings and credit institutions; informal credit and savings groups; and various forms of other informal institutions (shopkeepers, traders, landlords, including estate farmers, relatives, and friends).

Secondary data published by government sources usually provide information on lending volumes by economic sector. However, it does not report on the relative importance of the informal versus the formal sector for lending to rural households, with the exception of a few, mostly Asian countries. The data collected at the household level in various sample communities will therefore be aggregated at the community or higher level to give an indication of the volume of savings deposits and loans, differentiated by informal and formal financial institutions. In some case study countries, such as Madagascar, Cameroon, and Bangladesh, additional information on existence and functions of informal self-help groups and number of shopkeepers, traders, and moneylenders providing credit in the community or nearby has been collected. However, in order to obtain information on market shares and loan volume,

household-level data are seen as the most reliable and cost-efficient source. It has to be pointed out that the sample frame and size in all MP5 countries does not allow for nationally representative figures.

Desai and Mellor (1993) provide a multicountry analysis of shares of formal and informal credit sources for farm households in selected developed and developing countries. Again, these results are based on the aggregation of data collected at the household level. They find that the share of formal sources is increasing with the level of economic development. However, in their analysis of extant data sets, Desai and Mellor do not differentiate by the maturity of the loan. Thus, a monetary unit borrowed for three months from an informal lender is counted the same as a monetary unit borrowed for three years from a formal lender. Furthermore, it is not clear what recall period was used in the individual household surveys for loan transactions. In essence, loans and deposits are flow variables, and need to be measured accordingly. In order to avoid difficulties in interpretation of results across countries, the average loan amount borrowed per month from a particular institution is being computed, and market volume and shares are then derived on this basis.

Of particular interest in the analysis of market shares is also the relative importance of zero-interest lending by friends and relatives versus high-interest lending by socially distant lenders. Furthermore, by comparing across countries or regions within a country with different agroecological and socioeconomic conditions, it is attempted to identify some generalizable results about the structure of the informal market and its relative importance compared to the formal market. Malik finds in his study on source structure and utilization patterns of credit that the subsidized formal agricultural credit institutions, by disbursing large amounts of credit over the years to mainly owner-operated and wealthier farm households, has not been able to reduce the share of the informal sector, although the difference in interest rates

between the informal and the formal sector appear to have converged over time (Malik 1994).

The initiation and expansion of member-based financial institutions at the community level is hypothesized to increase the volume in loans and savings deposits by rural households without collateral, and change the structure of the market by reducing the share of high-interest informal lending. The results from several MP5 countries, such as Bangladesh, Cameroon, and Madagascar, confirm the former hypothesis. However, the role of high-interest borrowing in these countries does not appear to be affected by status of membership. This may be explained by the fact that few of the formal group-based credit programs in these countries offer credit for consumption at short notice. It is further hypothesized that the share of zero-interest informal lending by friends and relatives is decreasing with increased access to and diversity of formal financial services and with overall economic development. The analysis of market shares across countries is expected to provide insights into the scope for transformation of rural financial markets through bottom-up development of financial institutions.

A comparative, descriptive analysis of market volumes and shares, differentiated by main characteristics of policy framework and socioeconomic and agroecological conditions, will be conducted in order to identify common patterns between structure of the rural financial market and the underlying exogenous conditions.

Conduct and Performance of Financial Institutions

Our analysis follows the paradigm of structure, conduct, and performance (Williamson 1985). The analysis of conduct is exclusively geared towards member-based institutions, such as village banks, formal groups, and credit and savings cooperatives. In our sample of nine countries, group-based programs play a dominant

role in six of the countries. In China and Cameroon, credit and savings cooperatives are found. In the latter country, a very active sector of informal savings and credit associations exists, which has been extensively surveyed (Schrieder and Heidhues 1993; Schrieder and Cuevas 1992). Pakistan still maintains a traditional-type agricultural development bank, which is unable to include the poor to a significant extent, as it demands collateral and imposes other restrictions (von Braun, Malik, and Zeller 1993). Since the group-based approach—either promoted by government or by nongovernmental organizations—apparently has become the dominant institutional form for providing financial services to poor households without physical collateral, the multicountry project is mainly focusing on group-based approaches in its cross-country analysis.

The analysis of conduct and performance of a group-based system begins with the process of group formation. This process then, in turn, determines the structure of groups and, to a large extent, their conduct and performance. As most groups are formed through self-selection among peers, the process of group formation is seen as endogenous. The process is influenced by rules of access and conduct imposed by the formal financial institution, and by household and community-level characteristics. Therefore, our approach is to identify externally imposed rules of access and conduct of groups through a review of program guidelines and interviews with program officers. In particular, for each of the group-based programs sampled in the case countries, the formal criteria for eligibility in groups are highlighted, such as payment of initial membership fee, minimum amount saved, being member of a particular socioeconomic class, or participation in a training program. In some of the case studies, i.e., Bangladesh and Madagascar for formal groups and Cameroon for informal groups, surveys at the level of groups were conducted to identify rules of access which were internally set by the group. The descriptive analysis of externally or internally set rules aims to highlight factors that influence the structure of a group.

Research by the MP5 team along these lines includes a literature survey of member-based financial institutions in developing countries (Zeller et al. 1994a), and country reports for Bangladesh (Zeller, Ahmed, and Sharma 1995), Madagascar (Zeller et al. 1993, and Cameroon (Schrieder and Heidhues 1993).

The structure, i.e., the socioeconomic characteristics of the individual members and its social and economic relations to each other, determines to a large extent the degree to which the group can exploit commonly held information sets among members and economies in sharing of risks. From the perspective of the financial intermediary, a group is formed as an institutional arrangement that can reduce its transaction costs and possibly increase the rate of repayment compared to individual lending. From the perspective of an individual, his or her motivation to join a group is to benefit from the present and future financial and nonfinancial services that come along with membership. Groups in most of the case countries assume joint liability. Combined with a threat of losing access to future credit, members are induced to perform various functions of screening of loan applicants; of monitoring the individual borrower's efforts, fortunes, and shocks; and of enforcing repayment of the loan of their peers. The existing theoretical models of peer monitoring deduce that the repayment performance in group-lending programs is positively related to the homogeneity of members with respect to the riskiness of their projects (Devereux and Fishe 1993; Besley and Coate 1993, 1995). However, this result appears to be driven by the models' assumption that the expected returns of the member's projects are independent from each other, so that no economies of risk-sharing among group members can be exploited (Zeller 1995b). It seems plausible, that the same incentive structure that incites members to monitor the projects of peers may also make them want to enter into coinsurance contracts. Udry shows in his analysis that state-contingent contracts are chosen in informal credit markets in Nigeria that allow for direct risk pooling between the creditor and the debtor (Udry 1995). There appears to

be no reason to believe that such state-contingent contracts could not exist between members of groups with joint liability who want to maximize the utility from the present and from future loans through collective action.

Based on this framework, the following characteristics for group structure are analyzed for each of the country studies where data at the group level have been collected. First, the share of members having common social bonds, such as same profession, religion, neighborhood, gender, etc., are characteristics that give an indication for the degree of commonalities of information sets among members for efficient screening and monitoring of the efforts of the peers. Second, the size of the group at various points in time during the existence of the group is recorded, as size influences unit transaction costs for members and economies of risk sharing among groups. Third, characteristics of the individual members and their households, such as education, land ownership, primary occupation, etc., are enumerated. Statistical analysis of these characteristics can then inform us about the degree of homogeneity for various socioeconomic characteristics that influence the potential for sharing risks, including the repayment of loans of members in crisis. Descriptive analysis along these lines has been done for the cases of Bangladesh and Madagascar.

With respect to conduct of groups, the research identifies financial and nonfinancial services that are externally offered by the program or internally supplied at the initiative of the group members themselves. For example, the analysis of the Cameroon, Bangladesh, and Madagascar data set shows that groups expand the range of services, mainly by setting up group emergency funds for protecting members in difficulties and for providing highly liquid monetary savings options. The contractual arrangements, such as interest rate, collateral requirements, loan sizing, restrictions on use of loans, liquidity of savings options, and insurance services for idiosyncratic risks are quantified. Combined with the household-level survey, the contractual arrangements in the formal market are compared with those of the informal market in

order to assess gaps and inefficiencies in formal supply. For example, Zeller et al. (1994b) conducted such an analysis for several formal and informal rural financial institutions in The Gambia.

Performance of group-based institutions can be measured by various criteria. Based on a literature review (Zeller et al. 1994a), the following performance measures will be applied in the country cases:

- measures of financial performance, such as unit transaction costs (Desai and Mellor 1993), and the degree of dependency of the financial institution on subsidies (Yaron 1992a), as well as measuring economic costs and benefits of public investments in rural financial institutions; and
- measures related to coverage of the poor, such as the share of smallholders and landless participating in member-based financial institutions or the share of loans obtained by the poor from a particular institution or segment of the formal market. These measures of participation of the poor are discussed in the section covering the household-level analysis.

With respect to financial performance as an indicator for financial viability of the institution, data collected from financial institutions can be used to compute unit transaction costs. This cost measure is completed by first obtaining administrative and operation costs of the financial institutions, and dividing the total costs by the sum of assets (i.e., loans) and liabilities (i.e., savings) to arrive at transaction cost per unit lent or received from savers. This approach has been applied by several researchers (Cuevas 1984; Desai and Mellor 1993). The advantage of this approach is that it avoids making arbitrary allocations of transaction costs to particular operations within a financial institution. The financial performance can then be assessed by subtracting

transaction costs and interest costs for liabilities from the total revenues of the financial institution. Desai and Mellor propose to assess the financial viability also on a per unit basis, so that financial performance can be compared across financial institutions. Again, the unit is derived from all assets plus all liabilities of the financial institution. While revenues and costs can be obtained from profit and loss statements, the latter is easily derived from balance sheets. However, most financial institutions that were surveyed in the field, with the exception of larger nongovernment organizations in Bangladesh and the credit cooperatives in Cameroon, do not have such information readily available.

While the above measures of performance relate to the financial viability of a financial institution without consideration of policy distortions, the subsidy dependency index measures the degree of dependence of a financial institution on subsidies. This methodology was developed and successfully applied by Yaron to four financial institutions operating in Indonesia, Bangladesh, and Thailand (Yaron 1992b). By including the market rate into the calculation, and by identifying direct and indirect subsidies by the government or donors to the financial institution, the financial sustainability can be assessed for the case that subsidies are dismantled.

However, the above measures of performance are financial criteria, not criteria for economic evaluation of programs. For an economic evaluation of the use of public funds for financial institutions, the amount of subsidy required by a financial institution to reach financial viability, as defined by Yaron, has to be compared to the benefits that are generated at the household level by having access to the savings or credit services offered by the financial institution. For multicountry comparisons, subsidies and benefits could be expressed per unit of money lent by the financial institution. The valuation of benefits may also take into account explicit social weights for disadvantaged population groups in order to also reflect on equity objectives of financial market policy. This cost-benefit-analysis of public investments

in financial institutions has not yet been exemplified in the literature, probably because of the lack of quantification of welfare benefits. However, many studies have quantified the costs of financial institutions, and their dependency on subsidies. Thus, while the methodologies related to the costs side are fairly well-developed, this cannot be said for the measurement of benefits of financial services at the household level. This is one of the major reasons why MP5 puts more emphasis on the demand side rather than the supply side of financial services.

For financial institutions, the repayment rate for loans is a critical determinant of financial viability. For Madagascar and Bangladesh, data has been collected at the group level to analyze the determinants of repayment. Based on the previous discussion, repayment performance in group-based credit schemes is initially determined by the process of formation of groups. This process influences the composition and structure of the group, and therefore conditions its ultimate conduct and performance, given exogenous characteristics of the program and of the group's community and local economy. Thus, the member's decision to self-select herself and co-select her peers is governed or influenced by external regulations and characteristics of the credit program and socioeconomic and agroecological conditions of the households and communities. In the following, while the proposed approach does not attempt to model the different stages of group formation and definition of internal rules of conduct to repayment, it attempts to incorporate dependent variables that reflect on the process of group formation, the composition and structure of the group and the relationships between members, and on various community characteristics.

The repayment rate of group loans at the due date could be chosen as the dependent variable. Cross-section data from various groups of several credit and savings programs will be collected for institution-specific (I), community-specific (C),

and group-specific (G) characteristics that are expected to influence the repayment rate (Zeller 1995b).

Repayment rate = f (characteristics of financial institution, community, group)

Variations of this basic model are currently developed by Sharma and Zeller for the Bangladesh data and Zeller for the Madagascar data. While program-specific characteristics could be reflected by dummies, the community characteristics could, for example, include the following. First, with increasing transport costs to rural service centers, transaction costs for training, monitoring, and supervision of groups increase. It is expected that higher transaction costs result in less training, monitoring, and supervision of groups that live in remote villages. As these activities are undertaken to increase loan repayment, higher transport costs are expected to have a negative influence on loan repayment. Second, villages usually differ by the degree of commercialization, market orientation, and, therefore, monetarization. It is expected that groups in villages with higher levels of monetarization, as measured by the share of cash crops of their three most important cash crops, will be able to better raise the necessary cash to make timely loan repayments. Monetarization is measured by the cumulative percentage of the harvest of the major three cash crops that are sold in the market. Third, the existence of retailers for agricultural inputs is expected to be positively related to repayment performance, since such inputs become more readily available and cheaper for farmers in villages that have access to input markets. As agricultural inputs are yield-enhancing, the repayment capacity and repayment rate of groups with good access to agricultural inputs is expected to increase. Fourth, risks in crop and animal production, as well as storage of crops, can undermine repayment performance. In a survey at the community level with key respondents, potential risk

factors in crop and animal production as well as storage have been assessed in their relative importance.

In addition to community-specific variables, the repayment is also expected to be influenced by characteristics of the group and its members. These may include a dummy whether the group was initiated by a program officer or by the members of the community. Furthermore, group size is expected to augment the repayment rate but at a decreasing and, at some point, negative rate, because of increasing information asymmetry among members and therefore a higher risk of loan default. While wealthier households have a higher repayment capacity, they may not necessarily better repay their debt. Characteristics on the mean and dispersion of key assets, such as land, among group members, measures the degree of intra-group diversification of risky assets. Such measures can then be used as regressors to measure the effect of pooling risks by co-selecting peers who have a different level and structure of asset portfolios. However, with any risk portfolio and coinsurance strategy, too much of diversification increases the costs of monitoring and decreases the expected returns in exchange for decreasing gains in the reduction of variance of returns. Furthermore, education of members may play a role in the repayment of loans. Finally, the degree to which group members enter insurance contracts with each other is expected to be influenced by the social cohesion between them. As reciprocity and self-help are more frequently found among socially close individuals, the number of common social bonds that each member shares with her peers could be taken, for example, as an empirical variable to reflect on the degree of social cohesion.

The above approach focuses on the repayment rate as the dependent variable in a reduced-form regression framework, but does not explain the determinants leading to the structure and the conduct of the group. In order to address these issues, our research will also attempt to analyze these determinants. A recursive modelling approach, beginning with the initial structure of the group at the time of formation,

then focusing on the conduct of the group (i.e., the rules and services defined by the members themselves), and finally analyzing the loan repayment as one of the potential final outcome variables appears heretofore appropriate.

METHODOLOGIES FOR ANALYSIS AT THE HOUSEHOLD LEVEL

Based on the conceptual framework, it was hypothesized that the optimal levels of consumption, production, and investment of a household that faces liquidity constraints are different from, and provide lower utility than, the optimal levels in the absence of credit constraints. This insight suggests the following research questions. First, are credit constraints present, if so how severe is access to credit limited by rationing on behalf of formal or informal lenders, and how are they to be measured? Second, given access to credit, what is the extent of credit demand and demand and supply of other financial commodities (gifts, loans given, savings), and what are the determinants of participation in credit markets? Third, how does one measure the impact of a relaxation of the credit constraint on household utility and consumption and production?   In the following, we review methodologies for addressing these three questions.

Access to Financial Markets

The quantification of access to credit, i.e., determining the severity of credit constraints, is a very important objective in the scope of MP5, as the credit constraint in the formal market, and potentially in the informal market, can be eased by policy.

There are currently two methodologies in use for testing for the presence of credit constraints. The first infers the presence of credit constraints from violations of the assumptions of the life-cycle or permanent income hypothesis, while the second collects information directly from household surveys on whether households perceive themselves to be constrained.

Measuring the Occurrence of Credit Constraints.

Method one. In essence, what empirical models based on permanent income/life-cycle hypotheses do is examine whether or not current household consumption tracks current household income. The null hypothesis is that given regular (convex) preferences, consumption will not track income in the absence of liquidity and borrowing constraints. Hence, counterexamples—cases that exhibit significant tracking—are taken as evidence of liquidity and borrowing constraints. Hall's (1978) work has been pioneering in this area. Assuming a quadratic utility function and a constant rate of interest, Hall showed that consumption follows a simple rule: with no borrowing constraint, given C_t, no other variable known at time t—including that about income—should help predict consumption at time $t + 1$, C_{t+1} (Blanchard and Fischer 1989):

$$C_{t+1} = C_t + e_t, \qquad E(e_{t+1}|t)=0.$$

Evidence to the contrary would indicate borrowing constraints. Recently, Foster (1995) made a methodological contribution by relating the role of credit markets in smoothing fluctuations in the weights of young children. He did this by using intertemporal equilibrium conditions that related growth patterns of children to the cost of borrowing by household. The essence of the argument, once again, is as follows: better access to credit means that weight growth will depend less on current income than in cases where borrowing constraints exist. His findings in Bangladesh showed that growth patterns for children in landless households were influenced by credit market imperfections.

By its very nature, empirical testing of these types of models requires repeated observations on the same observational unit. Hence, most methods based on life-

cycle theories are unusable when lengthy panel data is not available. For mainly this reason, this approach has not been used widely in IFPRI research.

Since prudent behavior, too, can result in consumption tracking income, there is a need to distinguish empirically between prudent behavior and behavior produced by borrowing constraints. This is done by Zeldes (1989). Morduch (1990) extends this framework to model farm households that may modify production plans in the light of expected borrowing constraints. Both studies, like Hall's, rely on the violation of the first order conditions of utility maximization as a test for borrowing constraints. Though they represent major innovations, certain limitations nevertheless exist. First, if uncertainty is negatively correlated with wealth, then current income will be negatively correlated with consumption growth, even in the absence of borrowing constraints (Carroll 1991). Second, as Deaton (1990) points out, the effect of negative income shocks on consumption also depends on the initial asset position of households.

Another problem is that the approach does not identify individual households as being constrained, but only groups, such as landless laborers. The most serious objection is that it does not permit the quantification of credit constraints, i.e., it is impossible to say how severe the constraint is, only that all households in a group are constrained. For these reasons, this method is not very appealing if data are available to permit one to go beyond this approach (see the second method below).

However, while panel data (except for the Pakistan case country) test whether a household is credit constrained in a life-cycle sense, many MP5 data sets can be used for testing whether a household is credit constrained in the short run. Many of the MP5 data sets contain seasonal data on income, financial transactions, and consumption. The data will be used to test for the ability of households to smooth consumption in the short run, through access to credit and other consumption

smoothing options available to the household. Several authors have used cross-section data in testing for credit constraints.

Paxson (1992) offers, heretofore, an interesting approach. First, assuming a specific income process and a special form of the utility function (CARA), she derives a closed-form solution for an intertemporal consumption function that has current consumption as a function of current wealth, the "permanent income," and a third term reflecting prudent behavior. In the absence of a long panel, she uses historical rainfall data to decompose current income into its "transitory" and "permanent" parts. She then examines the propensity to consume out transitory income and permanent income for rural households in Thailand. Testing for borrowing constraints, in this framework, may thus be based on examining the coefficient of transitory income in the consumption function. If borrowing constraints were not binding, one could expect this to be close to zero. An alternative specification would be one that uses a varying parameters model that makes the effect of income shocks on consumption dependent on factors that affect financial intermediation. Paxson's approach does not require panel data, but repeated cross-sections of data.

However, while Paxson's approach can be applied to MP5 data sets, the methodology cannot be used to identify particular households that are credit-constrained. It can only respond to the question whether the sample, or specific socioeconomic groups within the sample, experienced any credit constraints. The results therefore cannot be used in subsequent analysis to test the impact of predicted credit constraints on production, nutrition, and savings outcomes. The following method therefore attempts to directly assess the existence of credit constraints.

Method two. The second approach uses direct information from household surveys to decide whether a household is constrained. This information can usually be collected fairly easily and a (0,1) variable constructed, which takes on the value 1

if someone in a household is constrained. The usual assumption is that if even one person is constrained, the household as a whole should be considered constrained. Since this approach is extremely rare in the literature (Jappelli [1990] and Feder et al. [1990] are exceptions), it would be worthwhile to discuss the derivation of such a variable in detail, using the IFPRI Pakistan rural household panel data set as an illustration. Two points to note are that in the Pakistan case, the variable was constructed for formal credit alone, while informal credit was included in the cases of Cameroon, Madagascar, Bangladesh, and Malawi. The method was first applied in the Pakistan sample, and then further developed in subsequent surveys.

In the Pakistan case, the (0,1) variable, CONST, was constructed from a sequence of three questions in the questionnaire. These were, "Have you applied—over the recall period—for a loan from banks, or government or semi-government institutions?,"[3] followed by, "If you applied for a loan, did you get it?," and "If you got the loan: a) was it on time; b) was the amount sufficient for you requirements?" The identification of *discouraged* borrowers begins with those who replied in the negative to the first question. Although respondents usually gave several reasons for not applying, these *had to be ranked in order of importance*. Those who gave at least one of the following reasons (in any order of importance), (i) "Could not offer the required security," or (ii) "Felt the procedure was complicated and expensive," were classified as discouraged, *provided* they did not simultaneously rank as most important one of the following, "no need for credit" or "dislike for credit on religious grounds" (the payment of interest is against the tenets of Islam). Anyone else who answered no to this question was classified as unconstrained.

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[3]In Madagascar, Bangladesh, and Malawi, similar questions have been asked for both formal and informal credit.

Rejected borrowers were defined as those who answered no to the second question, and *rationed* borrowers as those who answered no to any of the subquestions to the third question. Constrained households were then defined as those that fell into any one of these three categories (i.e., discouraged, rejected, or rationed). The process is shown diagrammatically in Figure 2 below. The category of discouraged borrowers, however, may be comprised of non-applicants who could have obtained a loan but did not bother applying for it because the expected costs for application (i.e., complicated and/or expensive procedure) and other loan costs (i.e., interest) were beyond the expected benefits of the loan. These households are therefore to be categorized as unconstrained. In the subsequent surveys in other countries, the probing on the question, "Why did you not apply for credit or membership in a particular program," was therefore expanded to better distinguish between nonapplicants who did not apply because of cost reasons (case of lack of economic demand for credit) and those who did not apply because of expected denial of access for a variety of reasons, such as lack of collateral (case of constrained nonapplicants).

The next step is to see if the magnitude and severity of credit constraints can be measured. Following Jappelli (1990), one can proceed as follows. A household is constrained if the following holds:

$$C_h^* - Y_h^* - A_h(1+r) > S_h \tag{1}$$

Figure 2   Definition of constrained households

```
                                  Applied for loan?
            +)))))))))))))))))))))))))))))))))))))))))))))))))))))))))))),
            *                                                                      *
         +))))2)))),                                            +))))2)))),
       +)))1   Yes  /))),                         +)))))))))1    No   /))))))))),
       *  .))))))))))-    *                        *         .))))))))))-          *
       *                  *                        *                               *
       *                  *                        *                               *
+))))))2)))),    +))))))2))))),       +))))))))))2))))))))))),   +)))))))))2)))))))))),
* Got loan  *    * Did not get *              *i)  Perceived no chance *   *i)  No economic      *
*           *    *    loan    /))))))),   +))))1   of getting credit/  *   *    demand          *
.))))))0))))-    * (Rejected) *       *    *    *  being member          *   *ii) Dislike for loan*
       *        .))))))))))))))-      *    *    *                          *   *    on religious or *
       *                             *    *    *                          *   *    other grounds   *
       *                             *    *    *                          *   .))))))))))0))))))))))-
       *                             *    *    *                          *                        *
       *                             *    *    .)))))))))))))))))))))))))))-                        *
       *                             *    *                                                          *
       /))))))))))))))),             *    *                                                          *
       *             *               *    *                                                          *
 +))))))2)))),   +))))2)))))))))),   *    *                                                          *
 * Enough    *   *Not enough or *    *    *                                                          *
 *           *   * not on time /))),  *    *                                                          *
 *           *   *  (Rationed)  *    *    *                                                          *
 .))))))0))))-   .))))))))))))))))-  *    *                                                          *
       *                             *    *                                                          *
       *                             *    *                                                          *
+))))))2)))))))),         +)))))))2)))2)))2)))))))),                     +)))))))))2)))))))))),
*              *          *                          *                   *                    *
*              *          *                          *                   *                    *
*UNCONSTRAINED *          *        CONSTRAINED        *                   *   UNCONSTRAINED    *
*              *          *                          *                   *                    *
*              *          *                          *                   *                    *
.))))))))))))))-          .))))))))))))))))))))))))))-                   .))))))))))))))))))))-
```

where

C_h^* = optimal consumption over the life cycle of household h in the
absence of credit constraints,

Y_h^* = net income of household h, where labor supply and other
household inputs into income generation are at their optimal levels
in the absence of credit constraints,

A_h = financial and nonhuman wealth, and

S_h = the maximum amount that potential lenders are willing to lend to
household h on the basis of its characteristics.

"Two factors determine whether the constraint binds: (i) how much the
individual would like to borrow, i.e., the difference between C_h^* and available
resources; and (ii) how much financial intermediaries are willing to lend to that
individual, i.e., S_h" (Jappelli 1990). Without credit constraints, the optimal amount
borrowed, B^*, is equal to the left side of equation (1): $C_h^* - Y_h^* - A_h(1+r)$. The household
is credit-constrained, if B^* is greater than the maximum amount available from
lenders.

The model is made operational by assuming that

$$C^* = X'\alpha + \epsilon,$$

and

$$S = X'\delta + \eta,$$

where X is a matrix of observable household-level variables, such as permanent
income, wealth, age, demographic characteristics, and education, plus possibly some
community-level variables. The implication is that lenders assess the creditworthiness
of potential borrowers through the same set of variables that would be used by the
borrower himself when deciding how much to consume. It is assumed that both C^*

and S are increasing in current income and wealth, i.e., that lenders will be willing to lend more to someone whose income and wealth are higher. It is also assumed that

$$Y^* = Z'\beta + \nu,$$

where Z is a matrix of demographic variables, education, and for farm households, land operated and farm capital as well. Substituting these functions for C^*, Y^*, and S, a reduced form equation can be derived:

$$X'(\alpha\text{-}\delta) - Z'\beta - A(1+r) + \epsilon - \eta - \nu > 0, \tag{2}$$

which can be rewritten as

$$X'\gamma - Z'\beta - A(1+r) + \mu > 0, \tag{2a}$$

where $\gamma = (\alpha\text{-}\delta)$, and $\mu = \epsilon - \eta - \nu$. This can be estimated as follows:

$$\text{CONST} = F(K + X'\gamma - Z'\beta) + \mu, \tag{2b}$$

where

$F(.)$	=	the c.d.f of the normal distribution,
$X'\gamma - Z'\beta$	=	the reduced form for the excess demand function for loans,
K	=	$A(1+r)$ plus a constant term, and
CONST	=	the (0,1) dummy variable described above.

The problem with this reduced form approach is that the variable of interest, S_h, the credit limit, is not modelled in an explicit fashion. Jappelli assumes that the household characteristics that influence the demand equation are the same that influence the credit limit determined by the lender. However, the lender's decision will not only be influenced by household characteristics of the loan applicant, but also by the characteristics of the informal lender (wealth, relationship with loan applicant, etc.) and, in case of a formal lender, by the set of constraints under which the formal sector operates (such as the program's criteria for member eligibility or loan sizing).

The technique has been applied in several IFPRI studies, notably in Madagascar and Pakistan. The Madagascar study differentiates between the informal and formal sectors and uses *individual household members* as the units of analysis. This model will be discussed in the following.

The model used in the Madagascar study can be seen as a generalization of the one described above, in that it employs two univariate probit models in which the probability of applying for credit in each sector and the probability of obtaining the credit are subsequently determined (Zeller 1994). The first stage regression is a probit regression:

$$\text{Prob}(\text{APPLY}) = F(\text{I,H,E}), \tag{3}$$

where

APPLY = a (0,1) dummy variable, which is 1 if the individual applied for a loan,

I = a vector of individual characteristics (age[+], sex[?], education[+], sick days[+], being a wage laborer[+], being the head of household[+], having social responsibility in the community[+]),

H	=	a vector of human capital variables that might be relevant to the decision to apply (education[+], dependency ratio[?]), and
E	=	a vector of events that are expected to influence credit demand (migration or death of a family member, bad harvest, costly social events such as marriage).

The dependent variable in the second stage is a (0,1) dummy variable, which is 1 if the household member was not rationed by formal or informal lenders, respectively. The second stage regression equation can be specified as follows:

$$Prob(SUPPMAX) = F(I,W,E,L), \qquad (4)$$

where

SUPPMAX	=	also a (0,1) dummy variable, which is one if the household member was rationed in its loan demand,
I and E	=	as in (3),
W	=	a vector of household characteristics affecting the lender's decision (the value of household assets owned by an individual at the beginning of the recall period[+], the value of liquid assets, e.g., monetary savings[+]), and
L	=	a vector of variables affecting the household's ability to repay (the household's outstanding[-] debt, or the ratio of debt to the previous year's income[-]).

The above model could be further improved by estimating it as a bivariate probit model. Identifying variables for the bivariate model could be the vector W, but also

could be characteristics of the lender or the set of constraints under which the formal sector provides loans to rural households. In some of the MP5 countries, information on such additional variables describing the characteristics of lenders has been obtained.

Measuring the Extent of Credit Constraints. Given the limitations of (0,1) variables, it is advisable to construct variables that directly measure the extent of credit constraints. The credit limit for each household or individual, i.e., the maximum amount that can be borrowed by the household or individual, is the best candidate. The ability of economic decisionmakers to bear risk is conditioned by the line of credit available to them. Data on credit limits and related variables are available for different countries. For Madagascar and Cameroon, data are available on the amount demanded and amount borrowed for each transaction. For Bangladesh and Malawi, additional information on the credit limit is also available, i.e., respondents were asked to estimate the maximum amount they thought they could borrow from different sources.

The credit limit variable can be used in a regression framework. One way to proceed would be to explain the credit limit, A, in a reduced-form regression with some of the variables described above:

$$A = F(I,W,E_1,L,C), \qquad (5)$$

where I, W, and L are as above. The new variable, E_1, needs some explanation. As pointed out by Udry (1995), the pattern of repayment depends on income shocks experienced by both the borrower and the lender, as the terms of informal loan contracts have been found to be contingent on the state of the borrower and lender. Similar reasoning can hold for the credit limit that a borrower is granted by a

particular lender. Thus, if the lender suffers an unexpected loss of income, the borrower is expected to repay the loan a little earlier if a loan is outstanding, or may not be able to borrow as much as he or she had expected. Therefore E_1 contains the same variables as E, except that it applies to the lender and not the borrower. The variable C is a community-level variable that captures the idea that someone living in a wealthy community will have a higher credit limit than someone living in a poor community. The estimated credit limit from the first stage can then be used as a regressor in a second stage equation, with a measure of welfare outcomes as the dependent variable, e.g., income.

The advantage of using the credit limit to measure access to credit is that it increases efficiency in estimation, since more information is used. However, care has to be exercised in the use of this variable, since the credit limit itself cannot be predicted with complete accuracy until potential borrowers actually apply. Moreover, the errors are likely to be heteroskedastic, since those households that are either at or close to their credit limit are in a position to more accurately predict credit limits than others.

Participation in Financial Markets

Many groups, such as small farmers, and female farmers, find themselves unable to participate in credit markets, usually because of collateral requirements arising from informational asymmetries in credit markets (Dasgupta 1993; Stiglitz and Weiss 1981). As a result, they are unable to reap the benefits of such participation (see Eswaran and Kotwal [1989] and Dasgupta [1993] for a discussion). Although governments in most developing countries have tried to mitigate some of the failures of credit markets by, for example, setting interest rate ceilings or establishing targets for lending to particular groups, these attempts have not been uniformly successful. Indeed, it has been argued that they have actually undermined the objectives they

ostensibly sought to promote (von Pischke, Adams, and Gordon 1983). Participation in credit markets remains problematic for large groups in developing countries.

It is often useful to have information on credit market participation in addition to information on access. At IFPRI, participation can be measured using data sets from all nine MP5 countries. One problem with part of these data sets (China, Mali, Ghana, Nepal) is that it is not known whether those who did not participate chose to do so voluntarily, or whether they would have liked to participate, but could not (i.e., whether they are *discouraged* borrowers).

A data set from Pakistan (the Rural Credit Survey 1985, consisting of over 2,000 households) has been used to construct two simple measures of participation in credit markets, with the focus on small farmers, and also to measure the determinants of participation (Malik, Broca, and Gill 1996). This methodology is applicable to all countries and is viewed as highly useful for intercountry comparisons.

A simple measure of participation (Measure 1) is given by the ratio of two quantities: (1) the proportion of the number of loans made to small farmers, which go to a particular category (e.g., landowners); and (2) the proportion of small farm households falling into that category. For example, suppose that owners get 10 percent of all loans made to small farmers, while they constitute 50 percent of all small farmers. Then Measure 1 = 0.2 (i.e., 0.1/0.5) for small farmer owners. It is clear that a value of Measure 1 greater than 1 for a category implies more than equal participation, while a value below 1 implies less than equal participation. Furthermore, the smaller the value of Measure 1, the more limited the participation for that household category.

A second measure of participation (Measure 2) can also be defined, once again as the ratio of two quantities: (1) the *value* of loans made to small farmers falling into a household category (e.g., small farmers who are owners); and (2) the *value* of loans made to all owners. For example, if an Agricultural Development Bank lends Rs 100

to landowners in the small farmer category, out of Rs 1,000 lent to all landowners, whether big or small farmers, the value of Measure 2 for small owners is 0.1. Once again, a value of Measure 2 greater than 1 indicates more than equal participation and vice versa.

The next question is how to measure the determinants of participation. One approach, which has been used at IFPRI in several studies, constructs a (0,1) variable that takes on the value 1 if a household or individual obtained any credit. This can be used as the dependent variable in a probit analysis to obtain the probability of participation. In the Pakistan study (Malik, Broca, and Gill 1996), for example, this (0,1) variable was constructed for each household so that it took on the value 1 if anyone in the household obtained institutional credit. This was then regressed on several *household-level* variables that determine participation, such as the ratio of dependents to adults in the household, the size of the household's landholding, a measure of the educational attainments of household members, ownership of a tractor, tenancy status, as well as several *community-level* variables, such as the mean amount of institutional credit obtained in the village (net of the respondent's own borrowing).

The Ghana study uses essentially the same methodology. Two household surveys were conducted in different regions of Ghana to evaluate the effects of different credit programs. A probit regression was run for credit program participation (1 if household participated in a credit program) (Kennedy et al. 1994).

Effects on Household Incomes, Consumption, and Nutrition

In the following, various modeling approaches are reviewed. Most of them have been tested by members, using data sets from IFPRI, and have been critiqued by the team members. As noted in Chapter 3, because of differences in data, but also because of structural differences in credit markets between countries, MP5 will employ several methods for measuring credit impact.

Earlier Approaches. Earlier studies have been of two types. They either provided a comparative description of outcomes between borrowers versus nonborrowers (Araujo 1967; Daines 1975; Cordova, Masicat, and Herdt 1978; Colyer and Jimenez 1971) or involved econometric analyses of the production function or the input demand function (Becker 1970; Gyekye, Acquah, and Whyte 1977) explicitly specifying credit use. David and Meyer (1978) raise three methodological issues concerning these types of studies. First, studies that attempt to measure the impact of credit on income and welfare use the farm as the basic unit of analysis and little attention is given to the interdependence of production and consumption activities typical in most farm households. Second, and quite related to the first, a narrow focus of farm analysis overlooks the fact that loans are fungible. Third, it is important to address the attribution problem by separating the effect of loans from other factors simultaneously affecting income and welfare. For example, if nonprice rationing of credit resulted in concentration loans among larger and richer farmers, then difference in outcomes between borrowers and nonborrowers may explain credit allocation rather than impact of borrowing.

Correcting for Selectivity-Bias: The Use of Two-Stage Procedures. The basic problem in impact evaluation arises because of the impossibility of observing what would happen to a household/individual in *both* the state it participates in the credit program and the state that it does not (see Heckman and Smith 1995). When program participation is not random, selection bias is likely to result if evaluation is simply based on the difference in outcomes of participants as compared to nonparticipants. To take Heckman and Smith's (1995) example: "if persons elect to participate in a program precisely because of the poor alternatives available to them outside the program, nonparticipants will have outcomes higher than those that participants would have if they had not participated, implying a negative selection bias" (p. 88). The

problem of self-selection may be handled by the use of two-stage estimated techniques; these are described below.

For the sake of exposition, let the impact of interest be Y_1. The problem arises because unmeasured household-level variables affect both credit transactions, -, and the level of outcome, $Y1$. With the resulting endogeneity, OLS regression of Y_1 on credit transacted Z is likely to result in biased estimation.

Specifically, let the two equations be specified as

$$A = \alpha_1 \mathbf{z}_1 + E_1 \tag{6}$$

and

$$Y_1 = \alpha_2 \mathbf{z}_2 + \gamma A + E_2 \tag{7}$$

The first equation states that A, access to a credit program, depends on a set of household- and community-level variables represented in $\mathbf{z}_1$. The second equation states that outcome, Y_1, depends on another set of household and community characteristics, $\mathbf{z}_2$, and access to credit A. The problem arises when equation (7) is estimated by OLS. This is because the random error terms, E_1 and E_2, are likely to be correlated, since unobserved household- and community-level variables affect both A and Y_1. Hence, in estimating equation (7), regressor A will be correlated with E_2, resulting in simultaneity bias.

When the outcome variable is continuous and observable (for example, household caloric intake, total food expenditures, anthropometric measures), a two-stage procedure may be used to produce unbiased and consistent estimates of program impact (Maddala 1983). When access to a special credit program is being analyzed, A in equation (6) may be a binary variable indicating membership of a special credit program. The specification may be the following:

$$A^{*=} \alpha_1 \mathbf{z}_1 + E_1, \tag{8}$$

where A^* is a continuous but latent variable describing access criterion and

$$A = 1 \text{ if } A^* > 0$$
$$= 0 \text{ otherwise.}$$

In order to remove endogeneity in the estimation of equation (7), a two-stage estimation is proposed. In the first stage, an estimate, $\hat{\alpha}_1$ of α_1, is obtained by probit maximum likelihood method for equation (8). As for equation (7), it can be rewritten as

$$Y_1 = \alpha_2 \mathbf{z}_2 + \gamma \quad (\alpha_1 \mathbf{z}_1) + \text{w}, \tag{9}$$

where   is the cumulative distribution function of a standard normal distribution, and w has a zero mean and is uncorrelated with the regressors (Maddala 1983). Equation (9) can now be estimated by OLS after substituting α_1 with $\hat{\alpha}_1$. Note that, unlike in the case of the usual simultaneous equations models, equation (9) can be estimated even if $\mathbf{z}_2$ contains all variables in $\mathbf{z}_1$. This is because A is replaced by a nonlinear function, $(\hat{\alpha}_1 \mathbf{z}_1)$, and not a linear function, $\alpha_1 \mathbf{z}_1$ as in the usual case. However, it is important to note that the standard errors from the second-stage regression cannot be used to compute the t-statistic, as it ignores the fact that the regressor is itself estimated. The method for computing the correct covariance matrix is described in Maddala (1983).

This simple approach can be used for data sets that do not have any information on the credit limit available to the household. However, the above framework does not allow taking into account the extent to which program services are utilized, i.e., how much is borrowed. Hence, in case program benefits—for example, loans—are

not uniformly distributed across member households, equations (6) and (7) may be augmented to

$$- = \alpha_1 \mathbf{z}_1 + \gamma_1 A + E_1 \tag{10}$$

and

$$Y_1 = \alpha_2 \mathbf{z}_2 + \gamma_2 - + \mu A + E_2 \tag{11}$$

Equation (5) states that the total amount of credit borrowed by the household (including that from nonprogram sources), $-$, is a function of a set of household variables, $\mathbf{z}_1$ and A, its access to the credit program. The second equation states that outcome Y_1 depends on a set of household characteristics, $\mathbf{z}_2$ the amount of credit transacted, $-$, and A. We include A in the impact equation because we postulate that group membership modifies the impact of credit, which, in principle, is completely fungible. E_1 and E_2 represent, as before, the random error terms. In such a case, it is proposed that the same technique as before be used, except that equation (9) be extended to

$$Y_1 = \alpha_2 \mathbf{z}_2 + \gamma \quad (\alpha_1 \mathbf{z}_1) + Z^- + w,$$

where Z^- is obtained from a reduced form regression of Z on all exogenous variables of the system. Under this scheme, however, identification can no longer be taken for granted. Hence, we need to find variables that affect $-$ but not Y_1. Potential variables are those that affect the supply of credit, but not demand. Community-level variables represent one potential set of instruments. Household-level variables reflecting the possession of "social capital" are others. In order to better address these identification issues, several of the MP5 surveys (i.e., Cameroon, Madagascar, Bangladesh, and Malawi) obtained data on the characteristics of the lender and its relationship with the

borrower. These lender characteristics influence the supply curve, but not the demand curve, so that they can be used as identifiers, at least for informal credit transactions. For formal credit transactions, dummies or specific program characteristics influencing the supply curve, such as criteria for loan sizing or member eligibility, can be used as identifying variables.

Use of Quasi-Experimental Techniques. Pitt and Khandker (1994) did not rely solely on the nonlinear property of probit maximum likelihood estimation. They, instead, made use of a survey that included communities in which there were no credit programs. This approach allows for the comparison between a "treatment group," living in communities with access to a formal credit program, and a "control group," living in communities without such access. Having done this, they identified the expected value of outcome, Y_1, without participation from a subsample that was not "contaminated" by self-selection.

IFPRI data sets do not, in general, permit the use of such an approach. One of the major reasons for not having used an experimental approach in the IFPRI surveys were cost considerations. Given a limited budget, the necessarily larger sample size of the experimental approach could only have been obtained by collecting less information on behavioral processes and their determinants at the household level, such as determinants of access to and participation in various programs and on interactions between formal credit (of different types) and their numerous substitutes, such as access to labor and land market and to informal means of smoothing consumption. Heckman and Smith (1995) provide a critical review of the experimental approach: it can, in principle, eliminate the selection bias, but does not give, except for special cases, information on the distributional consequences of the program impact on participants and nonparticipants. Furthermore, the possibility of substitution bias is eminent in studying the impact of a particular credit program on

household-level outcomes. Substitution bias arises when members of an experimental control group (those living in a village without the particular credit program in question) gain access to close substitutes of the services provided by the program in question. For example, in studying the impact of Grameen Bank in Bangladesh, close substitutes could be the numerous other nongovernmental credit programs that target the landless. If substitution bias is introduced through inappropriate randomization of villages having access to close substitutes to the program, the estimated impact on the program can be biased.

However, there is a related issue of sample-selection bias that will have to be addressed in those country-case studies where a stratified random sampling procedure, in which the stratifying variable was participation in a credit program, was used. Since, in most cases, participation is a choice made by individual members, the sampling procedure falls into the category of *endogenous (or choice-based) stratified sampling*. As a consequence, standard estimation methods that assume random sampling or exogenous stratified sampling yield inconsistent parameter estimates if applied in this context (Cosslett 1981; Manski and McFadden 1981; Hausman and Wise 1981; Amemiya 1985; Pitt and Khandker 1994).

Several estimators that are consistent under endogenous stratified sampling have been proposed (see Manski and McFadden (1981) and Amemiya (1985) for review and derivation of their asymptotic properties). They are all maximum likelihood estimators (MLE), except Hausman and Wise (1981). Weighted Least Squares is a feasible option only when the population proportions of the endogenous strata are known or can at least be consistently estimated from another random sample. Knowledge of the population proportions of the strata is also required by some of the simpler maximum likelihood estimators.

Use of Panel Data. Yet another method to deal with selection bias is to make use of panel data for households before and after program initiation. In case this is available, unobserved household characteristics could be swept out, using fixed effects. However, panel data are costly to collect and are available at IFPRI only in the case of Pakistan. An additional consideration is that precision of estimates depends on the length of the panel. A very short panel will produce imprecise estimates.

Separability Between Production and Consumption: The Use of Switching Regressions. Feder et al. (1990) suggested that production functions of constrained households should differ from those of unconstrained households, since production and consumption decisions are inseparable for households that are constrained. Feder et al. make the following assumptions:

- All farm households are unconstrained in all markets except the credit market.
- Some households are also constrained in the credit market. For these households, production decisions are influenced by household characteristics.
- Therefore, in estimating production functions, household characteristics should be included for constrained households and should be left out for unconstrained households.

The estimation technique used is switching regressions. Step one is to estimate a variable that determines whether or not a household is credit constrained. In the second step, the estimated value of this variable is used to deciding which of the two regimes (constrained or unconstrained) applies in the second-stage regressions. Depending on whether the predicted value is 1 (constrained) or 0 (unconstrained), the

production equation includes total liquidity and demographic structure as regressors for constrained households in addition to land, capital, education, and farm experience, which are common to all households.

The expectation is that the coefficient of total liquidity is positive and significant in the production function equation for constrained households, but the coefficients of the demographic variables are not. In addition, a "counterfactual" case can be estimated in which the version with total liquidity and demographic variables is run on the subsample of *unconstrained* households. The hypothesis is that these variables will be insignificant in this equation.

Experience with this model at IFPRI has not been very encouraging. The model was applied to the *Madagascar data set*, 180 households tracked over three rounds in 1991-1992. Three major problems with the switching regressions model were encountered. First, it does not yield results that conform to expectations. The simplest reason for this is probably that households are constrained in the labor market as well as in the credit market. This assumption was tested by including labor market variables as well in the equations for the unconstrained households. Yet, demographic variables like adult equivalent family size continued to be significant for unconstrained households. Second, the model is highly sensitive to specification. Adding or dropping variables produces dramatic changes in both sign and significance for key variables. Finally, it is difficult to assess significance, both because t-tests are not really appropriate and also because there are so many predicted variables being used as regressors (to reduce simultaneity bias) that conventional tests of significance (e.g., likelihood ratio tests) are hard to interpret.

System Approach

The demand for the various financial commodities are affected not only by their own cost and supply attributes (interest rate, transaction costs, and supply constraints),

but also by the prices of the other food and nonfood commodities as well of illiquid assets. For example, a rise in the price of a food staple may induce a household to borrow (or be ready to accept a reciprocal gift) in order to meet its food consumption requirement. Likewise, the cost-related attributes of the financial commodities affect the demand for the food and nonfood commodities, and illiquid assets. For example, the rise in the interest rate or the binding of the credit constraint for one financial commodity may lead a liquidity-constrained household to reduce its consumption for some food or nonfood commodities. The econometric implication is that one needs to estimate a system of demand/supply equations constituted by the demands and supply for the main types of financial commodities (formal and informal loans received, informal loans given, savings, and gifts given and received), food commodities, nonfood commodities, and other household outcomes of interest (nutritional and health status, for example).

With this system approach, and the implied theoretical restrictions (symmetry, homogeneity, etc.), which can be explicitly derived after setting up the optimization problem with all the constraints facing the household, one can calculate the various own and cross elasticities of substitution (both compensated and uncompensated) not only for the financial commodities, but also cross elasticities between financial commodities and other commodities (food and nonfood commodities). For example, this allows for evaluation, in a consistent way, of the percentage changes in the demand and supply for an informal loan, and savings, and in the demand for food, when the interest rate or the maximum loan amount in the formal sector is increased by, say, 1 percent. More importantly, the system approach, by incorporating the substitution and income effects that are likely to result from any change in the credit market, allows for an estimate of the *true welfare* impact of any improved access to formal credit.

Derivation of the System of Demand and Supply Equations. What follows is a brief outline of our methodology.

To derive such a system of household demand/supply for loans (formal and informal), savings, gifts, and food and nonfood commodities described above, there are basically two alternative approaches:

- The first approach is the direct econometric, reduced-form estimation approach. This approach is relatively straightforward and does not require a prior mathematical model. Indeed, one needs only to specify the demand for each commodity in the system as a function of the whole vector of "exogenous variables" (which would include interest rates—if their sampling variations are sufficient, the maximum amount that the household could borrow for each type and recorded loan transaction, prices, etc.), and then estimate the system jointly, using a variant of S.U.R (Seemingly Unrelated Regressions). Although this method is the common approach in the empirical literature dealing with saving and credit issues, it has two main disadvantages. First, with this direct approach, it is not, in general, possible to invoke and/or impose the theoretical restrictions that would be implied by the corresponding structural model. Second, the estimated system may not be integrable (i.e., it may not represent a true demand/supply system for a utility maximizing individual) and thus cannot generate valid indicators of *true welfare* impact for any considered change in "exogenous" variables. Even if the system is integrable, it may be difficult, if not impossible, to calculate the *true welfare* indicators (feasible only through very simple functional forms or numerical analysis).

- The alternative approach we prefer and plan to follow is the "duality" approach, consisting of the following steps:

- Start with a mathematical utility maximization model (in a intertemporal choice under uncertainty context) that explicitly formulates the credit constraints facing the household (in both the formal and informal sectors), along with the intertemporal budget constraint, the liquidity constraints linking the various sources of household income, and the imperfect substitutability of the financial commodities relation or constraint.

- Work out the theoretical and mathematical justifications that allow the derivations of analogues of Roy's identity, Shephard's dilemma, and the Slutsky equation.

- Derive the functional relationships between demands/supplies and the indirect utility functional (or the equivalent of an expenditure functional via duality). These functional relationships will be the analogues of Roy's identity and Shephard's Lemma in Standard demand theory.

- Postulate an explicit "*flexible*" and *integrable* functional form for the indirect utility functional (or the analogue of the expenditure function via duality).

- Use the functional relationships discussed above to derive the explicit functional form of the system of demand/supply functions to be estimated, indicators of *true welfare* impact, and the implied theoretical restrictions that could be imposed during the econometric estimation.

The methodology outlined above is fully worked out and empirically implemented in Diagne (1994) in a static context of price uncertainty. We note that under uncertainty, both the demand for credit and the credit limit are random variables, the outcomes of which depend on the realized state of nature. Indeed, loan

decisions are not instantaneous decisions made on the spot; rather, they are merely parts of the implementation of a well-thought optimal *contingency plan* (i.e., sequence of decisions that are taken over time, *conditional* on the occurrence of specific events). Similarly, the maximum amount one can borrow from a particular source of credit is likely to depend on the occurrence of some particular events that could positively or adversely affect potential lenders and other borrowers (drought, for example). Hence, formally, the credit constraint is a stochastic constraint that requires the resolution of some mathematical technicalities before an optimal solution can be proved to exist and characterized. However, the results in Diagne (1994) are general enough to handle this case.

Some Econometric Estimation Issues. From either one of the two approaches outlined above, one will arrive on a system of equations having, on the left-hand side, the amounts of credits demanded by individual household members from each sector (formal and informal), the amounts of informal credits supplied individual household members, the amounts of cash saved, the amount of gifts given and received, and the quantities demanded for the food and nonfood commodities. The right-hand side will contain observed household demographic variables, prices of food and nonfood commodities, prices of inputs and outputs of product, the interest rates in the formal and informal sector (including or excluding the observed transaction costs), and the maximum credit limit variables for both informal and formal loans.

More formally, the system of equations to be estimated will more or less have the following form:

$$y = f(\beta, r_i, r_f, l_i^m, r_f^m, p, z),$$
$$\text{with } y \equiv (l_i^d, l_f^d, l_i^g, s, g^g, g^r, c^d, o),$$

where

l_i^d (resp l_f^d) $=$ the amount of informal (resp formal) credit obtained,

l_i^g $=$ the amount of informal credit given out by individuals,

s $=$ the amount of cash saved,

g^g (resp g^r) $=$ is the value of gifts given (resp received),

c $=$ a vector of quantities for the food and nonfood

commodities (and of input and output products), and

o $=$ a vector of other choice or outcome variables of interest.

On the right side,

β $=$ the vector of parameters to be estimated,

r_i (resp r_f) $=$ the interest rate in the informal (resp formal) credit

market,

l_i^m (resp l_f^m) $=$ the maximum credit limit in the informal (resp formal)

credit market,

p $=$ a vector of prices for food and nonfood commodities

(and of input and output prices),

z $=$ the vector of household and individual characteristics,

and

ϵ $=$ an error term.

There are three important estimation issues that need to be dealt with in order to get consistent estimates of the parameters in the system: the problem of simultaneity bias due to the presence of the maximum credit limit variable as an explanatory variable, the pronounced nonlinearity for the demand of credit, and the problem of sample selection bias.

Simultaneity. The simultaneity of the maximum credit limit variable results not only from the obvious fact that it is likely to be correlated with unobservable household characteristics absorbed into the error term, but also because it is influenced by other observable (past) choices made by the borrower. This is especially true in the informal market, where one of the motivations for individuals to give loans and gifts to others is to preserve or increase its future ability to borrow. At present, the standard way to deal with this simultaneity is to use instruments. However, finding valid instruments for the maximum credit limit appears to be difficult, as most of the obvious candidates for instruments (household assets, income, and the like) are likely to be correlated with the same unobserved individual characteristics.

Nonlinearity. The type of nonlinearity we are talking about here is the one induced by the fact that for many individuals, zero is the optimal loan demand (either by choice or by constraint—zero maximum credit limit). A standard and now popular way to deal with this problem is to use limited dependent (Tobit) methods of estimation. However, standard full parametric Tobit estimation relies crucially on the distributional assumption of normality, and, in practice, this seems to yield parameter estimates that are very sensitive to minor changes in specification (inclusion or exclusion of explanatory variables). This is a robustness issue that has been addressed in recent literatures by the use of a semi-parametric estimation method (i.e., use of distribution free estimators), which tends to be computationally involved. An alternative way of dealing with the pronounced nonlinearity is to rely on a "parsimonious" nonlinear functional form and use Least Squares methods.

Sample selection bias. The sample selection bias we are talking about here is the one associated with the endogenous stratified sampling procedure used for our survey. This has already been discussed above.

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