

The Structure and Performance of Rural Financial Markets and the Welfare of the Rural Poor: A Comparative Study in Peru and Mexico

Principal Investigators:

Stephen R. Boucher
Assistant Professor: Agricultural and Resource Economics
University of California - Davis
Davis, CA 95616
Phone: 530-752-1527; Fax: 530-752-5614
email: boucher@primal.ucdavis.edu

J. Edward Taylor
Professor: Agricultural and Resource Economics
University of California
Phone: 530-752-0213; Fax: 530-752-5614
email: taylor@primal.ucdavis.edu

Carolina Trivelli Avila
Director: Instituto de Estudios Peruanos
Horacio Urteaga 694
Lima 11, Peru
Phone: 51-1-332-6194; Fax: 51-1-332-6173
email: trivelli@iep.org.pe

Antonio Yunez Naude
Professor: Center for Economic Studies
El Colegio de Mexico
Mexico, D.F. 01000
Tel: 55-444-93050; Fax: 55-752-5614
Email: ayunez@colmex.mx

Additional Researcher in Peru:

Javier Escobal D. Angelo
Senior Researcher
Grupo de Analises Para el Desarrollo
Avenida del Ejercito 18
Lima, Peru
Tel: 51-1-264-1780
Fax: 51-1-264-1882
Email: jescobal@grade.org.pe

The Structure and Performance of Rural Financial Markets and the Welfare of the Rural Poor: A Comparative Study in Peru and Mexico

Abstract

This research project will investigate the degree to which recently liberalized rural financial markets in Peru and Mexico meet the needs of the rural poor. Both countries - although to differing degrees - have reduced the role of the state in financial markets in hope that vibrant private markets for credit, savings and insurance will emerge. The terms of access to these markets afforded to rural households will determine, to a large extent, the success of broader programs of neoliberal economic reforms. While the more specific hypotheses to be investigated are detailed in the full proposal, the research proposed here will answer the following broad question:

- *Do post-liberalization financial markets promote efficient resource use and enable asset accumulation by the rural poor?*

In order to answer these questions, the research project will create a household level panel data set containing information on production, income, expenditures, asset accumulation, and participation in financial and other factor markets. Approximately 500 households will be interviewed at 6 month intervals in each country. Panel data econometrics will allow us to assess the impact of financial market access on household welfare, production decisions and the ability of households to accumulate assets over time. These data will also permit us to identify factors contributing to rationing in credit markets and trace the evolution of credit market structure over time.

The research will also be of interest to the region as a whole because most of the countries have undertaken similar market oriented reforms. As Latin America struggles to redress rising inequality, it becomes increasingly urgent to understand the factors which may prevent resource poor households from participating in and contributing to renewed economic growth. This research will take a step in that direction by contributing to our understanding of the inter-connections between financial and other market reforms and the links between market development, poverty and vulnerability.

Finally, the research will utilize an established methodology for capacity building. The Program for the Study of Economic Change and Sustainability in Rural Mexico (PRECESAM) is a unique institution recently founded by the Colegio de Mexico and UC-Davis which is designed to promote and facilitate research on Mexico's rural economy by local researchers. Through PRECESAM, local researchers will participate in the implementation of the study and also facilitate the rapid dissemination of results. In Peru, the research will be supported by the Instituto de Estudios Peruanos and GRADE - the two leading social science research institutions of the country. Dissemination of results will be facilitated by these institutions' close ties with policy makers. The Office of Agricultural Information in the Ministry of Agriculture will also be involved in research design and dissemination.

1 Overview of Research

1.1 Background and Motivation

The 1990's witnessed a fundamental shift in rural development policy in Latin America. The neoliberal reforms implemented throughout the region have replaced protectionism with openness and the state with private markets as the primary mechanism of resource allocation. Rural financial market policy has been at the forefront of these reforms. The elimination of development banks and interest rate controls has drastically curtailed the state's direct participation in financial markets. Instead, the state's role has been restricted to augmenting the potential supply of collateral via land titling projects and enforcing the rules of the game via an enhanced regulatory capacity. The objective of the liberalization of markets for credit and other key factors such as land, labor, inputs, and outputs is to enhance the efficiency of resource allocation – and thereby accelerate growth.

The research proposed here will evaluate the performance of two liberalized financial markets in the region – those of Mexico and Peru. While several specific hypotheses will be investigated (and detailed later in the proposal), this research will address the following broad question:

- *Do post-liberalization financial markets promote efficient resource use and enable asset accumulation by the rural poor?*

Financial markets – broadly speaking – facilitate the allocation of resources both across time and states of nature via the following three mechanisms: 1) Financing productive investment; 2) Risk management; and 3) Savings. The performance of these three components critically affect households' ability to accumulate and fully exploit the productive assets embodied in their land, labor, and human capital and thus are critical to enhancing efficiency and reducing poverty. The proposed research, by evaluating the structure and performance of rural financial markets and enhancing our understanding of the interaction between credit, insurance, and other factor markets will allow policy makers to design more effective policy for sustained rural development

1.2 Country Scenarios

1.2.1 Peru

While liberalization came relatively late to Peru, when it arrived it was perhaps the most radical example in the Americas. The election of Alberto Fujimori in 1990, signified a dramatic swing of the policy pendulum away from the previous García administration's economic populism towards stabilization, structural adjustment and market liberalization. The changes in the agricultural sector were dramatic. Price controls and the state monopoly over inputs were eliminated. Financial liberalization occurred immediately - the elimination of interest controls was accompanied by the closing of the Banco Agrario in 1992. Finally, in an effort to provide incentive to private investment, a new land law was passed. The maximum land size was eliminated and the market for land was restored by eliminating all restrictions over rental and sales transactions. The reactivation of the land market has been promoted by a large titling program which has sought to map and register every non-comunal parcel in the country (Trivelli and Larson, 2001).

The government maintained its 'hands-off' credit market policy throughout most of the 1990's. Apart from channeling minimal amounts of subsidized credit to priority areas, the main policy implemented was to provide the legal foundation for rural credit unions (CRAC) and to strengthen the already existing municipal banks (CMAC) (Trivelli, 1998). By 1997, it was clear that the formal rural financial market in Peru was experiencing some limited success (Boucher, 2000). Commercial banks had begun to increase loan volume to the small class of medium sized farmers while the CRAC's and especially CMAC's had aggressively increased their loan and savings portfolios in the most agriculturally viable coastal valleys. Credit markets in the highlands, however, continued to languish.

Development of the nascent financial market came to a dramatic halt in 1998, as the country simultaneously experienced macroeconomic crisis and a severe El Niño occurred. This was followed immediately by the political crisis culminating in the fraudulent presidential elections and eventual fleeing of Fujimori in 2000/2001.

Rural credit policy has now returned to center stage. The Toledo administration has yielded to pressure to re-establish an agricultural development bank (BANADES) - although the precise form is still being debated. The proposed research thus comes at a time a critical moment for Peruvian policy and will

hopefully contribute to a more informed financial market policy.

1.2.2 Mexico

Economic liberalization in Mexico can be traced to two broad periods. First, to promote recovery from the 1982 debt crisis, in 1986 the Mexican government implemented a macroeconomic stabilization and structural adjustment program. The key components for the agricultural sector included trade liberalization, removal of guaranteed prices (except for corn and beans), elimination of input and output subsidies and the privatization of parastatal input supply and marketing companies. While aggregate growth rates recovered and accelerated by the end of the 1980's and into the early 1990's, the agricultural sector's participation in renewed growth remained limited. Agricultural GDP fell at an average rate of over 4% between 1990 and 1994 (Zedillo, 1996).

This led in 1991, to what de Janvry and Sadoulet call 'Mexico's Second Agrarian Reform' (de Janvry et al., 1997) which sought to modernize the agricultural sector and incorporate the countryside - especially the 'traditional' or Ejido sector - into economic growth.. The reform of Article 27 of the 1917 Constitution is one of the key elements of the reforms. The new legislation opened the way to the creation of private property rights and land markets in the Ejido sector. This overturned the previous Article which stated that ejidal land could not be alienated or mortgaged and directly tied use rights with occupation. The old Article also provided strong incentives against migration since land that was not cultivated by its designated user could be expropriated and assigned to someone else. One component of this new Article which is key to this research is that ejidos are granted the power to decide the tenure regime under which they will exploit their land. Options range from maintaining collective exploitation to the implementation of full, private property rights. This provides a semi-controlled experiment to examine the relationship between different forms of property rights regimes and financial market performance.

Credit policy also shifted substantially. The volume of state credit channeled to farmers via the agricultural development bank - BANRURAL - declined sharply after 1989 (Aurbach, 2001). This was, in part, made up for by the increase in the volume of agricultural credit supplied by commercial banks. Commercial bank loans, however, are concentrated among large private farmers. The decline in formal credit to small

farmers was partially offset by government support for credit unions as well as several state programs such as PRONASOL and FONAES.¹ The degree to which small farmers have effective access to these formal institutions and, if not, what alternatives exist will be a key question addressed in this research.

1.3 Research Questions

In his recent book, Peruvian economist Hernando de Soto (de Soto, 2000) forcefully argues that it is poor households that stand to gain most from the types of property rights reforms and market liberalization policies implemented in Peru and Mexico. Market oriented reforms should allow poor households to ‘realize’ the previously unfulfilled potential of their assets. Drawing on the experience of the U.S., de Soto points out that in developed countries most entrepreneurs are able to make their start by leveraging their residential assets in capital markets. Following this logic, by defining and granting property rights over land, strengthening property registration and legal institutions, the recent policy reforms should spur investment demand - and thus the demand for finance - among poor households. The replacement of inefficient State run banks with agile and forward looking private financial institutions will allow this increased demand to be met, thereby generating a ‘win-win’ scenario of enhanced efficiency and the reduction of poverty and inequality.

While this scenario is attractive, there are, unfortunately, causes for concern regarding the outcome of liberalization policies. At the root of concern lie the information asymmetries inherent in financial market transactions - both for credit and insurance - that may lead to rationing and thereby prevent the types of efficiency enhancing transactions policy makers hope for. The potential for information based failures in liberalized markets to be biased against low wealth households raises equity concerns as well. For example, the absence of crop or weather insurance is likely to have more serious impacts on the production patterns of poor farm households - who are more risk averse - than on wealthier ones. Similarly, a land titling program may have minimal positive impact on a small farmer if she is unwilling to place her land at risk as collateral.

In order to increase our understanding of the structure of rural financial markets and gauge the impacts of financial market structure on resource allocation and, particularly, the ability of poor households to accumulate assets, the proposed research will address the following questions:

¹PRONASOL is the National Solidarity Program. FONAES is the National Fund for Solidarity Businesses.

1. *How effectively do formal financial institutions meet the credit and savings needs of rural households?*
 - (a) What are the frequencies and determinants of non-price rationing in credit markets?
 - (b) Have property rights reforms increased rural households' ability to provide collateral to banks?
 - (c) Is the ability to mortgage land a *sufficient* condition for activating credit demand of poor households? Or does the risk of losing collateral assets instead deter credit demand?
2. *What is the relationship between formal and informal segments of the credit market?*
 - (a) Who are the informal credit suppliers?
 - (b) How do formal and informal contracts differ across conventional terms such as interest rate, loan size and term structure as well as non-conventional terms such as transaction costs, liability rules, and risk sharing?
 - (c) How do we explain the observed patterns of sorting and matching of borrowers across different types of lenders? Do households seek informal lenders because they are denied access to formal lenders? Or - in contrast to conventional wisdom - are formal lenders instead able to offer more attractive contracts?
3. *What are the primary vehicles of savings utilized by rural households?*
 - (a) What is the composition of savings across formal financial instruments, consumer durables, livestock and machinery, etc.?
 - (b) What are the risks and rates of returns associated with these different vehicles?
4. *What is the nature of risk confronting rural households and how effectively do households insure against it?*
 - (a) What are the primary sources of risk (output prices, production, theft, illness...)?
 - (b) What is the distribution of the occurrence of these events across households within and across regions?
 - (c) What formal and informal mechanisms do households use to insure ex-post against these events?
5. *How does the presence of credit constraints affect the inter-temporal consumption patterns of households? and;*
6. *How do credit constraints affect the allocation of household resources across different production activities (especially those of different levels of risk)? What is the cost - in terms of foregone expected income and the ability to accumulate assets over time - of these allocation decisions?*

1.4 Overview of Methodology and Data Collection Issues

In order to address these questions, we will construct a panel data set using a multi-purpose household survey. We will interview approximately 500 households in each country a total of five times (at six month intervals) throughout the three year study. Constructing a panel data set is necessary for several reasons. First, as developed in greater detail in the Section 2.3, much of the proposed empirical analysis revolves around measuring changes in household consumption over time. Second, panel data minimizes econometric problems stemming from measurement error that plague cross section studies. In particular, the bias that

would result from not accounting for unmeasured household characteristics such as ‘talent’ or soil quality is minimized by estimating equations in ‘first differences’. Finally, panel data will permit us to evaluate the impacts of events - such as exogenous policy changes (migration policy, titling of communal land, or establishment of a new financial institution) that occur in the middle of the panel.²

We are interested in how financial markets perform in and households respond to different risk environments. We will achieve heterogeneity by stratifying the sample at the village level. Between 5-7 villages (*aldeas*) will be selected to achieve heterogeneity in agro-climactic conditions and general infrastructural development in each country. Within each village, we will select between 70 - 100 households. In order to achieve heterogeneity in wealth, the households will be selected from different land holding classes - including landless households. In Mexico, we will take advantage of Taylor and Yunez’ survey which will be applied to 1,600 rural households throughout Mexico in January 2003.³ That survey will provide a sub-universe of household from which we will draw a smaller sample for the panel study. In Peru, we will have an additional step of first conducting a census of households in the chosen aldeas which will serve as the panel sample frame.

The data requirements for addressing the questions posed above are steep and challenging. We describe here, in some detail, the composition of the survey instrument and discuss some of the anticipated challenges in data collection. In addition to standard sections on household demographics and wealth, the survey will include the follow key modules:

- *Credit Market Participation*: Understanding the relationship between market imperfections and household participation in land, insurance, and credit transactions requires detailed and innovative modules on factor market contracts. The credit market module is based on modules developed by Boucher in Peru and Central America and consists of three sections. i) The *credit history* section identifies the frequency of past participation and repayment histories with different types of formal and informal lenders. This information helps understand current transaction costs and supply probabilities. ii) The *current contract* section collects in-depth information on terms of outstanding contracts (in which

²We will also seek additional funding in order to continue the panel after the three years of this study - and thus establish a sorely needed longitudinal rural data set in Latin America which is equivalent to the ICRSAT data in India.

³The Rural Mexican Labor Survey is conducted jointly between UC Davis and El Colegio de Mexico. It will be carried out in 40 municipios throughout rural Mexico between January and March of 2003.

the household can be either lender or borrower). This is crucial to estimate effective interest rates⁴, transaction costs and, of particular concern here, the risk to households implied by liability rules and collateral requirements. iii) Finally, the *credit market perception* section - applied to non-borrowing households - identifies the degree and types of credit constraints in the sample. By asking subjective questions such as ‘Why didn’t you seek a bank loan,’ this section will allow us to distinguish between three types of non-borrowers. Price rationed (unconstrained) households are deterred by high interest rates. Quantity rationed households include rejected loan applicants as well as non-applicants that did not apply for fear of being rejected. Finally, risk rationed households are those who do not apply because the available contracts force them to bear too much risk.

- *Land Market Participation*: Land transactions are integrally linked to the performance of financial markets. Because fixed rentals require up-front payment, land abundant but credit constrained households may rent out a portion of their land in order to finance production on the rest. Conversely, land scarce households seeking to increase their operational farm size may - if they are constrained in credit access - be unable to rent in land. They may instead increase land area by sharecropping, which can be seen as an institutional innovation to both insurance and credit market imperfections. The land module will include a detailed parcel based section on household land holdings (area, quality, irrigation, property rights...) and a separate section on land transactions.
- *Risk and Risk Coping Strategies*: The abstract concepts such as ‘shocks’ and ‘transitory income’ have, with few exceptions, been operationalized in empirical work⁵. We will address this shortcoming in two ways. First, we will include a module which both solicits household definitions of shocks (‘*eventos inesperados*’) and then measures the frequency of these shocks and quantifies their impact on household income and wealth. An important innovation is to extend the definition of shocks to include those to assets (e.g., via flood or theft) as well as to consumption and income. Second, we will include a detailed section on household response to shocks - both via participation in informal risk

⁴Interest rate measurement is notoriously difficult as it may be embedded in transactions linked with input or output markets. The time frame which households discuss interest rates also tends to vary (i.e., 10% may refer to interest charged weekly, monthly, or annually).

⁵Notable examples of empirical estimation and use of shocks include: (Carter, 1997), (Paxson, 1992), and (Jalan and Ravallion, 1999).

sharing networks (gift giving, labor exchange, remittances, etc.), financial markets (saving, dis-saving and consumption credit) and sales purchases of assets.⁶.

- *Household Income:* The predominance of self-employment and lack of record keeping pose serious challenges to the collection of accurate household income data. Well structured and detailed (and time consuming) modules on revenues, costs, and household labor allocation to for farm and non-farm enterprises are required. Disaggregated data on farm inputs and cropping patterns will also be crucial for identifying risk taking behavior. Rural households also tend to diversify income strategies - both at a given point of time and throughout the course of the year. The module thus will also track each household members' activities, monetary earnings, and benefits over time.
- *Consumption and Expenditures:* Household consumption is our key welfare measure and consumption growth is one of the key dependent variables in the econometric analysis described below. Careful definition and measurement is thus critical. We define consumption as the value consumed of food, services, semi-durable and durable goods over the six month period. We will follow the LSMS practice of using short (two week) recall periods for food and non-durable items and longer recall for durables and semi-durables. An acknowledged difficulty in collecting consumption data is establishing a uniform time frame for recall (Deaton and Grosh, 2000). We will address this issue by splitting each semi-annual interview into two separate visits. In the first visit we will apply the demographic, wealth, income and labor market participation modules. At the end of the first interview, the household will be informed that the enumerator will return in two weeks to ask about their expenditures on food and other items. In the second visit, the household will be able to discuss consumption in the well defined, two week interval since the previous visit. The more sensitive credit, land, and risk modules will also be administered in the second visit.

There is a clear trade-off between representation via large samples on one hand, and depth and quality of data on the other. Given the objectives of this research - namely to understand the performance of financial markets and the complicated relationships with other factor markets, this research requires sacrificing large

⁶This portion of the survey will draw substantially on the survey instrument used by Marcel Fafchamps and Susan Lund in their careful study of risk sharing networks in the Philippines (Fafchamps and Lund, 2000).

sample size in order to collect sufficiently detailed and accurate data. While the methodology we propose is costly, we are convinced that the increase in quality - due to the precise time frame for consumption, breaking up the survey into two shorter visits, and establishing an ongoing relationship between enumerator and household - will be well worth the cost.

2 Conceptual Framework

In this section we lay out the theoretical and econometric approaches we will use to address two of the primary objectives of the research: i) The nature and determinants of credit market failure and ii) The implications of credit constraints on household welfare and production.

2.1 Quantity and risk rationing in rural credit markets

The potential for credit rationing is well established in the theoretical literature.⁷ The empirical evidence on credit rationing is, however, less developed. This research will both increase our understanding of the nature of credit rationing - and thereby suggest policies to redress it - and provide an in depth examination of its determinants and empirical relevance. In this section we provide a simple framework to understand the multiple ways in which risk can lead to imperfections in credit market outcomes. This discussion then leads to an empirical strategy for identifying the frequency and determinants of credit rationing.

A key insight from the credit rationing literature is that the conventional means by which lenders overcome the adverse selection and moral hazard problems derived from asymmetric information is by requiring borrowers to post collateral.⁸ In rural areas of LDC's, the 'cure' of collateral causes additional ailments. Conventional quantity rationing is one possible result. A farmer will be unable to undertake a productive investment project if she does not have sufficient collateral assets. By granting freehold titles, the property rights reforms introduced in Peru and Mexico partially redress this problem. Recent research (Boucher and Carter, 2002) suggests, however, that increasing collateral assets may be a necessary but not sufficient step

⁷For reviews of this literature see, for example, (Jaffee and Stiglitz, 1990) or (Hillier and Ibrahim, 1993).

⁸The key intuition is that collateral is not just a means of compensating for risk - since that could be accomplished by raising the interest rate. Collateral is also a means of indirectly controlling the composition of the applicant pool (high risk individuals will be less willing to post collateral) and borrower behavior (a borrower who stands to lose collateral is less likely to divert the investment funds to consumption).

in overcoming credit market imperfections. The key insight is straightforward - risk averse households may be unwilling to offer their assets as collateral even if the loan contract would raise their expected income. This result can be seen in the following simple model.

A farmer owns T hectares of land and $\$A$ of wealth. Her technology requires an investment of $\$1$ per hectare. With probability p the harvest succeeds and yields a revenue of Y . With probability $(1 - p)$ the harvest fails and yields $\$0$. The farmer has no liquidity and must finance production with a loan which requires her to pay back $(1 + i)T$ if the crop succeeds and TK under crop failure, where i and K are the interest rate and per-hectare collateral requirement. Her consumption is thus:

$$C = \begin{cases} A + T[Y - (1 + i)] & \text{under success} \\ A - TK & \text{under failure} \end{cases} \quad (1)$$

The risk neutral bank, which has opportunity cost of funds of γ , has the following per hectare returns to a loan:

$$R = \begin{cases} i - \gamma & \text{under success} \\ K - (1 + \gamma) & \text{under failure} \end{cases} \quad (2)$$

The lender will be indifferent between contracts yielding constant expected returns, or satisfying:

$$1 + i = \frac{1 + \gamma}{p} - \frac{1 - p}{p}K. \quad (3)$$

For a given level of returns, Equation 3 shows that lower interest rates must be accompanied by higher collateral. While the lender is indifferent amount contracts satisfying Equation 3, a risk averse farmer is not. She strictly prefers the ‘full-insurance contract’ - or the contract that fully stabilizes her consumption across success and failure.

While simplistic, this model shows the key result that credit markets may raise efficiency not only by permitting liquidity constrained agents to undertake productive investments, but also by efficiently distributing risk across agents in the economy. In this example, the ‘insurance’ afforded by the optimal credit contract would induce all farmers - no matter how risk averse - to undertake the profitable, risky investment.

Now, however, suppose the presence of asymmetric information leads lenders to require \underline{k} units of collat-

eral per hectare financed. Recalling Equation 3, this has the effect of limiting available contracts to those with relatively low interest rates but high collateral. Equivalently, the collateral requirement reduces the implicit insurance available in the credit contract. Now, even if a farmer can meet the collateral requirement, she may not be willing to bear the risk.

This example demonstrates the strong potential for credit market outcomes to be biased against low wealth households. First, the poorest ($A < Tk$) cannot post sufficient collateral. In addition, there will be a group of *risk rationed* individuals who are able to post collateral - and thus who have access to the credit market - but who prefer instead to undertake low risk, and low return, activities. An important innovation of the proposed research is to incorporate the potential for risk rationing into the empirical investigation of credit market performance.

This analysis also suggests alternative ways of understanding borrowers' choice between formal and informal lenders. The traditional view suggested that the informal loan market - with its high interest rates - was the sector of last resort and that any borrower observed with an informal loan must be quantity rationed in the formal sector (Iqbal, 1986). Recent work on credit markets in India (Kochar, 1997), suggests rethinking the role of the informal sector. Instead of simply receiving the 'spillover' demand from the formal sector, the informal sector - due to greater information and lower transaction costs - may in fact offer the lowest cost loans. Our discussion above suggest that lower cost may not be the only reason borrowers 'choose' informal instead of formal loans. If informal lenders indeed have greater information (or better means of contract enforcement) then they will be able to offer a greater variety of contracts - including higher interest rate/lower collateral contracts that, as seen in the analysis above, banks may be unable to offer.

2.2 Econometric approach to credit market structure

The econometric approach we will use to explore the issues raised above builds on recent innovative empirical work on credit rationing.⁹ The approach relies on the notion of 'reservation interest rates'. On the demand side, this is the *maximum* interest rate the borrower is willing to pay for the first dollar of loan. On the supply side this is the *minimum* interest rate the lender is willing to accept to lend the first dollar. The

⁹These studies include: (Bell et al., 1997), (Bell et al., 1997), (Conning, 1999), and (Mushinski, 1999).

reservation rates are borrower specific and vary across formal and informal lenders.

The econometric analysis proceeds from a linear specification of borrower demand (Q_i^D), formal supply ($Q_i^{S,F}$) and informal supply ($Q_i^{S,I}$) equations:

$$Q_i^D = \alpha_1 r_i + \beta_1 X_{1,i} + u_{1,i} \quad (4)$$

$$Q_i^{S,F} = \alpha_2 r_i + \beta_2 X_{2,i} + u_{2,i} \quad (5)$$

$$Q_i^{S,I} = \alpha_3 r_i + \beta_3 X_{3,i} + u_{3,i} \quad (6)$$

where r is the interest rate, α_j and β_j are parameters to be estimated and $u_{j,i}$ are unobserved components of demand and supply. The reservation interest rates are then:

$$r_i^D = \frac{-1}{\alpha_1} (\beta_1 X_{1,i} + u_{1,i}) \quad (7)$$

$$r_i^{S,F} = \frac{-1}{\alpha_2} (\beta_2 X_{2,i} + u_{2,i}) \quad (8)$$

$$r_i^{S,I} = \frac{-1}{\alpha_3} (\beta_3 X_{3,i} + u_{3,i}) \quad (9)$$

The key empirical assumption that permits estimation is that there is a relatively homogeneous ‘market’ interest rate in the formal sector.¹⁰ The comparison across reservation rates and the market interest rate - call this rate r^* - then determines a household’s credit market outcome. After imposing an assumption on the joint distribution of the three unobserved terms, a likelihood function can be formulated and the parameters estimated via maximum likelihood. For example, the probability that a household is quantity rationed in the formal sector and borrows from the informal sector is $\Pr(r_i^D > r^* > r_i^{S,I}, r_i^{S,F} > r^*)$. The parameter estimates can be used to estimate the probabilities of quantity rationing for households with different characteristics.

The research proposed here will improve upon existing empirical studies in two ways. First, as described in the methodology section, the survey will permit us to directly identify each household’s rationing regime. The ability to observationally separate the sample into different credit rationing regimes has important econometric benefits. Consider the case of a non-borrowing household. Without additional information,

¹⁰In India, for example the government interest ceiling serves as the ‘market’ rate (Kochar, 1997). In liberalized credit markets, this assumption is more problematic. The justification is that information asymmetries prevent uninformed lenders (banks) from varying the interest rate to eliminate excess demand (Mushinski, 1999).

we do not know if the household was quantity rationed (rejected or anticipated rejection) or price rationed (zero demand). This causes difficulty in estimation since we must probabilistically assign the household to multiple possible regime outcomes.¹¹ The data collection methodology we use will permit more efficient estimation - as it will allow us to observationally distinguish the regime of each household.

The second innovation is to incorporate the category of risk rationing into the empirical analysis. Previous research has treated risk rationed households as price rationed since they have access to formal credit but have zero demand. This will lead to an overly optimistic portrayal of the performance of the financial market as it neglects to acknowledge that these households are also victims of market failure.

The empirical analysis that results from this ‘market structure’ component of the research will be of immediate value to policy makers. On one hand it will allow us to see - on the basis of the frequency of quantity and risk rationed households - how well credit markets are performing in different areas. In addition, it will identify the regional and household characteristics that contribute to credit rationing. It will also permit us to track the performance of credit markets for different types of households over time. Finally, this component of the analysis will serve as an input to the next stage - which is to measure the impacts of financial market imperfections on rural development. It is to this second stage that we now turn.

2.3 The impacts of credit constraints on consumption and production

In this section we develop a simple conceptual framework which shows the implications of financial market constraints for consumption and production behavior. The work draws substantially from (Morduch, 1991), (Zeldes, 1989), and (Deaton, 1992). In each period, rural households must make two decisions – how much to consume and how to allocate their resources across alternative productive activities¹². A household that lives for T periods faces the following inter-temporal problem:

$$Max_{C_t, X_t} E_t \sum_{k=0}^{T-t} \left(\frac{1}{1+\delta} \right)^k u(C_{t+k}) \quad (10)$$

¹¹See (Pudney, 1989) for a discussion of the econometric problems associated with unobserved sample separation.

¹²For expositional clarity, we abstract from households’ labor market participation decisions. The ability of households to smooth consumption via adjusting participation in local labor markets as well receiving remittances is clearly important and will be incorporated in later versions of the theoretical and empirical models. Mitigating shocks by increasing labor supply locally has been investigated by (Kochar, 1999) and (Jacoby and Skoufias, 1998). Migration and remittances have been investigated by (Rosenzweig, 1988) and Amuedo (2002).

subject to :

$$A_{t+k} = (A_{t+k-1} - C_{t+k-1})(1 + r_{t+k}) + y_{t+k} \quad (11)$$

$$y_{t+k} = Z(X_{t+k-1}, \mu_{t+k}) \quad (12)$$

$$A_{t+k} \geq C_{t+k} \quad \forall k. \quad (13)$$

where C_t is the household's per-capita consumption in period t , $u(\cdot)$ is the instantaneous utility of consumption (so that overall utility is additively separable in time), and δ is the household's discount factor. Equation 11 shows that A_t - household assets in period t - come from savings - $(A_{t+1} - C_{t+1})(1 + r_t)$ and current income, y_t . To reflect the uncertainty and time lag inherent in agricultural production, current income, in turn, depends on last period's production decisions, X_{t-1} , and the realization of today's state of nature, μ_t . Following (Morduch, 1991), the production decision consists of the share of household resources that are dedicated to a high risk versus low risk activity. To capture this, assume that: $\mu_{t+1} \geq 0 \iff Z'(X_t) \geq 0$, so that the marginal impact of risk taking is positive when the state of nature is good and negative when it is bad. Finally, Equation 13 gives the credit constraint. Current consumption is limited to current assets. When assets are low - perhaps because of a particularly bad weather shock - the household cannot borrow against future income.¹³

With this framework, we can examine how the presence of the credit constraint affects the path of consumption and risk taking behavior. Let $V_t(A_t)$ denote the value function - or the value of lifetime utility between periods t and T when optimal consumption and production rules are followed. Letting λ_t represent the multiplier associated with the credit constraint, the necessary conditions for optimal consumption and production choices are:

$$u'(C_t) = \frac{1}{1+\delta} E_t [(1 + r_{t+1})V'_{t+1}(A_{t+1})] + \lambda_t \quad (14)$$

$$E_t [V'_{t+1}(A_{t+1})Z'(X_t, \mu_{t+1})] = 0 \quad (15)$$

$$A_t - C_t \geq 0; \quad (A_t - C_t)\lambda_t = 0 \quad (16)$$

Since V_t is an optimal value function, an application of the envelope theorem yields: $V'_t(A_t) = u'(C_t)$ - or, assuming optimal behavior, the increase in expected lifetime utility from an additional dollar in current

¹³While this form of credit constraint is extreme, it yields the same qualitative results as restricting assets to be greater than a negative constant.

assets is the same as the marginal utility of consuming the dollar today. Using this relationship in Equation 14 allows us to relate the marginal utility of consumption in adjacent periods via:

$$u'(C_t) = E_t \left[\frac{1 + r_{t+1}}{1 + \delta} u'(C_{t+1}) \right] + \lambda_t \quad (17)$$

This Euler equation shows the impact of the borrowing constraint on consumption growth. Conditional on interest and discount rates, households seek to equate the marginal utility of consumption today with the expected marginal utility of consumption tomorrow.¹⁴ A binding credit constraint, $\lambda_t > 0$, implies that the household cannot shift consumption from tomorrow back to today so that today's marginal utility will be "too high". This will lead to the empirical implication that - holding other things constant - the growth of consumption for a liquidity constrained household will be greater than for an unconstrained household.

Most of the theoretical and empirical work on liquidity constraints has assumed that household income, y_t , follows a stochastic yet exogenous process.¹⁵ Under this assumption, in order to understand the implications of liquidity constraints, we can restrict our attention to the Euler equation given in Equation 17. While the exogeneity of income may be a reasonable assumption where the principal source of income is formal, salaried jobs, it is less satisfactory in developing countries - especially in rural areas where households are continually making decisions regarding how to allocate their labor across farm and non-farm activities (as well as whether to migrate or not) and, on the farm, how to allocate resources across alternative crops and production techniques which vary in expected returns and risk.

We can see this latter concern by evaluating the impact of liquidity constraints on the choice of X_t - or the fraction of household resources dedicated to the risky crop. Use the envelope result to rewrite the FONC for X_t :

$$E_t [V'_{t+1} Z'(X_t; \mu_{t+1})] = E_t [u'(C_{t+1}) Z'(X_t; \mu_{t+1})] = 0. \quad (18)$$

¹⁴Of course this formulation does not permit the possibility that household preferences change over time. This will be addressed in the following section on econometric implementation.

¹⁵Notable exceptions include (Rosenzweig and Binswanger, 1993) and (Jacoby and Skoufias, 1998).

After substitution using Equation 17 (pushed forward one period) and rearranging we get:

$$E_t \left[\frac{1+r_{t+1}}{1+\delta} V'_{t+1} Z'(X_t, \mu_{t+1}) \right] = -E_t [\lambda_{t+1} Z'(X_t, \mu_{t+1})] > 0 \quad (19)$$

The LHS of Equation 19 gives the marginal benefit - in terms of expected lifetime utility - of increasing production risk. The RHS shows that households consider both the magnitude and probability of *future* borrowing constraints when calculating the marginal cost of risk taking. The RHS is positive because the constraint will only bind in bad states when $Z' < 0$ (or when risk taking decreases income). The net result is that the greater is the constraint, the greater will be the marginal benefit - and the lower the level of risk taking.

2.4 Estimating the depth of liquidity constraints and their impact on resource allocation

One way of characterizing the ‘depth’ of financial market imperfections is to examine the size of the multiplier, λ - which gives an indication of the welfare loss associated with a binding credit constraint. In this section we briefly explain the econometric methodology we will use to derive estimates of λ .¹⁶ Begin by parameterizing the Euler Equation 17 to take into account the heterogeneity of preferences across households - for example due to education or life cycle effects - as well as changes in preferences over time which might result, for example, from the return of a migrant or increased exposure to marketing channels. To capture this, we rewrite the utility for household i as $u(C_t; \theta_{i,t})$, where $\theta_{i,t}$ represents a vector of factors that affect the household’s tastes. Equation 17 combined with the assumption of rational expectations then implies the following relationship between marginal utility in adjacent periods:

$$\frac{u'(C_{t+1}; \theta_{i,t+1})(1+r_{t+1})}{u'(C_t; \theta_t)(1+\delta_i)} (1+\lambda'_{i,t}) = 1 + e_{i,t+1}; \quad (20)$$

¹⁶This section is based on the econometric discussion in Zeldes (1989).

where $e_{i,t+1}$ is the household's forecast (or expectation) error about the marginal rate of substitution¹⁷. This error has mean zero and is uncorrelated with all information available at time t . Equation 20 is made operational by making assumptions about the form of $u(\cdot)$ and the contents of θ . For example, assume preferences are described by the constant relative risk aversion function:

$$u(C_{i,t}; \theta_{i,t}) = \frac{\exp(\theta_{i,t})}{1-\alpha} C_{i,t}^{1-\alpha}. \quad (21)$$

Let $\theta_{i,t} = \beta' H_{i,t} + \eta_i + \gamma_t + u_{i,t}$ where $H_{i,t}$ are observed household characteristics, η_i is an unobserved fixed household component, γ_t an unobserved aggregate component, and $u_{i,t}$ an unobserved time varying, idiosyncratic component. Taking logs of both sides of 20 and rearranging yields:

$$\ln \left(\frac{C_{i,t+1}}{C_{i,t}} \right) = \frac{1}{\alpha} (\gamma_{t+1} - \gamma_t) + \frac{1}{\alpha} \ln(1 + \delta_i) + \frac{1}{\alpha} [\ln(1 + r_{t+1}) + \beta' \Delta H_{i,t}] + \frac{1}{\alpha} [(u_{i,t+1} - u_{i,t}) - \ln(1 + e_{i,t+1})] + \frac{1}{\alpha} \ln(1 + \lambda'_{i,t}) \quad (22)$$

Finally, by imposing additional structure on the expectation error, $e_{i,t+1}$, we arrive at the equation to be estimated¹⁸:

$$\ln \left(\frac{C_{i,t+1}}{C_{i,t}} \right) = a_t^0 + a_i^1 + \frac{1}{\alpha} [\ln(1 + r_{t+1}) + \beta' \Delta H_{i,t}] + v_{i,t+1} + \frac{1}{\alpha} \ln(1 + \lambda'_{i,t}) \quad (23)$$

where $v_{i,t+1}$ is a mean zero term consisting of components of the forecast error and the unobserved change in the idiosyncratic component of preferences.

The asymmetry of the credit constraint (i.e., a constrained household cannot borrow to *increase* current consumption when times are bad, however it can *reduce* current consumption via savings when things are good) combined with the concavity of the utility function implies that constrained consumption growth is greater than unconstrained consumption growth. The impact of the liquidity constraint on consumption

¹⁷In equation 20, $\lambda'_{i,t} = \frac{\lambda_{i,t}}{E_t \left[\frac{1+r_{i,t}}{1+\delta_i} u'(C_{i,t+1}; \theta_{i,t+1}) \right]}$

¹⁸Zeldes (1989), for example, assumes that the forecast error can be decomposed into the product of independent aggregate and idiosyncratic terms, both of which are orthogonal to all information at time t .

growth can be seen as:

$$\ln \left(\frac{C_{i,t+1}}{C_{i,t}} \right) |_{constrained} - \ln \left(\frac{C_{i,t+1}}{C_{i,t}} \right) |_{unconstrained} = \frac{1}{\alpha} \ln(1 + \lambda'_{i,t}) \quad (24)$$

Thus, just how much faster consumption grows for a constrained household depends on the size of $\lambda'_{i,t}$. To estimate $\lambda'_{i,t}$, we first use sample information (as discussed in Section 1.4) to divide the sample into credit constrained and unconstrained households. Equation 23 is then estimated for *unconstrained* households. Since $\lambda'_{i,t} = 0$ for unconstrained households, this yields consistent parameter estimates for both unconstrained and *constrained* households. The parameter estimates can then be used to construct estimates of $v_{i,t+1} + \frac{1}{\alpha} \ln(1 + \lambda'_{i,t})$ for constrained households. Let $n_{i,t+1} = v_{i,t+1} + \frac{1}{\alpha} \ln(1 + \lambda'_{i,t})$. Then, since the sample average of $v_{i,t+1}$ goes to zero, the sample average of $\hat{n}_{i,t}$ provides a consistent estimate of $\frac{1}{\alpha} \ln(1 + \lambda'_{i,t})$. If credit constraints are an important impediment to consumption smoothing, the estimates should be statistically significant and large.¹⁹

The results from the above estimation can then be used to examine the impact of borrowing constraints on farm resource allocation. Recall from Equation 19 that the larger is the household's expectation of λ , the more they will divert resources away from high return, high risk activities toward low return, but safe ones. To test this hypothesis and measure the efficiency loss associated with credit constraints, we can estimate the following type of equation:

$$X_{t,i} = \beta_0 g(\lambda_{i,t}) + \gamma' h_{i,t} + \varepsilon_{i,t} \quad (25)$$

where the dependent variable, $X_{t,i}$, is a measure of the riskiness of farm resource allocation. Morduch (1999), for example, defines $X_{t,i}$ as the proportion of operated land area cultivated in a risky crop versus the safer crop. Two alternative options he uses are high yielding versus traditional rice varieties and castor versus cereal/pulse intercrops. Appropriate choices for Mexico and Peru will be determined after more in-depth fieldwork in the region. Production or restricted profit function estimation can they be used to estimate the amount of expected income foregone as a result of the borrowing constraint.

¹⁹Note that the endogeneity of risk taking in production and households' expectation of credit constraints will cause the estimates from this methodology to understate the degree of credit constraints. For example, that are certain they will have no access to consumption credit will not undertake risky activities and, therefore, will be less likely to end up needing consumption credit.

A key insight that emerges from this framework - and that drives home the relevance of this research project - is that production decisions under uncertainty depend not only on households' attitudes and preferences towards risk, but also on the degree of risk that they must bear. In particular, households that are able to smooth consumption - whether through consumption credit, formal insurance, or informal risk sharing networks - will be more willing to engage in high-risk, high-return activities. Conversely, households facing poorly developed financial markets will sacrifice expected income and instead choose low risk, but low return activities. It is this relationship between financial market failure and activity choice which has key implications for both efficiency and equity and thus is of particular concern for policy. If low wealth households face greater financial market constraints, then they will "choose" to stick with activities that perpetuate their poverty. Just as the case of *risk rationed* households, households for whom ex-post consumption credit or insurance markets perform poorly will be caught in a vicious circle whereby they "voluntarily" abstain from high return activities and are unable to accumulate the very assets which would allow them better access to financial markets.

References

- Aurbach, N. N. (2001). *States, Banks, and Markets: Mexico's Path to Financial Liberalization in Comparative Perspective*. Westview, Boulder.
- Bell, C., Srinivasan, T., and Udry, C. (1997). Rationing, spillover, and interlinking in credit markets: The case of rural Punjab. *Oxford Economic Papers*, 49:557–585.
- Boucher, S. (2000). *Information asymmetries, risk and non-price rationing: An exploration of rural credit markets in northern Peru*. PhD thesis, University of Wisconsin.
- Boucher, S. R. and Carter, M. (2002). Risk rationing in moral hazard constrained credit markets. Ag and Applied Economics Staff Paper 445.
- Carter, M. (1997). Environment, technology and the social articulation of risk in west african agriculture. *Economic Development and Cultural Change*, 45(2):557–590.
- Conning, J. (1999). Outreach, sustainability, and leverage in microfinance lending: A contract design approach. *Journal of Development Economics*, 60:51.
- de Janvry, A., Gordillo, G., and Sadoulet, E. (1997). *Mexico's Second Agrarian Reform: Household and Community Response*. Center for U.S.-Mexican Studies, UC San Diego, San Diego.
- de Soto, H. (2000). *The Myster of Capitalism: Why Capitalism Triumphs in the West and Fails Everywhere Else*. Basic Books, New York.
- Deaton, A. and Grosh, M. (2000). Consumption. In Glewwe, P., editor, *Lessons from Fifteen Years of the Living Standards Measurement Study*, volume I, chapter 5. World Bank, Washington D.C.
- Deaton, A. S. (1992). *Understanding Consumption*. Oxford University Press, Oxford.
- Fafchamps, M. and Lund, S. (2000). Risk-sharing networks in rural philippines. (10). Oxford Department of Economics Discussion Paper.
- Hillier, B. and Ibrahim, M. (1993). Asymmetric information and models of credit rationing. *Bulletin of Economic Research*, 45:271–304.
- Iqbal, F. (1986). The demand and supply of funds among agricultural households in India. In Singh, I., Squire, L., and Strauss, J., editors, *Agricultural Household Models: Extensions, Applications, and Policy*, chapter 6. Johns Hopkins University Press, Baltimore.
- Jacoby, H. and Skoufias, E. (1998). Testing theories of consumption behavior. *American Journal of Agricultural Economics*, 80(1):1–14.
- Jaffee, D. and Stiglitz, J. (1990). Credit rationing. In Friedman, B. M. and Hahn, F. H., editors, *Handbook of Monetary Economics*, volume I, chapter 16. Elsevier Science, North Holland, Amsterdam.
- Jalan, J. and Ravallion, M. (1999). Are the poor less well insured? Evidence on vulnerability to income risk in rural china. *Journal of Development Economics*, 58:61–81.
- Kochar, A. (1997). An empirical investigation of rationing constraints in rural credit markets in India. *Journal of Development Economics*, 53:339–371.
- Kochar, A. (1999). Smoothing consumption by smoothing income: Hours-of-work responses to idiosyncratic agricultural shocks in rural India. *The Review of Economics and Statistics*, 81(4):50–61.
- Morduch, J. (1991). *Risk and Welfare in Developing Countries*. PhD thesis, Harvard University.
- Mushinski, D. (1999). An analysis of loan offer functions of banks and credit unions in Guatemala. *Journal of Development Studies*, 36(2):88–112.

- Paxson, C. (1992). Using weather variability to estimate the response of savings to transitory income in Thailand. *American Economic Review*, 82(March):15–33.
- Pudney, S. (1989). *Modelling Individual Choice: The Econometrics of Corners, Kinks and Holes*. Blackwell, Cambridge.
- Rosenzweig, M. (1988). Risk, implicit contracts and the family in rural areas of low income countries. *Economic Journal*, 98:1148–1170.
- Rosenzweig, M. R. and Binswanger, H. P. (1993). Wealth, weather risk and the composition and profitability of agricultural investments. *Economic Journal*, 103:56–78.
- Trivelli, C. (1998). Intermediación financiera en la agricultura en el Perú, 1994-1997. *IEP Documento de Trabajo No. 90*.
- Trivelli, C. and Larson, J. (2001). Titulación de tierras en el Perú: Se está cumpliendo la promesa? *Debate Agrario*, 32:49–88.
- Zedillo, E. (1996). *Segundo Informe de Gobierno*. Presidencia de la República, México D.F.
- Zeldes, S. P. (1989). Consumption and liquidity constraints: An empirical investigation. *Journal of Political Economy*, 97(2):305–346.

Capacity Building and Dissemination Activities

The institutional setup for this project will ensure that the research will be of high quality, carried out in a timely fashion, and be disseminated in both academic and policy circles.

Mexico

The Mexican survey work will be designed and implemented jointly by Boucher and Taylor from UC-Davis and Yunez from the Colegio de Mexico. In Mexico, we will utilize the infrastructure of the Programa de Estudios del Cambio Economico y Sustentabilidad en el Agro Mexicano (PRECESAM). PRECESAM (<http://precesam.colmex.mx/Presentacion/>) is located in the Colegio de Mexico and was founded by Taylor and Yunez in order to carry out research on the rapid economic changes occurring in rural Mexico. One of the primary objectives of PRECESAM is to include Mexican students from universities in rural states in ongoing research projects and thus strengthen the research and policy making capacity of regions outside of Mexico City. A team of enumerators comprised of university students from both UC-Davis and El Colegio de Mexico will apply the surveys. This is a model of data collection, entry, and analysis that has been successfully utilized by Taylor and Yunez in on multiple past research projects in Mexico.

The Colegio de Mexico is the leading research institute for issues of rural development in Mexico. As such, we will be able to rapidly disseminate the results of the research via academic and policy seminars held both in Mexico City and State universities.

Peru

The survey work in Peru will be designed and implemented jointly by Boucher and Taylor from UC-Davis and Trivelli from the Instituto de Estudios Peruanos (IEP) in Lima. In addition, Javier Escobal of the Grupo de Analisis para el Desarrollo (GRADE) will participate in the survey design and econometric model building/estimation.

Boucher and Trivelli are currently completing a multi-visit household survey of farmers in central Peru. The field team – comprised of university students and research assistants from the IEP and with significant experience conducting farm household surveys – will carry out the household surveys for this project.

IEP and GRADE are the leading social science research institutions in Peru. Both institutions are also deeply involved in strengthening local research capacity. Trivelli is the current president and Escobal is on the board of directors of SEPIA - the Permanent Seminar on Agrarian Research in Peru. SEPIA organizes and coordinates ongoing research in rural Peru. It also holds a bi-annual conference dedicated to the dissemination of research on diverse agrarian issues. SEPIA provides an ideal forum the dissemination of the results of this research project.

Boucher and Trivelli have also established a strong relationship with the Ministry of Agriculture. The current director of OIA (Office of Agricultural Information) – Dr. Eduardo Zegarra - in the Ministry has expressed interest in linking the research proposed

here with the Ministry's ongoing efforts to revamp and modernize its own data collection methodology. In particular, the Ministry would like to use insights from this research to design a credit market module to be applied to a sub-sample of the households interviewed in their new, semi-annual agricultural survey.

Products

The major products of this research project will include the following:

1. A detailed, multi faceted household panel data set to support empirical analysis of rural financial market development in Mexico and Peru. The breadth and depth of the information combined with the longitudinal component (5 semi-annual interviews with each household over a 3 year period) will make this data set unique in Latin America.
2. Multiple journal articles and policy discussion papers. The primary focus of this project is on analyzing the impacts of rural financial market structure on household welfare and productive efficiency. However, the survey data will facilitate other, related research as well, including the following:
 - a. The interactions between financial market structure, migration and remittances – especially in rural Mexico.
 - b. The role of financial markets in the adoption of new technologies, including environmentally sustainable investments.
 - c. Testing theories of intra-household bargaining and gender differentiated outcomes.
3. Dissemination of findings through websites at UC Davis, El Colegio de Mexico, the IEP, AAEA and other professional meetings, and other means.

Summary of Researchers' Qualifications

Stephen R. Boucher. After earning his Ph.D. in Agricultural and Applied Economics from the University of Wisconsin, Boucher joined the Department of Agricultural and Resource Economics at UC Davis in 2001. Boucher's theoretical work has focused on the role of information asymmetries in financial market structure. He is currently engaged in research on risk and credit markets among small farmers in Huaral, Peru as well as research evaluating the impacts of land market liberalization in Central America. He has extensive experience designing and carrying out household level surveys in Latin America – including an 18 month period of field work on rural financial markets in Piura, Peru for his dissertation in 1997-98.

J. Edward Taylor. Taylor is a professor in Agricultural and Resource Economics at UC Davis. Since joining UC-Davis in 1986, he has developed an internationally renowned research program on migration and rural labor markets in Mexico and the U.S. He is the co-director (along with Antonio Yunez) of the Program for the Study of Economic Change and Sustainability in Rural Mexico (PRECESAM) in the Colegio de Mexico.

Carolina Trivelli Avila. Trivelli earned her Master degree in Agricultural Economics from Penn State University in 1996. She is currently the General Director of the Instituto de Estudios Peruanos in Lima and President of the Executive Council of the Permanent Seminar on Agrarian Research (SEPIA). She also teaches courses in development economics and natural resources at the Universidad del Pacifico. Trivelli has written extensively on rural financial markets and the impact of poverty alleviation programs in Peru.

Antonio Yunez-Naude. Yunez earned his Ph.D. in economics from the London School of Economics in 1986. He is currently a professor in the Center for Economic Studies at the Colegio de México. He is also the Co-director of the Program for the Study of Economic Change and Sustainability in Rural Mexico (PRECESAM) and Executive Regional Director of the Center on Rural Economies of the Americas and the Pacific Rim of UC-Davis. Yunez has written extensively on many aspects of applied micro-development as well as trade policy in Mexico.

Javier Escobal D'Angelo. As senior researcher at Grupo de Analisis Para el Desarrollo (GRADE), Escobal has conducted and published research in many areas of applied agricultural development including poverty decomposition, agricultural marketing, and the development impacts of rural infrastructure.