

**IMPACT OF ACCESS TO FORMAL DEPOSIT FACILITIES AND LOANS ON
SCHOOLING: EVIDENCE FROM RURAL HOUSEHOLDS IN MEXICO**

THESIS

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ABSTRACT

This thesis offers empirical answers to the mostly unexplored question of the impact of access to formal deposit facilities on human capital formation, by looking at the schooling choices of two waves of a panel of rural households in Mexico. The results suggest that both financial instruments (deposits and loans) matter; however, access to deposit facilities may have a greater and less ambiguous impact on household schooling choices than loans. Access to deposits reduces the schooling gap 2.5 years when using a pooled sample, while access to both financial services in comparison to no access reduces the schooling gap 1.2 years. After adding an interaction of both probabilities (access to deposits and loans), access to credit increases rather than reducing the gap. Thus, the development and strengthening of financial institutions capable of offering safe and convenient deposit facilities, rather than simply loans, may induce beneficial impacts on human capital formation.

Dedicated to Yael, Emiliano and Valentina

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CHAPTER 1

INTRODUCTION

The main motivation for this thesis is the importance of human capital formation, in general, and of formal schooling, in particular, in the process of economic growth in the rural areas of low-income countries and in inducing improvements in the welfare of poor households over time. Poor rural households encounter, however, numerous barriers to their investments in the schooling of their children. Salient among these barriers are the high incidence of risk (in particular, the frequency and magnitude of adverse income shocks), the accompanying difficulties in smoothing and sustaining consumption above subsistence levels, and the absence or the high cost of instruments to manage risk. In these environments, household strategies to cope with risk and to smooth consumption may jeopardize investment in the children's education.

There has been substantial research about the strategies used by poor rural households for consumption smoothing and about the consequences of these strategies on their demand for schooling. Moreover, with the microfinance revolution and the gradual expansion of the frontier of rural financial markets, some attention has been devoted to the role that access to formal credit transactions may play in improving the set of

household instruments used to cope with risk and, thereby, in influencing schooling choices. However, very little attention, if at all, has been paid to the role that the expansion of the **deposit** facilities offered by formal financial intermediaries may play in modifying both household strategies for addressing risk and schooling choices.

This thesis attempts to offer some empirical answers to the mostly unexplored question of the impact of access to formal deposit facilities on human capital formation, by looking at the schooling choices of rural households in Mexico. Because both the holdings of precautionary reserves, in the form of savings deposits in financial institutions, and access to formal loans may improve the set of instruments available for risk management, the thesis **jointly** explores the impact on schooling of access to both types of financial services. Given their particular importance in Mexico, the exercise also controls for the potential influence of remittances and of several government cash transfers.

The results suggest that both financial instruments (deposits and loans) matter. However, access to formal deposit facilities may have a greater and less ambiguous potential impact on household schooling choices than loans may have. This is an important result because, despite the difficulties encountered and the high costs of supplying deposit facilities in the rural areas, once these facilities become available households can—in contrast to loans immediately access these services. Indeed, even when financial institutions do operate in the rural areas, household access to credit further requires a demonstration of creditworthiness. In contrast, deposit transactions almost entirely depend on the household's choices.

Moreover, loans obtained for productive purposes may actually increase the demand for child labor and, thereby, they may potentially reduce the demand for schooling. This effect would not be expected, however, when the household gains access to deposit facilities, which mostly facilitate its risk and liquidity management.

Therefore, these results suggest that, in the promotion of rural financial deepening, the development and strengthening of financial institutions capable of offering safe and convenient deposit facilities, rather than just loans, may induce additional beneficial impacts on human capital formation, which have been mostly ignored until now. This impact of formal deposits on schooling would provide further justification, in addition to the greater efficiency of resource allocation obtained through the increased level of financial intermediation in the rural economy, for government interventions that focus their promotion efforts on deposit-taking institutions and on innovations that facilitate the access of poor rural households to deposit facilities.

1.1 Investment in education

One of the main goals of government agendas is the reduction of poverty. In particular, the understanding of poverty as a dynamic and multidimensional phenomenon identifies investment in the children's education as an effective way of reducing poverty over time and across generations.

Indeed, a beneficial cycle is generated for society by the education of its children. The greater the children's educational attainments, the higher their incomes will usually

be. The higher these incomes and educational achievements, the higher the levels of education, health, and opportunities for the next generation of children will be. The likelihood of the emergence of this beneficial cycle implies both that (i) the parents do care about the educational attainments of their children and that (ii) the positive correlation between parental education and investments in the children's human capital persists for future generations.

Education may help children acquire knowledge and skills that in the future may have an economic value in the labor market. Moreover, schooling may also promote modernization and economic growth, encourage reductions in fertility rates, improve the family's health, and contribute to a culture of information.

The returns to investments in education may show, however, much variability. Under the traditional approach (Mincer, 1974), which focuses on the private rates of return for an average individual, the returns to education are always positive. Nevertheless, both individuals and their environments are heterogeneous. Thus, it has been recognized that the returns to schooling may be low or even zero when there are barriers to job mobility, poor labor market conditions, or bad quality education (Patrinos, Ridao-Cano and Sakellariou, 2006).

These adverse circumstances are frequently present in the rural areas of developing countries. Hence, people in rural areas may decide not to get an education for their children more frequently than would people in urban areas, where a formal education may be a more indispensable credential to get a better job. The result of these

differential choices is a large schooling gap between an average individual who lives in a rural area and an average individual who lives in an urban area. Since the greatest incidence of poverty in developing countries is found, however, in the rural areas, the adoption of mechanisms that increase the household's demand for schooling is critical. Access to formal financial services (both deposits and loans) may have a positive **net** impact on this demand.

1.2 Household risk management and schooling

Rural households are exposed to risky environments. This vulnerability comes from two sources. The first source of vulnerability reflects the fact that these households are frequently exposed to shocks that adversely affect their incomes, given that most of them work in agricultural activities. These risks result from either systemic shocks (shared by all other local households), such as fluctuations in weather and commodity prices, or idiosyncratic shocks (uncorrelated with other households), such as illness, unemployment, business failures or death in the family (Morduch, 1995; Gomez-Soto, 2007). Moreover, occasionally these households may have to face exceptional expenditures (e.g., a funeral), for which current income may not be sufficient.

The second source of vulnerability reflects the lack of instruments or mechanisms to efficiently cope with adverse shocks and prepare for future events. Poor households face high costs in employing the tools available to them in order to cope with these adverse shocks and sustain their consumption. Among their menu of available

instruments are plot fragmentation and crop diversification, domestic and international migration, the accumulation and depletion of non-financial (even productive) assets, adjustments in their labor supply, and borrowing and saving with some informal agent. Access to formal financial services is very limited and formal insurance is completely absent in these environments.

These household strategies may also include the choice of productive activities and of technologies that offer lower but safer returns (Deaton, 1991). Indirectly, therefore, the accompanying high costs and potentially lower income flows resulting from these risk-coping efforts may have adverse effects on investments in education.

Some households may actually turn to strategies that directly affect the children's schooling. For instance, some households may adjust their labor supply by increasing their demand for child labor or they may deal with adverse shocks with temporary adjustments, such as pulling children out of school, in order to avoid the associated expenses. Although decisions that reduce the accumulation of the children's education may have high opportunity costs for these households in the long run, those foregone long-term returns are highly discounted by poor households facing immediate requirements for consumption smoothing.

1.3 Finance and consumption smoothing

A more efficient remedy for rural households to cope with these adverse shocks may actually be to gain access to formal financial services, both loans and deposit

facilities. These options would improve the menu of instruments available to these households for the management of risk.

In general, financial services are useful both (i) in overcoming the intertemporal budget constraints faced by rural households (which, among other things, may constrain current school expenses) and (ii) in reducing the costs of risk management. In particular, financial services may allow the household to rely less on costlier strategies while, by increasing the resulting protection, consumption becomes smoother and household welfare improves (Gomez-Soto, 2007). Improvements in the set of instruments available to households for risk management, including both loans and deposit facilities, may then have a positive impact on the demand for schooling.

Access to financial services requires, however, a coincidence in the market between the suppliers and the demanders of these services. In the rural areas of developing countries, however, despite the existence of substantial legitimate demands, the supply of formal financial services has been particularly limited. This has reflected high transaction costs for all market participants and the need to overcome substantial information, incentive, and contract enforcement problems for financial transactions to emerge (Gonzalez-Vega, 2003).

In these rural areas, financial markets are highly fragmented and economic agents are isolated. On the one hand, isolated households face different prices for goods, services, and factors of production, including financial services. High transaction costs prevent the arbitrage required for price equalization. On the other hand, households do

not have the same degree of access, on equal terms, to resources, technology, and public services, including the institutional infrastructure needed for the smooth operation of financial markets (McKinnon, 1973; Gonzalez-Vega, 1986a, 2003).

This fragmentation induces limited financial intermediation, as high transaction costs and high risks prevent surplus units from depositing their command over resources with the financial sector (and thereby obtain attractive net returns on their deposits), while these costs and risks prevent deficit units from taking advantage of these resources through their access to credit. The consequence of this fragmentation is the prevalence of diverse marginal rates of return across surplus and deficit units, an indication that there are still unexploited opportunities to improve the allocation of resources. Increased financial deepening, in turn, reduces this fragmentation and increases the productivity of available resources.

Moreover, in the rural areas of low-income countries, some households may find themselves excluded or dissuaded from obtaining access to formal credit instruments by collateral requirements and other non-price terms and conditions of loan contracts. Given asymmetric information that threatens lenders with adverse selection and moral hazard problems, formal financial institutions adopt non-interest credit rationing practices that exclude households from credit portfolios, despite their legitimate demands for credit, given by their ability and willingness to repay the loans (Stiglitz and Weiss, 1981; Conning and Udry, 2007). Interest rate controls and other instruments of financial repression have further accentuated these credit rationing practices (Gonzalez-Vega, 1976).

The excluded households may then find other options, perhaps by turning to more expensive sources of informal finance or by using non-financial mechanisms to smooth their consumption (Conning and Udry, 2007). Indeed, in the rural areas of developing countries, households use both informal financial services (provided by relatives and friends, deposit collectors and moneylenders, and informal credit and savings associations or clubs, known in Mexico as *tandas*) as well as non-financial mechanisms (holdings of relatively liquid assets, such as livestock, jewelry or land) to anticipate and cope with adverse shocks. These mechanisms are not always reliable, however, or do not adequately match the household's requirements under specific states of nature.

In particular, non-financial assets may be both unproductive and risky, and holdings of these assets may cause inefficiencies in resource allocation (Meyer and Alicbusan, 1984). The instruments that informal markets offer for the holding of precautionary reserves may not enjoy sufficient liquidity; the interest rates charged on informal loans may be substantially higher than those found in the formal financial sector; informal savings arrangements may generate low returns on resources or, even worse, informal agents may charge high fees for deposit services, while opportunistic deposit-takers may not guarantee the safety of the deposits, forcing savers to face high insolvency and bankruptcy risks, if not outright fraud.

The introduction of institutional (i.e., formal) financial instruments (both loans and deposit facilities) in the rural areas of developing countries may allow households to face new relative price tradeoffs across time periods and state-contingent events. The new trading opportunities may either allow households to specialize in higher-value

income-generating activities or to face smoother consumption streams (Conning and Udry, 2007). These circumstances may change the constraints that households face or alter the incentives they have for investment in the schooling of their children (Maldonado and Gonzalez-Vega, 2008). When this is the case, a virtuous circle may emerge between financial deepening and human capital formation. Greater access to financial services accelerates investment in human capital, while the more educated population will demand additional financial services, in order to take advantage of the higher-return opportunities that become available.

1.4 Thesis objectives and organization

The main objective of this thesis is, therefore, to understand whether (*ceteris paribus*) children from households with access to formal financial services, defined as both access to credit and access to deposit facilities, are able to get more schooling than the children from households without access to formal financial services.

The main hypothesis is that access to formal financial services is a more effective way for rural households to deal with risk than the usual strategies used for this purpose when financial markets are absent or incomplete. This access is a means to decrease the costs of accumulating precautionary savings or to reduce the reliance on informal risk-coping mechanisms and, thereby, it is an attractive tool for smoothing household income and consumption. Increased access to formal financial services would prevent otherwise costly household decisions that may negatively affect human capital formation.

There is a growing literature that examines the impact of access to credit on education, but there is nothing on the impact of access to formal deposit facilities on schooling. The main contribution of this thesis is its attempt to explore the combined effect of access to loans and to deposit facilities on the schooling of children.

While many barriers constrain access to formal loans and while not all households have a demand for credit, deposit facilities offer universal opportunities for a more efficient management of precautionary wealth. From this perspective, deposit facilities may offer a more broadly accessible mechanism to increase and sustain investment in schooling.

Moreover, a public policy emphasis on deposit-taking leads to the development of more complete and robust financial intermediaries. The expansion of financial intermediation induces, in turn, a number of additional positive externalities in the rural areas, beyond the impacts on human capital formation considered here (Beck, Demirgüç-Kunt, and Levine, 2004). These externalities further justify government promotion of deposit-taking activities. Furthermore, improvements in the human capital stock in the rural areas would encourage additional financial intermediation.

Thus, the emphasis in this thesis is on the role of deposit facilities in facilitating investment in schooling. If a positive link were found, as indeed is the case from the data used in the empirical analysis here, this would be an additional reason for the promotion of deposit mobilization in the rural areas of developing countries.

Beyond this introduction, the thesis is organized as follows. Chapter two reviews the literatures on the role of education in economic development, the determinants of child labor, and the role of financial services in improving the welfare of rural households. Chapter three describes the Rural Microfinance Technical Assistance Regional Project (PATMIR), the source of the data used in the analysis, and it reviews studies of this project's impact. Chapter four discusses the econometric approach to be used in assessing the influence of access to financial services on schooling. Chapter five identifies the variables used in the econometric exercise. Chapter six discusses the data used and the results from the econometric estimations. Chapter seven presents some conclusions.

CHAPTER 2

LITERATURE REVIEW

The purpose of this chapter is to review, on the one hand, the literature on the role of education in economic development and on the determinants of household investment in schooling and, on the other hand, the literature on the role of financial deepening in the rural areas of developing countries, on the main barriers to the development of rural financial markets, and on the policies that have been adopted to encourage rural financial progress.

The first part of the review underscores the motivation for the thesis, while the second part highlights the importance of rural financial deepening in inducing a number of welfare-improving outcomes, including forward-looking schooling choices at the household level. A potential link between the supply of formal financial services –in particular, the supply of safe and convenient deposit facilities– and human capital formation constitutes the focus of the thesis.

This chapter also reviews some of the literature on child labor and on its consequence on schooling outcomes, because poor households that have little or null access to financial services may use child labor as an available alternative to cope with

unexpected income shocks. The direct consequence of an increased demand for child labor is a lesser accumulation of the children's human capital among these households.

Moreover, while the impact of access to loans on the demand for child labor may be ambiguous, given the increased demand for household labor that may be associated with expanded household production (Maldonado and Gonzalez-Vega, 2008), the theoretical prediction in this thesis is of an unambiguous positive impact of access to deposit facilities on the demand for schooling. Thus, a greater outreach of deposit facilities may play a key role in promoting human capital formation in the rural areas of developing countries.

2.1 Education

Schultz (1961) was the first one to contribute to the development economics literature in ways that recognized education as an essential factor in reducing poverty in the long run. In general, education generates a beneficial cycle between parental education and investment in the children's human capital.

There is a long-established literature that focuses on the monetary (pecuniary) returns that individuals gain from completing higher levels of schooling. This literature recognizes that people who attend school develop abilities that make them more productive and capable of taking advantage of productive opportunities (Schultz, 1961, 1992; Becker, 1964; Mincer, 1974; Griliches, 1977; Card, 1999; Krueger and Lindahl,

2001; Patrinos, Ridao-Cano and Sakellariou, 2006; Booth, Coles and Gong, 2007; Andini, 2007).

According to Glewwe (2002), schooling provides children with cognitive skills such as literacy, numeracy, scientific knowledge, and advanced thinking skills. This author also argues that schooling can provide social skills and (internalized) values that may help children to succeed in their adulthood. These benefits are materialized at the aggregate and the individual level.

At the aggregate level, some studies have pointed out that education is related to the growth rate of GDP (Lucas, 1988; Barro, 1991; Mankiw et al., 1992; Benhabib and Spiegel, 1994; Barro and Sala-i-Martin, 1995, 2004; Sala-i-Martin, 1997; Middendorf, 2006). This literature explains that human capital investment, in the form of schooling for children, promotes the generation of the new products or ideas that underlie technological progress and improves the adoption of new products or ideas that have been discovered elsewhere.

At the individual level, more education is related to improvements in child health (and, thereby, reductions in infant mortality) and a decrease in fertility rates and maternal mortality (Thomas, 1999; Glewwe, 2002; Doyle, Harmon and Walker, 2007). According to Glewwe (2002), different mechanisms may explain the relationship between education and child health. In particular, it is likely that education directly increases the mothers' knowledge about health and health-care procedures.

Basic literacy and numeracy skills may be even more important than health knowledge per se. Schooling may reduce the women's adherence to traditional cultural practices, making mothers more receptive to modern health care treatments. Increased maternal schooling may also improve the children's health outcomes by increasing household income. Moreover, the mechanisms that may explain the relationship between the parents' education and fertility rates operate through cognitive skills acquired in school. Thomas (1999) finds evidence that reading skills improve the women's ability to gain access to and assimilate information, including information about reproductive health.

Household characteristics and the parents' education are involved in the decision of investing in the children's human capital. With regard to student performance, children whose parents' education is higher achieve better scores in school (Behrman et al., 1997; Case and Deaton, 1999). More educated parents also provide higher levels of key goods and services that complement learning and devote more time to their children, in part because they expect higher returns from education (Brown, 2006).

Additionally, some of the literature emphasizes that investment in the children's human capital depends on both the parent's and the child's gender (Lillard and Willis, 1994; Thomas, 1994). According to Glewwe and Jacoby (1994), Sathar and Lloyd (1994), and Brown (2006), there is a stronger relationship between the mother's education and the children's education than between fathers and children.

Furthermore, empirical studies (e.g., Schultz, 1988; Behrman et al., 1989; Hanushek, 1992; Parish and Willis, 1993; Haveman and Wolfe, 1995) show that individual educational attainments depend on family resources and family size. In particular, if the household faces borrowing constraints, investment in human capital will be affected by the number of children among whom family resources will have to be shared (Bommier and Lambert, 2004).

2.2 Child labor

In the rural areas of developing countries, financial markets may not exist, may be incomplete, or simply may not work adequately. Thus, households may have little or null access to formal financial services, which may make it hard for households to efficiently transfer their resources across time and to resort to these financial services in order to cope with adverse shocks. Moreover, missing formal insurance markets are a frequent feature of the rural landscape.

In these rural areas, it is typical to find households using alternative mechanisms rather than formal financial services to cope with risk. These alternatives include domestic and international migration, labor force adjustments, or the depletion of non-financial (even productive) assets, and the holding of precautionary reserves. When some adverse shock affects the income of more than one household in the same community and at the same time (namely, a systemic shock), these households become even more

vulnerable. Indeed, informal safety nets cannot address systemic difficulties, because diversification opportunities are limited.

In these systemic circumstances, as well as their neighbors, poor households may choose the same or very similar mechanisms in order to cope with the shock, such as sales of grain reserves or sales of livestock, because these mechanisms are most available to these households. When they all try to sell assets at the same time, however, their prices drop. The consequence is that some or all of these households may not deal efficiently with systemic risk. The literature has pointed out that one alternative way to cope with unexpected income shocks under a credit constraint scenario is the use of child labor (Rosenzweig, 1988; Cox, 1990; Jacoby and Skoufias, 1992; Baland and Robinson, 2000; Ranjan, 2001; Guarcello, Mealli and Rosati, 2003; Beegle, Dehejia and Gatti, 2003, 2006; Casabonne, 2006). However, this self-insurance mechanism affects the children's human capital accumulation, causing high costs for the household in the long run (Jacoby and Skoufias, 1997).

Low accumulation of the children's human capital is thus the direct consequence of child labor, in response to adverse shocks (Jacoby and Skoufias, 1997). This lower accumulation may be reflected in a decrease in the number of years of schooling completed (Psacharopoulos, 1997), in a reduction of study time (Akabayashi and Psacharopoulos, 1999), or in poor learning achievements at school (Heady, 2003; Rosati and Rossi, 2003; Gunnarsson, Orazem and Sanchez, 2006). This low accumulation of human capital has negative effects in the long run, because it limits the opportunities for households to escape from poverty (Maldonado, 2004).

Among poor households, child labor is an available alternative in coping with income shocks, given household constraints for using more efficient strategies. Child labor may be demanded both for participation in income-generating activities and for taking care of younger siblings, which allows productive household members to work (Maldonado and Gonzalez-Vega, 2008). Thus, the children from poor households may go to school, work, take care of their younger siblings, or undertake more than one activity at the same time. The possibility that some children may not be involved in any of these activities is ruled out here, because in a rural context there is a high opportunity cost from not getting the income that a child could be earning or could be helping other household members to earn.

Under the assumption that parents have altruistic preferences toward their children, the parents' utility depends on the consumption of their children (Becker, 1981). The main reason, therefore, why parents may take their children out of school in order to send them to work is because parents may consider child labor necessary for contributing to the household's budget. Nonetheless, Becker's presumption may be wrong when parents actually do not perceive a positive return from investing in the education of their children and when parents perceive that the return on education is not high enough to compensate families for the lost income of their children in the present (Baland and Robinson, 2000). It is likely, moreover, that social perceptions about the returns from education may be higher than private household perceptions. If this were the case, interventions, such as financial deepening, that may increase the demand for

schooling will trigger the externalities associated with these divergences between social and private rates of return.

Indeed, complete credit markets are important for the efficient allocation of household resources with respect to their decisions on human capital investment. Thus, according to the literature, parents resort to child labor in order to smooth consumption in the face of financial market incompleteness (Baland and Robinson, 2000; Ranjan, 2001).

Jacoby and Skoufias (1997) conclude that financial intermediation facilitates human capital investment in the sense that it may prevent poor households from adopting costly self-insurance strategies, such as child labor, in response to unanticipated income shocks. There is actually evidence that access to credit may help lower the extent of child labor and increase the probabilities that children are kept at school when households face income shortfalls.

Pitt and Khandker (1998), for instance, demonstrate that participation in microcredit programs in Bangladesh leads to an improvement in the children's schooling. Similarly, Ersado (2002) finds that in the rural areas of Nepal and Zimbabwe credit access improves enrollment rates and decreases child employment rates. Moreover, child labor is employed to a lesser extent when households have access to credit or when credit enables them to acquire more assets that substitute for child work (Cockburn, 2001; Guarcello, Mealli and Rosati, 2003; Dehejia and Gatti, 2002; Beegle, Dehejia and Gatti, 2003).

Nonetheless, there is also evidence that access to credit may increase the demand for child labor, thus negatively affecting the children's schooling. Maldonado (2004) and Maldonado and Gonzalez-Vega (2008) find that microfinance programs increase child labor demand, especially in households that cultivate land or operate labor-intensive microenterprises, because families may take their children out of school either for farming, working in a microenterprise, or taking care of siblings when the loans allow an expansion of household production opportunities.

Similarly, Wydich (1999) observes that the positive effect of access to credit on schooling may be mitigated when, in the context of family enterprises, hired labor and child labor are not easily substitutable. The parents in these families may display a preference for imparting skills to their children for working at the enterprise rather than to hired labor because of a moral hazard problem associated with hired labor. If monitoring costs are higher for hired labor, households may prefer family labor.

These results may occur more frequently in the rural areas because there is a higher probability in self-employed households that their children will work (Kruger, 2001). Moreover, increasing income-earning opportunities for the household may sometimes increase the opportunity cost of keeping children at school (Maldonado and Gonzalez-Vega, 2008).

2.3 Financial services

Household investment in human capital may be severely constrained by limited access to credit, in general, and by the difficulties of funding education with loans, given the typical requirements of creditworthiness in formal financial markets. Human capital, in particular, cannot be pledged as collateral. Household investment in human capital may also suffer from the household's inability to deal with adverse shocks. Deposit facilities may increase human capital formation (i) if they facilitate the accumulation of wealth, when the household has to fund education expenses with its own resources (a behavior frequently observed even in high-income countries), and (ii) if they facilitate the management of risk. The following sections discuss financial deepening in the rural areas of developing countries and the barriers that constrain the access of the poor to formal financial services. The removal of these barriers through the adoption of the appropriate policies would thus contribute to human capital formation among poor households. In turn, inappropriate policies that retard financial deepening become obstacles to human capital formation.

2.3.1 The role of the financial system

The financial system may be seen as one more productive sector, with its own firms, markets, prices, institutions, and policies. Financial intermediaries combine factors of production to provide financial services, which in turn are used as intermediate inputs

in other productive processes (Shaw, 1973). When efficiently provided, these financial services increase the productivity of available resources (Levine, 1997).

In particular, the financial sector allows the creation, exchange, and holding of financial assets and liabilities and in this way it affects all other sectors in the economy. Through financial intermediation, surplus units can earn a return on their financial savings, while deficit units can increase their purchasing power, in order to undertake or expand their investment opportunities (Gonzalez-Vega, 1986a).

The financial system matters because of the services it produces. According to Gonzalez-Vega (1986a, b), the financial system performs three main functions. The first one is the monetization of the economy, which allows the integration and expansion of markets. With substantial monetization, the number of transactions increases, the time and effort needed for each transaction decreases, and economic agents avoid the inconvenience of a barter economy.

The second function of the financial system is to be an intermediary. On the one hand, surplus units, with less profitable marginal opportunities, are better off by depositing their funds in the financial sector. On the other hand, deficit units, with more profitable opportunities, demand funds and expect to earn a return —by using these funds— that exceeds their interest payments to the financial intermediary (McKinnon, 1973). The role of the financial system is to channel surplus resources towards profitable investments. Intermediation improves upon direct financial transactions between surplus

and deficit units if there are scope and scale economies in the operations of financial institutions and if risk can be reduced through portfolio diversification.

Finally, the financial system helps economic agents in managing their precautionary reserves at a low cost, offers deposit instruments with high liquidity, and creates the opportunity to borrow for emergency purposes. The role of the financial system in facilitating the management of risk is particularly useful for poor households (Conning and Udry, 2007).

2.3.2 Impact of finance on economic agents

Gonzalez-Vega (1986a) points out that a stable macroeconomy is a precondition in inducing financial deepening in developing countries. The importance of financial deepening lies in the fact that financial services help to integrate markets and to mobilize funds across sectors in a more efficient way. Greater financial deepening increases aggregate income and accelerates economic growth (Gonzalez-Vega, 2003). Financial progress actually occurs when transaction costs decline, when the intermediaries diversify their portfolios, and when useful information resulting from the relationships between institutions and clients is accumulated (Gonzalez-Vega, 1986b).

Transaction costs reduce both the demand and the supply of financial services. Thus, they create barriers to financial deepening (Gonzalez-Vega, 2003). Transaction costs can be reduced in several ways. These mechanisms include (i) taking advantage of scale and scope economies to supply different financial products in a more efficient way,

(ii) innovations in the provision of financial services, (iii) the expansion of the branch network, in particular to increase outreach in the rural areas, (iv) interactions and connections among different intermediaries in the financial sector, (v) greater competition, to reduce loan interest rates and to increase the net returns on deposits, and, in general, (vi) a greater integration of financial markets (Gonzalez-Vega, 1986b).

Financial intermediaries may improve the *variety* of their outreach by providing diverse financial products to heterogeneous clients who have different demands and face different opportunities. According to Meyer and Alicbusan (1984), the heterogeneity among households and firms facilitates financial intermediation. There is a wide range of households and firms, which experience diverse shocks over time. There are differences in family life cycles, and households have or perceive diverse investment opportunities. These differences create opportunities for them to participate in the process of intermediation, while assuming different roles at different moments in time.

Financial deepening improves the stock of information in the economy. The disclosure of information occurs in both directions, from the financial sector to clients and from clients to the financial sector. Depositors need information to assess the risks and expected returns from leaving their funds with the deposit-taker; borrowers need to know the terms and conditions of their loan contracts.

In turn, financial institutions want to react optimally to the risk of loan default and also to know when the depositors will desire to withdraw their funds. Financial institutions may want to set an appropriate (incentive compatible) structure of interest

rates in the design of the contracts for the supply of both types of services. When financial institutions have only borrowers as clients, they miss information about the savings behavior of these clients, which could help them in refining their estimations about the creditworthiness of their borrowers (Vogel, 1984).

2.3.3 Two basic financial services

The two most basic services that financial institutions supply are credit and deposit facilities. According to Rutherford (2005), the use of these two services can be seen as merely saving at different times by the client. This author calls *saving up* the action of converting a series of deposits into a large lump sum, while *saving down* would be the action of getting a large lump sum as an advance against future savings. For the purposes of this thesis, I will differentiate these forms of saving simply as depositing and borrowing.

The way in which depositors and borrowers participate in the financial system is influenced by the interest rate that they receive or pay, respectively. Individuals and firms decide to deposit or borrow funds in the financial sector because they think that this decision will make them better off. Depositors may get a positive or a better return on their financial assets, in comparison to other alternative marginal uses of their resources. Alternatively, borrowers may expect to use the funds in a profitable way, as they are willing to pay an interest rate for them. A division of labor between depositors (savers)

and borrowers (investors) emerges and the whole economy benefits from the more efficient allocation of resources among sectors (Gonzalez-Vega, 1992).

Most important for these decisions, however, is the total cost of the funds for borrowers, whereas most important for depositors is the net return on their deposits. The total cost of funds includes the borrower's transaction costs, in addition to the interest payments, while the depositor's transaction costs must be subtracted from interest earnings, in order to obtain the net return on deposits. The intermediary's margin between loan and deposit interest rates must cover the costs of lending and the costs of mobilizing deposits and other funds and generate a surplus for further growth and the accumulation of reserves (Gonzalez-Vega, 2003).

2.3.4 Rural financial markets

Conditions in rural financial markets may be understood considering different aspects, such as the structure and composition of the rural financial sector, the relevant features of institutions and clients, the alternative mechanisms for depositing and borrowing in rural areas, the objectives and functions of traditional state-owned agricultural banks, and the overall fragmentation of markets.

Rural financial markets consist of formal, semiformal, and informal entities. Each one of these entities offers particular services to different types of clients. In the rural areas, these three types of agents may interact, depending on the degree of regulation in the sector, the extent of monetization, the public's confidence in financial institutions,

and other factors determined by geographic, economic, and cultural circumstances (Robinson, 1994).

Informal markets are the oldest providers of financial services in the rural areas; as a result, their influence on the way how poor people manage their savings and loans is significant. Informal services are organized and provided in different forms, with different alternatives for saving or borrowing. For example, there may be deposit collectors or moneylenders, informal credit and savings associations or clubs such as the ASCA (accumulating savings and credit association) or the ROSCA (rotating savings and credit association), and other types of entities, such as pawnshops.

Informal markets are still present in many rural areas; however, formal financial markets are starting to have a larger presence in the rural areas of some developing countries, adjusting or reproducing practices that poor people know from the services provided by informal agents. In particular, formal markets are reaching some rural areas through microfinance institutions. In comparison to informal sources, credit from these institutions is cheaper, the institutions tend to make bigger (and rising) advances when people require it, and they are more reliable for clients, when they are sustainable. These institutions offer further opportunities for trade and specialization in the rural areas, and a new set of information and contract enforcement problems are solved, allowing the multiplication of financial transactions (Conning and Udry, 2007).

Despite the existence of formal, semiformal, and informal sources of finance, poor people employ other mechanisms for managing their funds and coping with risk.

For instance, the most immediate way for saving is doing it at home. Poor people tend to use this mechanism because it helps them to save any amount, at any time, and because withdrawals from under the mattress are easy. Another common form of accumulating savings is holding non-financial but relatively liquid assets, such as livestock, jewelry, or land. Moreover, poor people may turn to relatives or friends for depositing or borrowing.

In general, people use all of these mechanisms for saving or getting credit because frequently they are more accessible to them and because quite frequently they represent lower transactions costs in comparison to using formal financial services. These transaction costs are particularly high when the country's infrastructure is undeveloped and when the branch network has not been expanded. Thus, poor people use alternative mechanisms when the supply of formal financial services is limited. When these services are eventually offered, however, poor people modify their behavior, and the latent demand for deposit facilities materializes (Gonzalez-Vega et al., 1992; Robinson, 1994).

For a long time, formal rural financial markets were characterized by cheap credit offered to a few clients through specialized state-owned agricultural development banks (Gonzalez-Vega, 2003). These banks directed credit to target clienteles in response to particular government or donor objectives. For example, these banks focused on the growth of agricultural production, regional development, the promotion and adoption of new technology, the support of a new agrarian reform, or combination of some of these particular non-financial objectives.

Two main characteristics of these cheap-credit programs were the provision of loans at low interest rates, which did not cover the costs of lending, and the forgiveness of outstanding debt (Adams, Graham and Von Pischke, 1984). These state-owned institutions minimized the role of interest rates as an instrument to allocate resources and encouraged rent-seeking (Gonzalez-Vega, 1986b, 1992, 2003). These policies led to inefficient distortions in relative prices, which lowered welfare and suppressed trade, but the experience of a few countries indicates that state intervention may at times be used to address market failure and/or break local market power (Conning and Udry, 2007).

The subsidized credit programs made loans to target clienteles without considering their repayment capacity and the level of risk being assumed in each situation (Adams, Graham and Von Pischke, 1984). Moreover, the government-owned institutions had limited resources, so they allocated the funds to wealthy farmers (Vogel, 1984; Robinson, 1994; Conning and Udry, 2007). The result was the concentration of resources in a few hands, leading to greater inequality in the distribution of wealth (Gonzalez-Vega, 1976). Because credit is fungible, however, it is virtually impossible to promote specific agricultural activities with low-interest loans (Von Pischke and Adams, 1980).

Moreover, because of the nature of their sources of funds, these institutions did not have the incentive or they were not allowed to look for profits and to mobilize deposits. As a result, these institutions became incomplete and vulnerable. The financial viability, growth, and strength of these financial institutions were not objectives of these programs. Therefore, in most countries the survival of these institutions lasted until the

time when government funds were exhausted (Gonzalez-Vega, 1986b, 1992, 2003). Moreover, these policies were often characterized by high levels of arrears and by political capture (Conning and Udry, 2007). For instance, for a long time, the interventions of the Mexican Government in rural financial markets were focused almost entirely on loans and completely ignored deposit mobilization (Campos-Bolaño, 2005). The PATMIR project, to be described, has been a recent exception to this approach.

There are several reasons why financial institutions offered only credit but not additional financial products, such as deposit facilities in the rural areas. The institutions implemented specialized programs that only allowed for credit, without accepting deposits, and those programs created poor incentives for private financial intermediaries to enter the rural sector (Conning and Udry, 2007).

Moreover, according to some authors (Vogel, 1984; Robinson, 1994; Rutherford, 2005), there was a belief that most of the rural population do not save because they are too poor and that they prefer to use their resources for consumption. Substantial empirical evidence has rejected these assumptions. Given their extreme vulnerability, the poor are forced to accumulate precautionary reserves (that is, they have to save) in order to survive adverse shocks and to deal with the seasonality of their income and expenditure flows. Several authors (Vogel, 1984; Campos-Bolaño, 2005; Rutherford, 2005) have indeed argued that poor people must save to manage their small incomes in acquiring basic survival items, make some investments, and deal with unexpected events.

Thus, the government-owned institutions and directed credit programs of the past assumed that rural households neither saved nor looked for converting part of their assets into bank deposits and that they did not react in the presence of changes in interest rates and other economic incentives (Gonzalez-Vega, 1992). However, high transaction costs (Vogel, 1984) and the inappropriate structure of services and institutions (Robinson, 1994) are part of the reasons for the low volumes of deposits actually mobilized.

Furthermore, in the rural areas there is less financial deepening than in the urban areas. The rural supply of financial services is limited because transaction costs are very high, for different reasons. In the rural areas, potential clients are geographically dispersed, their transactions are small, numerous and risky, their demands of financial products are heterogeneous, and people face higher risks and unexpected variations in prices that induce greater instability of incomes (Gonzalez-Vega, 1986b). Thus, financial development has been concentrated in the urban areas.

2.3.5 Conditions to develop a healthy rural financial sector

Certain conditions must exist for an economy to develop a healthy financial sector. It is important that institutions be sustainable, without dependence on funds from governments or donors. Sustainability allows the institutions to be permanent and allows them to supply their financial services to increasing numbers of people.

In order to be sustainable, typically institutions must be *complete* financial intermediaries. For this, they must supply a wide range of services and not only credit

(Vogel, 1984). Institutions can use part of the money from their savings accounts for making loans, and they can take advantage of different terms to maturity from their diverse clients and products to manage their liquidity and allocate their loanable funds.

Moreover, most people would rather have deposits than loans. Financial institutions typically reach more depositors than borrowers. In addition, growth in institutional deposits can both significantly increase the amount of credit available to smaller entrepreneurs and allow the provision of loans at much lower interest rates than are otherwise available in the informal market (Robinson, 1994). Thus, policies that focus on improving services for depositors redistribute income among poor people (Vogel, 1984).

When financial institutions manage their own resources, they have a greater incentive to allocate them more efficiently. Intermediaries attempt to allocate funds to the most profitable projects and make sure that the borrowers will repay their loan obligations in the future (Aguilera and Gonzalez-Vega, 1992).

The most salient concerns for deposit clients are safety and easy access, liquidity, a variety of instruments with different maturity dates and returns, high returns on deposits, lower rates of interest for credit in comparison to informal mechanisms, and appropriate financial technology to address the diverse local demand (Robinson, 1994; Campos-Bolaño, 2005).

There is evidence (Meyer and Alicbusan, 1984; Vogel, 1984; Gonzalez-Vega et al., 1992; Robinson, 1994) that poor people use formal and semiformal financial services

if they become available. They will use financial services as long as they have access to them and find institutions and instruments to be appropriate. Poor people find the financial sector to be more secure and convenient than having their resources in other forms of savings or getting loans at a high interest rate from informal lenders.

Nevertheless, an appropriate regulatory framework is important to develop a financial system in the rural areas. This regulatory framework should lead to the development of robust financial intermediaries, capable of safeguarding the command over resources deposited by the rural savers, and it should discourage the opportunistic behavior of deposit-taking institutions, in order to protect depositors and the stability of the system (Chaves and Gonzalez-Vega, 1998).

The main objective of public policies, moreover, should be the reduction of transaction costs for all the participants in the market: depositors, borrowers, and intermediaries. Some mechanisms to achieve this objective are technological innovations, institutional development, including the establishment of credit bureaus, and linkages among markets (Gonzalez-Vega, 1986b, 2003; Conning and Udry, 2007).

An important lesson learned from the old subsidized credit programs in the rural areas of developing countries is that financial institutions have to set interest rates sufficiently high to cover their operational costs. In addition, they have to allocate credit according to the applicant's repayment capacity (Gonzalez-Vega, 1986a; Campos-Bolaño, 2005).

In summary, financial services matter for several reasons. The supply of these services is, however, very limited in the rural areas of developing countries. When the supply increases and the services get closer to the rural clients, these are eager to demand those services, in particular deposit facilities. Because of their role in improving the risk-management strategies of poor households, deposit facilities are expected to have a positive impact on the demand for schooling and on human capital formation.

CHAPTER 3

RURAL MICROFINANCE TECHNICAL ASSISTANCE REGIONAL PROJECT (PATMIR)

The Mexican Ministry of Agriculture (SAGARPA) started the Rural Microfinance Technical Assistance Regional Project (PATMIR) in 2002, to provide specialized technical assistance to financial intermediaries operating or willing to operate in the rural areas of Mexico. The data used in this thesis come from surveys implemented in connection with this project.

The institution building strategy for the first phase of the project (2002-2007) was based on the (i) creation, (ii) consolidation, and (iii) expansion into rural areas of financial intermediaries, through the assistance of three international consulting firms. This first phase of the project operated in rural communities –with up to 10,000 inhabitants– that belong to municipalities with very high, high, and medium levels of marginality, and which at the same time belong to regions of central and southern Mexico.

In Mexico, *marginality* is officially measured by an index that combines features related to levels of education, occupation, housing, and access to public services with other indicators, at the level of each municipality and community. According to the

Consejo Nacional de Población (CONAPO), there are five levels of marginality, namely very high, high, medium, low, and very low. The first three levels of marginality are used for targeting public interventions in poor communities.

3.1 First phase of PATMIR

The consulting firms identified a number of financial institutions willing and capable of fulfilling the requirements of the Mexican Popular Savings and Credit Act of 2001 (*Ley de Ahorro y Crédito Popular*) and of offering financial services in marginal rural areas. The project promoted alliances between the consulting firms and the selected financial institutions, and the partners followed an established work plan according to the project's objectives (Zapata-Alvarez, 2007b).

The Canadian consulting firm, Développement International Desjardins (DID), operated three contracts with PATMIR. The first contract was for Chiapas-Tabasco, and it based its strategy on the creation of new rural financial institutions. The second contract was for the Huastecas (Huasteca hidalguense, potosina and veracruzana), and it implemented institution building strategies for both the creation and the consolidation of institutions that provide financial services in the rural areas. The third contract was for Puebla-Tlaxcala, and it both consolidated financial institutions that operate in rural areas and expanded into the rural areas the operations of some non-rural intermediaries.

The World Council of Credit Unions (WOCCU), based in the United States, operated two contracts. The first contract was for Veracruz, and it employed both the

expansion and consolidation strategies. The second contract was for Michoacan, and it based its strategy on both the creation and the consolidation of financial institutions.

In turn, the German Cooperative Confederation, Deutscher Genossenschafts-und Raiffeisenverband (DGRV), implemented the Guerrero contract, in which all three strategies were applied, as well as the Oaxaca contract, which both created and consolidated financial institutions that operate in the rural areas.

Thus, the three consulting firms combined –in different ways– the alternative strategies for increasing rural outreach, in various areas of the country. These diverse combinations of strategy and location created an opportunity to explore the comparative success of each institution building approach (Paxton, 2006).

The technical assistance provided by the consulting firms was adapted to the scope of the institutional requirements and potential of each participating financial institution. In order to promote their rural outreach and the massification of financial services adapted to the target population, the consulting firms guided the institutions in the definition, selection, and outreach toward the target segments of the financial market.

These firms also helped in the establishment of connections between the selected financial institutions and some financial entities, such as the second-tier state-owned development banks and some private and government organizations that offer financial and non-financial services to first-tier institutions. In order to secure the sustainability of the financial institutions, the consulting firms developed innovative, efficient, and adequate techniques and methodologies for management, administration, operations, and

accounting. They also created human capital at all levels (managerial, administrative, operational, and promotional) in the supply of financial services by the selected institutions (Proyecto de Asistencia Técnica al Microfinanciamiento Rural, 2007).

The consulting firms supervised the quality of performance in all the processes, with the purpose of verifying that the results reported by the institutions went according to the objectives of the project. These firms also provided technical assistance oriented to implementing processes that could be replicated in the future by other financial institutions (Proyecto de Asistencia Técnica al Microfinanciamiento Rural, 2007). The project offered the participating institutions subsidies, mostly for the establishment of new branches. The consulting firms diagnosed the costs of each financial institution, in order to avoid an excessive support in terms of this subsidy. This subsidy was targeted, decreasing, and transitory.

At the end of the first phase, PATMIR reports to have worked with 33 financial institutions, 21 existing institutions and 12 new institutions. Under the project, these institutions operated 193 branches, of which 157 were newly established through the assistance of the project. A total of some 267,000 users of financial services were reached by these branches, of which about 194,000 were new users (of them, 53 percent were women and 29 percent were indigenous people). Thus, the project's initial goal of a number of new users of banking services (*bancarización*) was exceeded by 24 percent.

Moreover, at the end of 2005, all the participating financial institutions had obtained an extension in their process of becoming regulated, in accordance to the

Mexican Popular Savings and Credit Act, and nine of the 33 institutions had achieved their complete authorization before the end of the first phase (Zapata-Alvarez, 2007b).

3.2 Second phase of PATMIR

The second phase of the project initiated operations in January of 2008. The new target population includes communities throughout the whole country –with up to 15,000 inhabitants– that, as during the first phase, belong to municipalities with very high, high, and medium levels of marginality.

This second phase promotes only the robust expansion into the rural areas of existing financial institutions (rather than following any one of the three alternative strategies of the first phase), given an evaluation of the costs and benefits of the three types of approach. The implementation of the technical assistance now takes place through four international consulting firms, with the goal of incorporating 400,000 new users into banking services (*bancarización*) during the first three years of the project (Proyecto de Asistencia Técnica al Microfinanciamiento Rural, 2007).

For both phases, the project has specified a time frame of three to five years of assistance, under the condition that the selected financial institutions provide integrated financial services (namely, both loans and deposit facilities) adapted to the rural poor and that they achieve financial viability and permanence, in accordance to the requirements of the Mexican Popular Savings and Credit Act (Paxton, 2006; Zapata-Alvarez, 2007a; Proyecto de Asistencia Técnica al Microfinanciamiento Rural, 2007).

The levels of marginality used to determine the target communities for PATMIR were based on the estimation of this index by the *Consejo Nacional de Población* (CONAPO) in 2000 and 2005, respectively, for each phase. The CONAPO calculates the marginality index for each Mexican municipality, on the basis of socio-economic indicators that represent a certain level of economic deprivation and of isolation in each municipality. The index synthesizes information about education, access to basic services and goods, levels of occupation, and characteristics of the region.

In particular, the marginality index includes information for people over 14 years of age who are illiterate and have not completed elementary education. It also includes information for individuals who live in dwellings with a dirt floor and without sewer, toilet, electricity, piped water, and refrigerator and with a given level of overcrowding. Moreover, this index includes information for people living in communities with less than 5,000 inhabitants (isolation and small markets) and for workers earning low incomes. All this information is included in the construction of the index, which is calculated as a percentage of the total population in each municipality with a given characteristic. The objective of this approach is that the scale effect originated from population size would be eliminated and comparisons among different regions would become possible (Consejo Nacional de Poblacion, 2005).

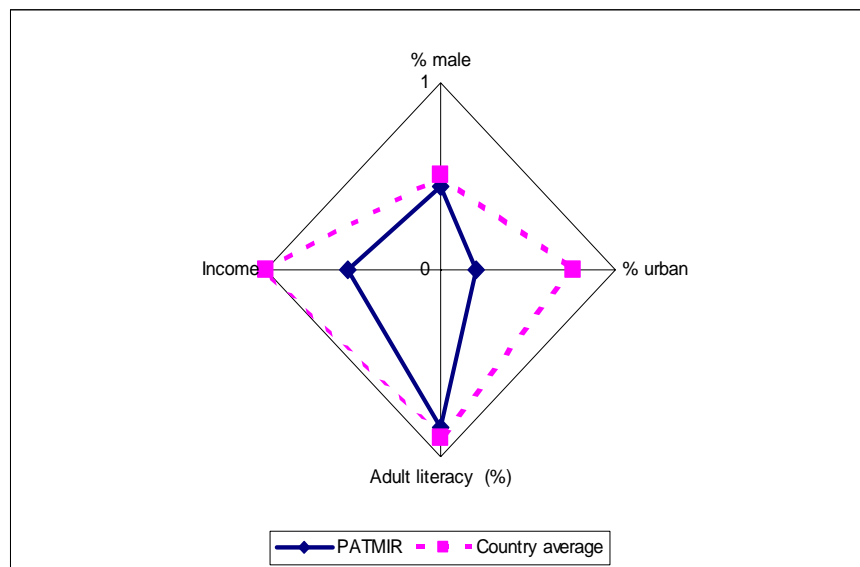
3.3 Studies of PATMIR

Paxton (2006) analyzes the PATMIR project according to the strategy pursued for each financial institution (that is, creation, consolidation, or rural expansion) and by consulting firm (WOCCU, DGRV, and DID). Her study evaluates the outreach and sustainability outcomes for the participating financial institutions, in agreement with the PATMIR objectives. In terms of *outreach*, through the institution building offered by the international consulting firms, PATMIR seeks to provide financial services to those people typically beyond (outside) the frontier of formal finance. In terms of *sustainability*, PATMIR seeks that the participating financial institutions provide permanent services to their rural clients.

The data used in the Paxton study include information about the size, scope, and financial performance of the institutions that PATMIR supervises. The data also contain detailed information about dimensions of outreach and sustainability of 15 institutions and information from interviews with the technical consultants and some bank managers. Finally, the data also include information from the household surveys in which SAGARPA and BANSEFI collaborated.

The analysis embraces two categories of outreach (breadth and depth). The breadth of outreach measures the number of clients reached under the first phase of the PATMIR project. The depth of outreach includes the percentage of these clients who are women, poor, and illiterate. These three variables are related to categories of clients who have traditionally been excluded from access to formal finance.

The analysis of *depth of outreach* shows that, during the first phase, the PATMIR institutions reached a clientele that is more rural, poor, female, and illiterate than the country's average, as shown in Figure 1. Among the three institution building strategies, the newly created institutions were the ones that achieved the greatest depth of outreach and that showed the least breadth of outreach.



Source: Paxton (2006).

Figure 1. Comparison of the clientele of the PATMIR institutions and Mexico's averages.

The *poverty outreach* index is a measure used to identify whether the institutions have a good combination of depth and breadth of outreach. This index includes

information on the number of clients below a given poverty line and on the distribution of income below that line.

The poverty outreach index is computed as:

$$PO(x; z, \alpha) = \frac{\text{Log}(q)}{q} \sum_{i=1}^q \left(1 - \frac{x_i}{z}\right)^\alpha, \text{ where } x_i \text{ is the income of the } i\text{th household below}$$

the poverty line, q is the number of households below the poverty line, z is the poverty line, and $0 \leq \alpha \leq 1$ is the scaling weight defined according to the relative poverty of the clients. An institution serving clients well below the poverty line would be associated with a higher PO index than one serving clients just at the poverty line. The PO index is not bounded theoretically, but it typically ranges from 0 to 4, in an international context, when using a \$2/day poverty line. The index for the PATMIR sample ranges from 0 to 2.25, while the institutions strengthened by each one of the consulting firms achieved a similar PO index score, despite the fact that their methodologies vary significantly. However, the results from this index reveal that encouraging existing institutions to open branches in marginalized areas leads to the highest PO index.

The analysis of sustainability includes a financial, technical efficiency, and sustainability trend analysis of the PATMIR financial institutions. The financial examination includes information about profitability, operational self-sufficiency, portfolio quality, and staff productivity.

The Paxton study uses the rate of return on equity (ROE) and the rate of return on assets (ROA) to measure the profitability of the institutions. The two measures are

positive in five of the seven PATMIR regions. The institutions sponsored under the Chiapas contract show positive rates of return on equity and on assets even though these institutions are new and operate in marginal rural areas. The new institutions show, however, the lowest levels of operational self-sufficiency. In particular, these institutions cannot yet cover their operating costs with their own revenues, while the opposite result is true for existing institutions that expanded their operations into the rural areas.

With respect to portfolio quality, on average, the institutions under consolidation or with a program of rural expansion have a riskier portfolio than the new financial institutions. Thus, the new institutions are those with the highest repayment rates. The existing institutions (both strengthened and expanded) have an average portfolio at risk exceeding 10 percent. Finally, WOCCU, which works mostly with existing institutions, shows the highest levels of staff productivity, whereas DGRV, which works with small institutions, many of which are newly created, has the lowest productivity levels.

In order to have an idea about the future sustainability of the financial institutions, the study investigates which institutions are the most efficient by using Data Envelopment Analysis. This approach measures technical efficiency (the ability to produce a maximum output from a given set of inputs) and scale efficiency (the ability of the firm to produce at an optimal scale). The results suggest that the participating financial institutions show economies of scale (that is, they could become more efficient by increasing their scale) and, in general, the PATMIR institutions are considered relatively technically efficient in comparison with a sample of 300 rural financial institutions in Mexico. According to institution building strategy, the institutions under

consolidation tend to be the most technically efficient among the set of participating institutions.

Paxton (2006) finds an increasing level of operational sustainability over time for most of the participating financial institutions. The newly created institutions show the fastest annual rate of growth in the loan volume, while the institutions that expanded into the rural areas are the ones with the fastest annual rate of growth in the savings volume, from 2004 to 2005.

According to this study, in general, the PATMIR financial institutions have managed the dual objectives of outreach and sustainability quite well. However, there are some institutions that present a trade-off between outreach and sustainability. Some financial institutions are completely sustainable but do not have a good depth of outreach, whereas those institutions with a good depth of outreach have problems in terms of financial viability, and therefore these institutions largely depend on subsidies.

Paxton (2006) concludes that there is not a single institution building strategy or consulting firm that dominates in terms of the PATMIR's objectives of outreach and sustainability. Overall, the newly created institutions reach more marginalized clients, while the existing institutions that are being consolidated or that expand into rural areas are more likely to be sustainable. The choice of existing institutions for the second phase suggests that PATMIR has considered that sustainability is very important and that the costs of creating new institutions may be too high, given their limited breadth of outreach.

In another study, Townsend and Woodruff (2006) analyze some aspects of the PATMIR project. This study focuses on the characteristics of the clients and of the communities where PATMIR operates. The objective of the study is to examine the effectiveness of the PATMIR program in reaching low income households and households that were previously unbanked. This study uses the baseline survey of the household panel in which BANSEFI and SAGARPA collaborated. The authors distinguish between PATMIR households and non-PATMIR households, the latter ones coming from what is called the EACP sample (*Entidades de Ahorro y Crédito Popular*). They also distinguish between rural and urban areas.

The Townsend and Woodruff study estimates two probit models, in order to find the characteristics of households associated with having a savings account and a formal loan. This analysis is differentiated by the type of household (PATMIR and EACP) and by the type of community (rural and urban).

The descriptive analysis includes statistics on the variables used in the probit regressions, the frequency of the different (declared) uses of the funds from the loans by the households, and a comparison of these variables between households with loans and those without loans (which, in turn, are distinguished into credit constrained and unconstrained households).

The descriptive statistics show that households from the EACP sample are better off than those from the PATMIR sample, because PATMIR households have lower monthly incomes, monthly expenditures, and levels of assets. The heads of household in

the PATMIR sample have lower levels of education than the heads of household in the EACP sample. The PATMIR households are also less likely to have either agricultural or non-agricultural enterprises. This represents further evidence that the PATMIR institutions are reaching marginalized populations.

The same pattern is observed when the analysis is divided by type of community. In general, the differences between households with and without financial services in communities served by PATMIR branches and households in communities served by EACP branches are still apparent, but they are less pronounced than in the total samples. These differences are much more pronounced in urban areas than in rural areas.

The analysis of the frequency of (declared) uses of the funds from the loans shows that the stated purpose is similar for PATMIR and EACP households. For both samples, almost half of the households that reported having a loan claimed to use the funds for investment (mainly on housing construction or repair), between one-quarter and one-third of the households used the funds for regular expenditures, and around one-sixth of the households used the funds for emergencies.

The comparison of some characteristics between households that demanded but did not receive loans (*constrained* households) and households that are able to get a loan but currently do not have any loan (*unconstrained* households) suggests that the constrained households are poorer. Constrained households have significantly lower levels of durable assets, and female heads in these households have lower schooling

achievements. Moreover, in general, the constrained and unconstrained households without loans are much poorer than households with formal loans.

The first probit models estimate the probability of having a savings account. The results indicate that this probability increases with the level of schooling of the head of household, in both samples; however, this increase is greater for the EACP households. That is, levels of education make a greater difference among households in this sample, in terms of the probability of being a depositor or not.

Some variables, such as having agricultural and non-agricultural enterprises and having remittances from abroad, are positively associated with owning a savings account. The coefficients for these variables are lower for households in the EACP communities. Moreover, the results indicate that measures of household wealth, such as house and land ownership and being connected to sewer, are variables with a stronger relationship with the probability of having a savings account. This result is observed mainly in urban areas.

The second probit models estimate the probability of having had a loan from a formal financial institution within the past five years. In the EACP sample, 66 percent of the households reported having taken at least one loan, while in the PATMIR sample 51 percent reported having taken at least one loan. In the rural areas and for the PATMIR households, remittances from abroad, operating a non-agricultural business, a head of household that speaks an indigenous language, and the number of years that the client has had a savings account are variables with a positive impact on the probability of

getting a formal loan. In the urban areas and for the EACP sample, the probability of taking a formal loan is increasing in the number of years that the client has had a savings account. This suggests that possessing a deposit in a formal financial intermediary increases the likelihood of becoming a borrower, as suggested by the literature (Vogel, 1984). In general, PATMIR institutions are more likely to lend in rural than in urban areas.

In general, Townsend and Woodruff (2006) show that the PATMIR program reaches low-income households and households that were previously unbanked. The authors compare the characteristics of two types of households (PATMIR and EACP households) associated with having a savings account and a formal loan, and they conclude that the households from the EACP sample are better off than those from the PATMIR sample. Finally, they find that credit-constrained households (households that demanded but did not receive loans) are poorer than unconstrained households (households that are able to get a loan but currently do not have any loan).

CHAPTER 4

ECONOMETRIC APPROACH

This thesis examines whether access to formal financial services, both loans and particularly access to deposit facilities, may reduce inter-generational poverty in the rural areas of Mexico, through the impact of this access on the children's human capital formation. An econometric specification is needed to explore the relationship between a child's schooling and several variables that may influence the household's decisions to send its children to school.

According to Maldonado and Gonzalez-Vega (2008), the observation that a child is attending school at a particular point in time does not mean that he/she had been able to attend continuously during the previous years, had performed acceptably, or had started school at the right age. Thus, a dynamic framework is needed in order to capture the accumulated schooling performance of each child. The variable that these authors suggest in order to capture the accumulated schooling history of the child is the *schooling gap*, measured as the number of years of the difference between the expected level of education, according to the child's age, and the highest level of education actually completed.

Namely,

$$\textit{Schooling gap} = \max \{0, \textit{expected education} - \textit{actual education}\}$$

The econometric specification used here to explore the effect of access to formal deposit facilities and access to formal credit on the i th child's human capital (*schooling gap*) may be represented by the following equation:

$$\textit{gap}_i = \delta Z_i + \alpha_1 y_{i1} + \alpha_2 y_{i2} + u_i \quad (4.1)$$

where Z is a vector of individual and household characteristics for each child i , δ is a vector of unknown parameters to be estimated, y_1 represents access to formal deposit facilities by the household of child i , y_2 represents access to formal credit by the household of child i , and u is a nonsystematic error.

One difficulty is that the assessment of the impact of access to financial services on schooling may be biased by nonrandom participation in financial markets (that is, having access to formal credit and to deposit facilities may not be random). Participants may actually have unobserved abilities or characteristics that make them choose to participate in financial transactions or not (e.g., greater initiative or familiarity with formal organizations) and that also make them demand more or less education for their children. Moreover, the observation of loans is typically a consequence of a systematic (non-random) evaluation of creditworthiness by the lender.

If equation (4.1) is estimated without taking into account this potential problem, the estimates of the coefficients related to both access to deposit facilities, α_1 , and access to formal credit, α_2 , in their impact on the reduction of the schooling gap, may be overestimated, because of the expected role of these unobserved characteristics.

One way to correct for this problem is to use instrumental variables in the estimation of equation (4.1). The use here of instrumental variables in the estimation is based on the inclusion of two variables. One of them represents the *probability* of access to formal deposit facilities and the other one represents the *probability* of access to formal credit by the household of the child i .

These new variables must not be correlated with Z and u in equation (4.1), in such a way that now the dependent variable (schooling gap) depends only on exogenous variables. The result is that the unobservable characteristics are no longer a problem, and an OLS regression will generate unbiased estimates (α_1, α_2) for the influence of access to formal financial services on the schooling gap.

The instruments used in this thesis are thus the probability of having access to formal deposit facilities and the probability of having access to formal credit. These probabilities are obtained, in turn, from a **bivariate** probit model, which estimates two probit equations at the same time. The dependent variable of each equation is a dummy variable that represents whether the household has had access to deposit facilities or to formal credit or not.

The separate estimation of two probit models, in order to get each one of the instruments, is not advisable, given that having access to formal credit may be influenced by having deposit facilities (as the observation of depositing behavior may influence the evaluation of creditworthiness) or that the holding of deposits may be a result of an existing credit contract. Indeed, Townsend and Woodruff (2006) found that for Mexican households, the length of holding a deposit account positively influences the probability of getting a formal loan.

To show that the separate estimation of two probit models is not appropriate, I follow Maddala (1983). Assuming that we are interested in estimating the probability of having access to either type of financial service, let us consider the following equations:

$$y_1^* = \beta_1' y_2 + \gamma_1' x_1 - \varepsilon_1 \quad (4.2)$$

$$y_2^* = \beta_2' y_1 + \gamma_2' x_2 - \varepsilon_2 \quad (4.3)$$

where y_1 represents household access to deposit facilities and y_2 represents household access to formal credit. These variables are defined by:

$$\begin{aligned} y_1 &= 1 & \text{if } y_1^* > 0, & \quad 0 \text{ otherwise} \\ y_2 &= 1 & \text{if } y_2^* > 0, & \quad 0 \text{ otherwise} \end{aligned} \quad (4.4)$$

where y_j^* is called a latent variable, because it is unobserved, unlike y_j , which we actually observe.

For simplicity, and without loss of generality, let us assume that $x_1 = x_2 = 0$ and that ε_1 and ε_2 are independent. Also, denote by $\Phi_1(\cdot)$ and $\Phi_2(\cdot)$ the distribution functions of ε_1 and ε_2 , respectively.

Then we have:

$$\Pr(y_1 = 1, y_2 = 1) = \Phi_1(\beta_1)\Phi_2(\beta_2) \quad (4.5)$$

$$\Pr(y_1 = 1, y_2 = 0) = \Phi_1(0)[1 - \Phi_2(\beta_2)] \quad (4.6)$$

$$\Pr(y_1 = 0, y_2 = 1) = [1 - \Phi_1(\beta_1)]\Phi_2(0) \quad (4.7)$$

$$\Pr(y_1 = 0, y_2 = 0) = [1 - \Phi_1(0)][1 - \Phi_2(0)] \quad (4.8)$$

The sum of these probabilities is equal to:

$$1 + \Phi_1(0)\Phi_2(0) - \Phi_1(\beta_1)\Phi_2(0) - \Phi_1(0)\Phi_2(\beta_2) + \Phi_1(\beta_1)\Phi_2(\beta_2) \quad (4.9)$$

This sum is not equal to 1, unless β_1 or β_2 are equal to zero. Thus, we cannot estimate these equations separately, by using independent probit models. Instead, a solution is the use of a bivariate probit model, which allows the estimation of more than one probit with correlated disturbances.

Equations (4.2) and (4.3) are modified here under the assumption that having access to deposit facilities helps more in having access to formal credit than the influence that debt has on the holding of formal deposits. This assumption reflects stylized facts of

rural financial markets in low-income countries and the empirical evidence about Mexico already cited.

Hence, the bivariate probit estimation includes the following equations:

$$y_1^* = \gamma_1' x_1 - \varepsilon_1 \quad (4.10)$$

$$y_2^* = \beta_2' y_1 + \gamma_2' x_2 - \varepsilon_2 \quad (4.11)$$

To simplify the notation, let us define

$$\gamma_1' x_1 = \lambda_1' x_1 \quad (4.12)$$

$$\beta_2' y_1 + \gamma_2' x_2 = \lambda_2' x_2 \quad (4.13)$$

Thus, the general specification of the bivariate probit model would be:

$$y_1^* = \lambda_1' x_1 + \varepsilon_1 \quad (4.14)$$

$$y_2^* = \lambda_2' x_2 + \varepsilon_2 \quad (4.15)$$

where conditions (4.4) and conditions (4.16) are satisfied:

$$\begin{aligned} E[\varepsilon_1] &= E[\varepsilon_2] = 0 \\ \text{Var}[\varepsilon_1] &= \text{Var}[\varepsilon_2] = 1 \\ \text{Cov}[\varepsilon_1, \varepsilon_2] &= \rho \end{aligned} \quad (4.16)$$

This model can be estimated using maximum likelihood techniques. Reasonably efficient approximations have been devised for the bivariate normal distributions. The bivariate normal cumulative distribution function is:

$$\Pr[X_1 < x_1, X_2 < x_2] = \int_{-\infty}^{x_2} \int_{-\infty}^{x_1} \phi(z_1, z_2, \rho) dz_1 dz_2 \quad (4.17)$$

$$\text{which we denote as } \Phi(x_1, x_2, \rho) \quad (4.18)$$

The bivariate normal density is

$$\phi(x_1, x_2, \rho) = \frac{e^{-1/2(x_1^2 + x_2^2 - 2\rho x_1 x_2)/(1-\rho^2)}}{2\pi(1-\rho^2)^{1/2}} \quad (4.19)$$

To construct the log-likelihood, let us define:

$$z_{ij} = \lambda'_j x_{ij} \quad w_{ij} = q_{ij} z_{ij} \quad q_j = 2y_{ij} - 1 \text{ and } \rho_* = q_{i1} q_{i2} \rho \quad (4.20)$$

where $q_j = 1$ if $y_{ij} = 1$ and $q_j = -1$ if $y_{ij} = 0$, for $j=1,2$.

We can now construct the log likelihood to be used for parameter estimation. The probabilities that enter the likelihood function are:

$$\Pr[Y_1 = y_{i1}, Y_2 = y_{i2} | x_1, x_2] = \Phi(w_{i1}, w_{i2}, \rho_*) \quad (4.21)$$

This expression accounts for all the necessary sign changes needed to compute probabilities for y_1 and y_2 equal to zero and one.

Thus,

$$\ln L = \sum_{i=1}^n \ln \Phi(w_{i1}, w_{i2}, \rho_{i*}) \quad (4.22)$$

represents the log likelihood that is computed by the bivariate probit model (Greene, 2008).

Using the estimates $\hat{\lambda}_1$ for λ_1 and $\hat{\lambda}_2$ for λ_2 from equations (4.14) and (4.15) computed by the bivariate probit method, the probabilities of having access to deposit facilities $\Phi_1(\hat{\lambda}_1 x_1)$ and having access to formal credit $\Phi_2(\hat{\lambda}_2 x_2)$ are obtained.

In order to estimate the schooling gap regression, the instruments for formal deposits and formal credit have to be substituted for the original dummy variables:

$$gap_i = \delta Z_i + \alpha_1 \Phi_1(\hat{\lambda}_1 x_1) + \alpha_2 \Phi_2(\hat{\lambda}_2 x_2) + u_i \quad (4.23)$$

where $\Phi(Z)$ is the distribution function of the standard normal evaluated at Z . Because u has zero mean and it is uncorrelated with the regressors, we can estimate this equation by OLS. Note that even if the vector Z includes all the variables already included in the vector X , this does not create a perfect multicollinearity problem in the model, because nonlinear functions substitute for formal deposits and for formal loans (Maddala, 1983).

CHAPTER 5

VARIABLES

The purpose of this chapter is to describe the variables used in the two stages for the estimation of the influence of access to formal finance on the schooling gap of the children of rural households in Mexico.

5.1 *The first stage: Access to financial services*

The equations that represent the access to deposit facilities and formal credit by households are equations (4.14) and (4.15). These equations depend on some household and regional characteristics.

Both vectors x_1 and x_2 in equations (4.14) and (4.15) include the following variables: travel costs to get to the bank or financial institution, type of community (rural or urban), human capital of the household workers, remittances, public sector transfers, quality of the dwelling, and age of the head of household. In addition, the vector x_2 , from the equation of access to formal credit, includes one more variable, which represents having access to formal deposits.

1. *Travel cost to get to the bank.* These are two different variables, one for each type of financial service. This cost is measured in Mexican pesos, and it is expected to have a negative impact on both probabilities of access to financial services (loans and deposits). The travel cost in getting to the bank, faced by the household, is a proxy variable to represent the transaction costs of access to formal finance. High transaction costs are among the most important barriers of access to financial services in the rural areas.

2. *Type of community.* This variable represents the degree of development in the locality where the household lives. It takes the value of one if the community is a rural community and zero otherwise. A negative sign of the coefficient for this variable is expected, given the notion that if the community is urban, the probability of the household having access to formal financial services would be higher. This would be a reflection of the urban bias that has characterized financial deepening in countries like Mexico.

3. *Human capital of household workers.* This variable is measured as the sum of all the years of schooling of the household workers over 14 years of age. The stock of human capital of the household workers reflects the household's income-earning capacity; thus, this variable is expected to positively affect the probability of access to financial services.

4. *Remittances.* This variable is the amount in thousands of Mexican pesos that the household receives as domestic and international remittances during the year.

5. *Public-sector transfers*. This variable is the amount in thousands of Mexican pesos that the household receives as a transfer from public programs such as *Progres*a, *Procampo*, or *Jóvenes con Oportunidades* during the year.

These two variables (remittances and public-sector transfers) may have an ambiguous influence on access to formal finance. Moreover, the sign of the corresponding coefficient may differ for access to formal loans and for access to deposit facilities. In the latter case, it is more likely that remittances and transfers may have a positive influence on the probability of access.

In the case of access to formal loans, the sign may be positive if having an additional source of income, which is not correlated with regular household earnings, may serve to demonstrate more stable household income flows and, therefore, greater creditworthiness in the case of asking for a formal loan (Svarech, 2008), while having some extra income may increase the probability of saving and holding a deposit with a financial intermediary. However, the sign of the coefficient in the equation for the probability of access to credit may be negative, if the household substitutes remittances or public program cash transfers for some of the benefits of having access to formal credit services. These benefits may be a better ability to cope with risk, to smooth household income and consumption, and to take advantage of productive opportunities.

6. *Quality of the dwelling*. This proxy variable is an index that reflects the extent of poverty of the household. This index includes information on some characteristics of the dwelling, such as the material of the floor (dirt, cement, or wood floor), access to

piped water, and access to sewer. The index takes values from zero to three, depending on how many of these valued characteristics are observed in the dwelling. This variable is expected to have a positive impact on the probability of access to formal financial services.

7. *Age of the head of household.* This variable measures the head of household's age in years. This variable may have either a positive or a negative impact on the probability of access to formal financial services. However, the usual expectation is to find a greater demand for credit among the younger heads of household (who have not yet accumulated sufficient resources of their own) and a greater demand for deposit facilities among the older heads of household.

8. *Access to formal deposits.* This is a dummy variable that takes the value of one if the household has access to deposit facilities and zero otherwise. It is expected that the holding of deposits positively affects the probability of having access to formal credit. *Access to formal deposits* is identified when the household has, at the moment of the survey, at least one savings account in any one of several types of financial institutions, such as a *cajas de ahorro*, *cajas solidarias*, *sociedades de ahorro y préstamo* (savings and loan associations), cooperatives, *uniones de crédito*, banks, *Banco del Ahorro Nacional y Servicios Financieros* (BANSEFI), or in any other formal and semiformal institution.

9. *Access to formal loans.* This is a dummy variable that takes the value of one if the household has access to formal loans and zero otherwise. *Access to formal loans* is

identified when the household obtained at least one formal loan during the twelve months prior to when the survey was conducted. This loan may have been granted by several types of financial institutions, such as *cajas de ahorro*, *cajas solidarias*, *sociedades de ahorro y préstamo*, cooperatives, *uniones de crédito*, banks, *sociedades financieras de objeto limitado* (SOFOLÉS), or by government institutions such as NAFINSA (*Nacional Financiera*), *Financiera Rural*, and FIRA (*Fideicomisos Instituidos en Relación con la Agricultura*).

5.2 *The second stage: Schooling gap*

This thesis attempts to assess whether access to financial services has an impact on human capital formation (schooling). The dependent variable (*schooling gap*) in the second stage of the estimation captures the accumulated schooling history of each child. This variable is the number of years of the difference between the expected level of education, according to the child's age, and the highest level of education actually completed. Thus,

$$gap = \max \{0, \text{expected education} - \text{actual education}\}$$

$$\text{Expected education} = \begin{cases} 0 & \text{if } age \leq 6 \\ (age - 6) & \text{if } 7 \leq age \leq 18 \\ 12 & \text{if } age > 18 \end{cases}$$

The vector Z in equation (4.23) includes individual and household characteristics. The corresponding proxies used to represent these characteristics are described next.

***Individual variables.** These variables include child characteristics, such as age and gender.

1. *Age.* This variable measures the child's age in years. A positive relationship between the schooling gap and the child's age is expected. This implies that, when the child is older, it is more likely that the schooling gap is greater.

2. *Gender.* This is a dummy variable that takes the value of one if the child is a girl and zero otherwise. With the inclusion of this variable, I can distinguish if there is a difference between the schooling gaps by gender. The expected sign is positive. In a rural context in developing countries, it is more likely that the parents have a greater preference for the education of boys than girls, given the assumption that boys will be heads of household.

***Household variables.** These are variables shared by all the children in a given household. These variables are the stock of human capital of household workers, the amount of arable land, the presence of adverse shocks, access to transfers from public programs, remittances, dwelling ownership, overcrowding, the quality of the dwelling, having a woman borrower in the household, the dependency ratio, the use of informal sources of savings, and having a family business.

1. *Human capital of household workers.* As in the previous section, this variable is measured as the sum of the years of schooling of the household workers over 14 years

of age. This variable is expected to negatively affect the schooling gap, because it may reflect the household's income-earning capacity as well as perceptions about returns to education, as used in Maldonado and Gonzalez-Vega (2008).

2. *Arable land*. This variable is measured in hectares. It represents the total area of land used for crops and other productive activities. The sign of the coefficient for this variable may be positive, if the household employs family labor, including children, in the cultivation of this land. However, the sign may be negative if having a big area of land represents more wealth for smoothing household consumption during emergencies.

3. *Adverse shocks*. There are two variables to represent adverse household shocks. The first one is a dummy variable that takes the value of one if the household has been exposed to at least one adverse shock that affects the household's income in a twelve-month period and zero otherwise. The second one is a variable that reflects the accumulation of shocks for a household in the second wave of the panel. This variable takes values from zero to two, depending on how many times the household has been exposed to at least one negative shock in the two years of observation. These shocks may be a reduction in sales, a reduction of agricultural yields or output, illness, a natural disaster, unemployment, a reduction in agricultural prices, and death in the family. The expected sign for the coefficient for these variables is positive, which means that an increase in the schooling gap may be due to the household's exposure to adverse shocks, as broadly claimed in the literature.

4. *Transfers from public programs.* A distinction is made between transfers from the Progresa program and transfers from other public programs. It is expected that these two variables will have a negative impact on the schooling gap. However, the relationship between the conditional cash transfers from Progresa should be stronger, given that transfers from this program are contingent on sending the children to school (De Janvry et al., 2006). One of the criteria to determine the amount of money that households receive from Progresa is the level of the school grade that the children are taking, so these households have a greater incentive to keep their children at school longer.

5. *Remittances.* This variable is the amount in thousands of Mexican pesos that the household receives from remittances during the year. It is expected that this variable has a negative impact on the schooling gap. If households receive an extra stable income flow, not correlated to local shocks, it is likely that households may be able to pay for education and that the opportunity cost of sending their children to school would be lower. Moreover, special remittances may be received in the case of adverse shocks.

6. *Dwelling ownership.* This is a dummy variable that takes the value of one if the household is the owner of the dwelling and zero otherwise. This variable is a proxy for the household's wealth. It is expected that the coefficient will have a negative sign.

7. *Overcrowding.* This variable is constructed by dividing the number of people in the household by the number of bedrooms. The sign of this variable is expected to be positive. This variable represents the extent to which the members of the household have

to share their living quarters. An indirect effect on the schooling gap is observed when a high level of household overcrowding negatively affects the children's health and this, in turn, may diminish their school attendance or may be a reason for failing a grade.

8. *Quality of the dwelling*. As in the previous section, this variable is an index that includes information about some characteristics of the dwelling, such as material of the floor, access to piped water, and access to sewer. A smaller schooling gap is expected for higher values of this index.

9. *Woman borrower*. This is a proxy variable for women empowerment. It is a dummy variable that takes the value of one if there is at least one woman borrower in the household. This variable is expected to have a negative impact on the schooling gap, given the idea that the ability of female household members to generate income flows as a result of borrowing increases their power in the household's decision-making process (Romero, 2002). In general, females are expected to have stronger preferences than males towards the schooling of their children (Parish and Willis, 1993). This empowered female's influence on schooling decisions reduces the schooling gap.

10. *Dependency ratio*. This variable is constructed as the number of household members minus the number of household workers divided by the number of household workers. The coefficient for this variable is expected to have a positive sign, because the lower the number of workers compared to household size, the greater the difficulties in supporting the required levels of household consumption and the more limiting will be the budget constraint.

11. *Informal mechanisms of saving*. This is a dummy variable that takes the value of one if the household has access to informal mechanisms of savings and zero otherwise. Households may turn to these alternative holdings of funds when they must cope with lower incomes or emergencies, so the expected sign is negative. This variable includes the observation if the household has access to informal rotating credit and savings associations (*tandas*), or if the household saves with friends or neighbors, or if the household saves its money at home, or if the household lends money to others.

12. *Family business*. This is a dummy variable that takes the value of one if the household has a family business and zero otherwise. The impact of this variable on the schooling gap is ambiguous; it may be either positive or negative, for the same reasons indicated for having some land area for cultivation, given the potential impact of business expansion on child labor demand (Maldonado and Gonzalez-Vega, 2008).

CHAPTER 6

DATA AND ECONOMETRIC RESULTS

The purpose of this chapter is to report the empirical results of the analysis. This report includes a discussion of the descriptive statistics for the variables that were defined in Chapter 5. Further, this chapter seeks to portray the financial situation of rural households in Mexico before the observations of the panel and during the first two waves of the survey, in the understanding that there has been a specific intervention (PATMIR) to increase the access to finance of households in the rural areas. The financial environment of these households is described, with an identification of the alternative sources of formal and informal access, by type of financial service.

Finally, this chapter reports the econometric results of the bivariate probit estimations of the probability of access to loans and deposit facilities and the OLS regressions used to establish the influence of access to deposit facilities and formal loans on schooling.

6.1 The survey data

The Mexican Ministry of Agriculture (SAGARPA) and the National Savings and Financial Services Bank (BANSEFI) commissioned the implementation of an annual household panel survey from 2004 until 2007, with support from a World Bank project on rural financial markets. This thesis uses the sample of households related to the PATMIR project, which has operated within the SAGARPA.

The households interviewed have been divided into two groups according to their access to financial institutions, as the only difference between the two sets. *Treatment* households are those that have at least one member in the family who is a client of a financial institution, while *control* households are those that do not have any member in the family who is a client of a financial institution. The objective of this survey has been to learn about the differences in access to financial services over time between the two types of households, which otherwise have similar socio-economic characteristics.

The sampling for the survey was implemented in different stages. All the Mexican states were divided into three groups or regions, according to their geographic location (north, center, and south). Each region was then divided into four strata, according to the estimated number of clients of financial institutions (that is, according to the density of access to financial services in each particular area). The institutions were grouped, in turn, into very small, small, medium, and large institutions.

In the first stage, financial institutions were randomly selected from each stratum, with a proportional allocation. That is, the number of institutions selected for each

stratum was proportional to the size of the stratum (in terms of the numbers of estimated clients). In the second stage, clients (the *treatment* group) were randomly selected from the financial institutions that had been previously selected, in the first stage. This selection was made using the client directory of each one of the institutions as sampling framework (Berumen and Associates, 2006).

Once the localities where the selected clients lived were identified, an additional sample of *control* households was selected in the same localities where the (treatment) clients lived. Some filter questions were applied to generate this new sample of households. The objective of the filter was the identification of households that did not have any member in the family who was a client of any financial institution. As a result, those households that passed the filter became part of the control group in the survey. The selection of these households did not follow an independent process such as was used for the treatment households (Berumen and Associates, 2006).

Four waves of the survey have already been undertaken (2004, 2005, 2006 and 2007). However, only information from the first two waves is used in this thesis. Mostly for practical (budgetary) reasons, the number of households incorporated in the third wave was much smaller than the original numbers. This reduction in sample size poses challenges of attrition that cannot be properly addressed in this thesis. In turn, the information from the last wave was not available at the time when the thesis was being written. The availability of these two additional waves opens, however, opportunities for future research, provided that the issues related to attrition can be resolved. The first two

waves used here allow, nonetheless, an assessment of the influence of access to financial services on schooling outcomes.

The total sample size for the survey is about 5,700 households, of which 1,400 households correspond to the SAGARPA-PATMIR regions, the focus of this thesis. The survey gathers detailed information from households on assets and liabilities (physical and financial, formal and informal), expenditures, level of income (from labor and non-labor sources), productive activities, remittances, and income shocks, among other variables (Zapata-Alvarez, 2007a).

This thesis uses the first two waves of the panel (2004 and 2005) with respect to the PATMIR sample. There are 1,179 households with at least one child from 6 to 18 years old in the first wave and 938 households with at least one child from 6 to 18 years old in the second wave of the panel. For the explanation of the schooling gap, however, the unit of analysis is each particular *ith.* child. The econometric analysis is thus implemented for three different samples of children, the *pooled* sample (4,471 children), which includes information from the two waves, the *first-wave* sample (2,513 children), and the *second-wave* sample (1,958 children). Given that, in Mexico, children start elementary school when they are six years old, the cohort ages for the three samples are children from six to eighteen years old.

For the purposes of this thesis, a new classification of the households is adopted. Households are identified as *having access to deposit facilities* in those cases where they have at least a savings account at the time when the survey was implemented, in contrast

to households that do not have access to formal deposits. For the first wave, around 47 percent of the households have access to deposit facilities; while, in the second wave, 52 percent of the households have access to deposit facilities.

6.2 Descriptive statistics

6.2.1 Variables used in the estimation of the influence on schooling

The distribution of the schooling gap for the pooled sample is reported in Table 1. This table indicates that around 34 percent of all the children in the sample do not present a schooling gap, while 40 percent exhibit one year of schooling gap. Descriptive statistics for the children's characteristics are reported in Tables 2, 3 and 4 for the pooled sample, the first-wave sample, and the second-wave sample, respectively.

These three tables report that the **schooling gap** is greater among households without access to deposit facilities than among households with access to formal deposits. The differences of the average schooling gap between the two types of households are 0.23, 0.27, and 0.16 (years) for each sample, respectively. These differences are statistically significant at the 1 percent level of significance (significance is designated by * in all the tables). The average schooling gap is greater in around one-tenth of a year for households in the first wave than for households in the second wave (1.27 versus 1.16 years). This reduction of the gap between waves is observed for both types of household, and it likely represents gradual improvements over time in access to schooling among all Mexican households.

Schooling gap (years)	Frequency (children)	Percentage	Cumulative
0	1,523	34.06	34.06
1	1,799	40.24	74.30
2	575	12.86	87.16
3	266	5.95	93.11
4	119	2.66	95.77
5	74	1.66	97.43
6	56	1.25	98.68
(7-12)	59	1.32	100
Total	4,471	100	

Table 1: Schooling gap of children from the pooled sample

The average **child age** for the three samples is 12 years old. The second-wave sample is the only one for which there is no a statistically significant difference of children ages between the two types of households. In the case of the other samples (pooled and first-wave), the children of households with deposit facilities are older by around one-fourth of a year. Older children are expected to show larger gaps. Moreover, the tables report that around 50 percent of the children are girls in all the samples, and there are no significant **child gender** differences between households with and households without access to formal deposits for the first-wave and second-wave samples.

All households (4,471 children)					Households with access to deposits (2,148 children)		Households without access to deposits (2,323 children)		t-statistic for the difference
Variable	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Mean	Std. Dev.	
Schooling gap	1.22	1.52	0	12	1.10	1.39	1.33	1.63	5.05*
Child age	12.17	3.64	6	18	12.28	3.65	12.06	3.64	-1.99*
Child gender:1, girl	0.49	0.50	0	1	0.48	0.50	0.51	0.50	2.05*

Table 2: Descriptive statistics of the children characteristics in the pooled sample

All households (2,513 children)					Households with access to deposits (1,165 children)		Households without access to deposits (1,348 children)		t-statistic for the difference
Variable	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Mean	Std. Dev.	
Schooling gap	1.27	1.59	0	12	1.12	1.43	1.39	1.70	4.31*
Child age	12.16	3.65	6	18	12.31	3.66	12.02	3.64	-1.96*
Child gender:1, girl	0.50	0.50	0	1	0.49	0.50	0.51	0.50	1.29

Table 3: Descriptive statistics of the children characteristics in the first-wave sample

All households (1,958 children)					Households with access to deposits (983 children)		Households without access to deposits (975 children)		t-statistic for the difference
Variable	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Mean	Std. Dev.	
Schooling gap	1.16	1.43	0	12	1.08	1.34	1.24	1.51	2.55*
Child age	12.18	3.63	6	18	12.25	3.64	12.12	3.63	-0.77
Child gender:1, girl	0.49	0.50	0	1	0.47	0.50	0.50	0.50	1.58

Table 4: Descriptive statistics of the children characteristics in the second-wave sample

Tables 5 and 7 report descriptive statistics about household characteristics observed for the first and the second wave of the survey, respectively. Moreover, Tables 6 and 8 report these household characteristics according to whether the households have access to formal deposit facilities or not.

The costs of bridging the *distance* between the client and the financial institution are a major component of transaction costs. The average **travel costs** of getting to the financial institution in seeking one type of service or the other are higher for households that do not have access to formal deposits. These costs are particularly higher for non-depositors when related to the possibility of depositing (\$16 versus \$9 and \$19 versus \$11 Mexican pesos per trip, for the first and the second waves, respectively).

For both waves, the average cost is higher for getting to an institution to make a deposit than for getting to an institution to ask for a loan (\$13 versus \$12 Mexican pesos in the first wave, and \$15 versus \$11 in the second wave). It seems that, on average, there is a greater distance to deposit-taking institutions than to the available credit facilities.

This component of transaction costs is high, given the expected small amounts of the deposits. If two trips (to deposit and to withdraw the funds) cost on average \$30, this would represent 5 percent of a deposit balance of \$ 600. Thus, just one set of trips may be enough to wipe out any annual interest earnings on the deposit. The impact of these costs increases as deposit size declines and as the number of depositor transactions in a year rises. These differences are reflected by the large standard deviation of these costs.

Remittances and public transfers add to the household's liquidity and expand its budget constraint. The average total amount of **remittances** that the household receives annually is significantly higher for households with access to deposit facilities; this may anticipate a positive relationship of remittances with access to formal deposits. International remittances are the bulk of these earnings, which show much variability across households.

The **total transfer from public programs** is also greater for those households with access to deposits; the first-wave households with access to deposit facilities receive \$2,620 Mexican pesos per year, compared to \$2,170 that are received from public programs by households without access to deposits.

The amount of the conditional cash transfers from the **Progresa** program is not statistically different between the two types of households, in either one of the two waves; on average, households from the first wave receive \$1,400 Mexican pesos per year and households from the second wave receive \$2,000 per year from Progresa. This transfer depends on the number of children and the level of schooling (grade) that they are attending. As most eligible households choose to receive the cash transfer, both types of household appear to have access to this subsidy.

In the case of the second wave, the amount of **transfers from public programs, excluding Progresa**, is not statistically different between households with access to deposit facilities and households without access to formal deposits. In the case of the first-wave sample, however, this transfer is statistically significant larger among

households with access to deposit facilities than among those without access. This observation may suggest the possibility of a positive relationship between public transfers and household use of deposit facilities.

Farm size reflects the household's wealth and ability to generate income from crops. The mean **land area** for cultivation is statistically significant and larger for households with access to deposit facilities, in the case of the first wave. On average, this area amounts to 1.8 and 1.2 hectares in the first wave and the second wave, respectively. In the case of the second-wave sample, however, there is no significant difference according to land area between the two sets of households.

Variable	Number of observations	All households			
		Mean	Std. Dev.	Min	Max
					1,179
Travel cost to get a loan	12	29	0	340	
Travel cost to make a deposit	13	21	0	200	
Remittances	2.1	10.4	0	200	
Remittances per capita	0.4	2.1	0	33	
Domestic remittances	0.3	2.1	0	30	
Domestic remittances per capita	0.1	0.5	0	11	
International remittances	1.8	10.3	0	200	
International remittances per capita	0.4	2	0	33	
Public transfers (excluding Progresa)	1	3.5	0	70	
Public transfers per capita (excluding Progresa)	0.2	0.6	0	14	
Public sector transfers	2.4	4.6	0	70	
Public sector transfers per capita	0.4	0.9	0	14	
Progresa	1.4	3.1	0	60	
Progresa per capita	0.3	0.6	0	10	
Land hectares	1.8	5.8	0	76	
Land hectares per capita	0.3	1.1	0	12	
Index quality dwelling	1.9	1	0	3	
Dependency ratio	2.9	1.8	0	12	
Overcrowding	2.2	1.4	0.3	13	
Sum schooling workers	11	9	0	60	
Schooling male head	7	5	0	17	
Schooling female head	7	4	0	18	
Index marginality	-0.7	0.5	-1.5	3	
Toddlers	0.5	0.8	0	5	
Elderly	0.2	0.5	0	3	
Head household age	45	13	17	87	
Adults older than 18	3	1	1	10	
Locality:1, rural	0.69	0.46	0	1	
Dwelling: 1, owner	0.77	0.42	0	1	
Family business:1, HH has	0.37	0.48	0	1	
Shock:1, HH has suffered	0.52	0.50	0	1	
Borrower woman:1, at least one in HH	0.36	0.48	0	1	
Head household gender:1, woman	0.17	0.38	0	1	
Remittances:1, HH receives	0.14	0.35	0	1	
Formal loans:1, access	0.20	0.40	0	1	
Formal deposits:1, access	0.47	0.50	0	1	
Informal sources of savings:1, access	0.43	0.50	0	1	
Informal loans	0.28	0.45	0	1	

Remittances and transfers are in thousands of Mexican pesos

Table 5: Descriptive statistics of the household characteristics in the first wave

	Households with access to formal deposits		Households without access to formal deposits		t-statistic for the difference
	560		619		
Variable	Mean	Std. Dev.	Mean	Std. Dev.	
Travel cost to get a loan	11	28	13	30	0.78
Travel cost to make a deposit	9	18	16	23	5.73*
Remittances	3.3	14.1	1	5	-3.78*
Remittances per capita	0.7	2.7	0.2	1.2	-3.59*
Domestic remittances	0.3	1.9	0.3	2.3	0.38
Domestic remittances per capita	0.1	0.4	0.1	0.6	0.82
International remittances	3	14	0.7	4.4	-3.92*
International remittances per capita	0.6	2.7	0.1	1	-3.91*
Public transfers (excluding Progresa)	1.2	4	0.9	2.9	-1.77*
Public transfers per capita (excluding Progresa)	0.2	0.8	0.2	0.5	-1.91*
Public sector transfers	2.6	5.4	2.2	3.9	-1.65*
Public sector transfers per capita	0.5	1	0.4	0.7	-1.60
Progresa	1.4	3.6	1.3	2.4	-0.51
Progresa per capita	0.3	0.7	0.3	0.5	-0.34
Land hectares	2.3	7	1.2	4.3	-3.30*
Land hectares per capita	0.5	1.4	0.2	0.8	-3.49*
Index quality dwelling	2	1	1.8	1	-2.94*
Dependency ratio	2.6	1.8	3.1	1.8	4.07*
Overcrowding	2	1.3	2.4	1.4	5.77*
Sum schooling workers	14	11	8	7	-10.13*
Schooling male head	8	5	6	4	-8.32*
Schooling female head	8	5	6	4	-8.27*
Index marginality	-0.7	0.5	-0.7	0.5	-1.16
Toddlers	0.5	0.8	0.6	0.8	1.66*
Elderly	0.2	0.5	0.2	0.5	1.26
Head household age	46	13	45	14	-2.23*
Adults older than 18	3	1	3	1	-3.23*
Locality:1, rural	0.70	0.46	0.67	0.47	-1.16
Dwelling: 1, owner	0.80	0.40	0.74	0.44	-2.43*
Family business:1, HH has	0.46	0.50	0.28	0.45	-6.56*
Shock:1, HH has suffered	0.51	0.50	0.53	0.50	0.89
Borrower woman:1, at least one in HH	0.44	0.50	0.29	0.45	-5.42*
Head household gender:1, woman	0.14	0.35	0.20	0.40	2.32*
Remittances:1, HH receives	0.19	0.39	0.10	0.30	-4.34*
Formal loans:1, access	0.40	0.49	0.02	0.14	-18.59*
Formal deposits:1, access	1	0	0	0	.
Informal sources of savings:1, access	0.47	0.50	0.40	0.49	-2.39*
Informal loans	0.29	0.45	0.27	0.44	-0.61

Remittances and transfers are in thousands of Mexican pesos

Table 6: Descriptive statistics of the household characteristics in the first wave by depositors and no depositors (t-statistic of the difference in means between groups is reported)

Another proxy for wealth is housing. The **quality of the dwellings** is better for households with access to formal deposits. According to the descriptive results, in both waves of the survey the dwellings have, on average, two of the three basic services incorporated in the index (access to piped water, access to sewer, and a floor that is not dirt). Moreover, almost 80 percent of all the households are owners of the **dwelling** where they live.

The observations for the level of **overcrowding** indicate that households that do not have access to deposit facilities have a higher level of overcrowding. On average, there are two family members per room for all the households. The means tests for these three variables (namely, quality of dwellings, dependency, and overcrowding) are statistically significant at the 1 percent level of significance when comparing households with and without access to deposit facilities, except for the variable dependency in the second-wave sample. In general, therefore, the variables that proxy for wealth have a positive association with the status of being a depositor.

The **average age of the head of household** is 45 and 46 years old in the first and second wave, respectively. Table 6 reports that the head of household is older among households with access to formal deposits, as expected according to life cycles.

In turn, the **dependency ratio** is higher for households with access to formal deposits, since this ratio is around 3 compared to 2.5 dependents per worker for households without access to deposits.

Variable	All households				
	Number of observations	Mean	Std. Dev.	Min	Max
					938
Travel cost to get a loan	11	21	0	150	
Travel cost to make a deposit	15	25	0	150	
Remittances	2	11.4	0	218	
Remittances per capita	0.4	2.3	0	44	
Domestic remittances	0.3	2.6	0	48	
Domestic remittances per capita	0.1	0.7	0	12	
International remittances	1.6	11.1	0	218	
International remittances per capita	0.3	2.2	0	44	
Public transfers (excluding Progresa)	1.1	2.9	0	21	
Public transfers per capita (excluding Progresa)	0.2	0.6	0	4.2	
Public sector transfers	3	4.4	0	38	
Public sector transfers per capita	0.6	1	0	19	
Progresa	1.9	3.2	0	38	
Progresa per capita	0.4	0.8	0	19	
Land hectares	1.2	8.9	0	250	
Land hectares per capita	0.2	1.6	0	42	
Index quality dwelling	2	1	0	3	
Dependency ratio	2.8	1.8	0	12	
Overcrowding	2	1.2	0.1	9	
Sum schooling workers	11	9	0	57	
Schooling male head	7	5	0	17	
Schooling female head	7	4	0	18	
Index marginality	-0.7	0.5	-1.5	2.65	
Toddlers	0.5	0.8	0	4	
Elderly	0.2	0.5	0	3	
Head household age	46	13	20	98	
Adults older than 18	3	1	1	8	
Locality:1, rural	0.70	0.46	0	1	
Dwelling: 1, owner	0.79	0.41	0	1	
Family business:1, HH has	0.33	0.47	0	1	
Shock:1, HH has suffered	0.44	0.50	0	1	
Accumulated shock	0.95	0.76	0	2	
Borrower woman:1, at least one in HH	0.24	0.43	0	1	
Head household gender:1, woman	0.16	0.36	0	1	
Remittances:1, HH receives	0.13	0.34	0	1	
Formal loans:1, access	0.19	0.40	0	1	
Formal deposits:1, access	0.52	0.50	0	1	
Informal sources of savings:1, access	0.59	0.49	0	1	
Informal loans	0.20	0.40	0	1	

Remittances and transfers are in thousands of Mexican pesos

Table 7: Descriptive statistics of the household characteristics in the second wave

Variable	Households with access to formal deposits		Households without access to formal deposits		t-statistic for the difference
	Mean	Std. Dev.	Mean	Std. Dev.	
	Number of observations 487		451		
Travel cost to get a loan	10	19	13	22	1.87*
Travel cost to make a deposit	11	19	19	30	4.55*
Remittances	3	15.2	0.8	4.1	-2.96*
Remittances per capita	0.6	3	0.2	1.1	-2.82*
Domestic remittances	0.4	3.1	0.2	2	-1.28
Domestic remittances per capita	0.1	0.7	0.1	0.7	-0.84
International remittances	2.6	14.9	0.6	3.7	-2.73*
International remittances per capita	0.5	2.9	0.1	0.8	-2.68*
Public transfers (excluding Progresa)	1.2	2.9	1	3	-0.76
Public transfers per capita (excluding Progresa)	0.2	0.6	0.2	0.5	-1.20
Public sector transfers	3.1	4.2	3	4.5	-1.27
Public sector transfers per capita	0.6	0.8	0.5	1	-0.97
Progresa	2	3.1	1.7	3.3	-1.04
Progresa per capita	0.4	0.6	0.4	1	-0.36
Land hectares	1.3	4.3	1.2	12	-0.18
Land hectares per capita	0.3	0.9	0.2	2	-0.51
Index quality dwelling	2.1	1	2	1	-1.50
Dependency ratio	2.6	1.7	3	1.8	3.37*
Overcrowding	1.8	1	2.3	1.3	5.61*
Sum schooling workers	13	10	10	8	-5.31*
Schooling male head	8	5	6	4	-5.06*
Schooling female head	8	4	6	4	-6.27*
Index marginality	-0.7	0.5	-0.8	0.5	-1.28
Toddlers	0.5	0.7	0.6	0.8	2.59*
Elderly	0.1	0.4	0.2	0.5	1.51
Head household age	46	12	46	14	-0.43
Adults older than 18	3	1	3	1	0.17
Locality:1, rural	0.71	0.45	0.70	0.46	-0.40
Dwelling: 1, owner	0.82	0.38	0.76	0.43	-2.38*
Family business:1, HH has	0.38	0.49	0.28	0.45	-3.36*
Shock:1, HH has suffered	0.43	0.50	0.45	0.50	0.51
Accumulated shock	0.92	0.77	0.98	0.75	1.26
Borrower woman:1, at least one in HH	0.30	0.46	0.18	0.38	-4.44*
Head household gender:1, woman	0.15	0.35	0.17	0.38	1.05
Remittances:1, HH receives	0.16	0.37	0.10	0.30	-2.66*
Formal loans:1, access	0.34	0.47	0.04	0.19	-12.80*
Formal deposits:1, access	1	0	0	0	.
Informal sources of savings:1, access	0.61	0.49	0.57	0.50	-1.18
Informal loans	0.18	0.38	0.22	0.41	1.49

Remittances and transfers are in thousands of Mexican pesos

Table 8: Descriptive statistics of the household characteristics in the second wave by depositors and no depositors (t-statistic of the difference in means between groups is reported)

There are substantial differences in the size of the stock of human capital possessed by the households in the sample. They reflect differences in the number of workers per household and in their levels of schooling. Thus, for the pooled sample, the stock of human capital ranges from 0 to 60 years of accumulated schooling. The accumulated number of years of **schooling of household workers** is greater among households with access to deposit facilities than among households without access to these facilities (14 versus 8 years of schooling in the first wave, and 13 versus 10 years of schooling in the second wave). Thus, a strong correlation between levels of household education and access to deposits should be expected. The household's stock of human capital, moreover, is also positively correlated with wealth and other variables that may influence schooling.

Typically, education helps bridge the cultural distance between potential clients and financial institutions. Schooling has further influences on income-earning abilities, willingness to undertake riskier investments, and ability to interact with formal process that may influence the probability of access to financial services. There is much heterogeneity, however, in terms of schooling achievements and local opportunities to earn a return on human capital as well as in terms of the supply and availability of financial services in each locality.

Given the fact that the PATMIR program reaches very **rural communities**, it is not surprising that around 70 percent of the households live in rural areas. The rurality of this population represents a particular challenge in providing a cost-effective supply of financial services. Appropriate policy interventions may help overcome these challenges.

On average, 35 percent of all the households operate a **family business**. The proportion of households that possess a family business is higher for those households having access to formal deposits (46 versus 28 percent in the first wave, 38 versus 28 percent in the second wave). The operation of family businesses generates demands for liquidity management that are facilitated by access to deposit facilities.

A key hypothesis in this thesis is that, in this environment of incomplete markets and missing financial services, adverse shocks have an adverse impact on the demand for schooling. More than half (52 percent) of all the households had suffered a **shock** in the past twelve months, at the time of the first wave. This proportion was 44 percent for the second-wave sample. Moreover, the **accumulation of shocks** over the two waves represented 0.95 (when a given household suffered a shock in one or both waves). Therefore, the incidence of substantial risk among the households in the sample is high, and their choices will reflect their efforts in coping with this vulnerability. The incidence of adverse shocks is greater among households without access to deposit facilities and the difference of the means between the two types of households is statistically significant. In particular, the accumulation of shocks is 0.92 versus 0.98 –out of 2 maximum possible shocks– for those with access versus those without access to deposits, respectively. Thus, not only are households without deposits more exposed to risk, but they also more frequently lack access to financial instruments to cope with this risk.

Households with access to deposit facilities have at least one **woman borrower** in a greater proportion than those without deposits. This percentage is lower among the households in the second wave (36 versus 24 percent of households with at least one

woman borrower in the first and second wave, respectively). Deposit accounts facilitate, in general, access to formal credit. They may play a special role in facilitating female access to loans.

Finally, the use of **informal mechanisms of saving** is greater for households with access to formal deposits, for the two waves; however, the mean test between the two types of households is only significant for the first wave.

6.2.2 Financial variables

This section portrays the financial experience of rural households in Mexico before the survey and during the first two waves of the panel. This analysis includes the characterization of the different sources of financial services, either for depositing or for borrowing. The survey data make it possible to identify four alternatives for the management of household finances: formal deposits, formal credit, informal mechanisms of saving, and informal credit. The data also offer information about the household's financial history, when the households reported, at the time of the first wave, to have had a loan at some point in time before the survey.

The definitions of formal deposits, formal credit, and informal mechanisms of savings are already included in Chapter 5. *Informal credit* is constructed with observations of whether the household had had at least one loan in the previous twelve months at the time of the survey from friends, relatives, neighbors, boss, moneylender, pawnshop, informal savings club, merchant or store that sells on credit.

The use of either one of these services is described as *access* to a particular source. This access has been the result, in each case, of a coincidence of demand and supply. Some households may have *latent* access to services, for example loans, but they may choose not to exercise this access at a particular time and, therefore, use of the service is not observed. This may be the case with informal credit, as households may seek these loans mostly in times of emergency but do not necessarily borrow from these informal sources all the time.

The descriptive statistics about the *historical* financial variables (prior use of formal credit and prior use of informal credit) are reported in Table 9. The descriptive statistics about the *current* financial variables (formal deposits, formal credit, informal credit, and informal mechanisms of saving) for the first and the second wave are reported in Tables 10 and 11, respectively.

It is important to emphasize that the construction of each financial variable takes into account the access by the households to **at least one** of the particular sources that are included in each one of the categories. Thus, given that there are some households that use more than one type of source within the same category (for example, both friends and relatives and store credit), the sum of all the financial relationships of the households with the various sources in each and all the categories is greater than the number of households reported here as having access to that particular category.

	Percentage with respect to: 1,179	Number of households	
Prior access to formal credit	29.3	346	
			<i>% with respect to:</i>
Prior formal credit from:			361
Instituciones de ahorro y credito popular	26.7	315	87.3
Banks	1.4	16	4.4
SOFOL	0.2	2	0.6
Government organizations	2.4	28	7.8
Prior access to informal credit	47.1	555	
			<i>% with respect to:</i>
Prior informal credit from:			751
Friend, neighbor	28.9	341	45.4
Merchant	13.6	160	21.3
Lender	3.1	37	4.9
Store credit	10	118	15.7
Boss	3.8	45	6
Pawnshop	2	24	3.2
Savings club	0.6	7	0.9
Other entity	1.6	19	2.5

Table 9: Descriptive statistics of the historical financial variables in the first wave

According to Table 9, around 30 percent of the households in the first wave report to have had at least one formal loan at any point in the past. Most of this formal credit was obtained from the category of *instituciones de ahorro y crédito popular*, which includes *cajas de ahorro*, *cajas solidarias*, *sociedades de ahorro y préstamo*, cooperatives, and *uniones de crédito*. This category represents 87 percent of the number of households that had had prior access to formal credit (361 households) and, in turn, these borrowers from *cajas* and equivalent organizations in the sector represent 26 percent of all the households in the first wave (1,179 households). In contrast, formal credit from a *sociedad financiera de objeto limitado* (SOFOL) appears to be an

infrequent option for rural households, since only 2 out of the 1,179 households had had access to credit from a SOFOL prior to the survey.

Among rural households, the use of informal sources of finance is significant, as 47 percent of the households in the first wave reported to have had access to informal credit at some point in the past. Almost half of the households borrowing from informal sources (45.4 percent) turned to friends, relatives and neighbors for these loans, which usually involve a reciprocal obligation. Borrowers from friends, relatives and neighbors accounted for about one-third of the households in the whole sample. The next important sources of informal credit are merchants and stores that sell on credit. These two categories add up to 37 percent of the number of households with borrowers from informal sources (a total of 751 households).

	Percentage with respect to: 1,179	Number of households	
Access to formal deposits	47.5	560	
			<i>% with respect to:</i>
<i>Formal deposits from:</i>			661
Instituciones de ahorro y credito popular	46.6	550	83.2
Banks	7.6	90	13.6
BANSEFI	0.9	11	1.7
Other entity	0.8	10	1.5
Access to formal credit	20.1	237	
			<i>% with respect to:</i>
<i>Formal credit from:</i>			244
Instituciones de ahorro y credito popular	18.2	215	88.1
Banks	0.9	11	4.5
SOFOL	0	0	0
Government organizations	1.5	18	7.4
Access to informal credit	27.7	327	
			<i>% with respect to:</i>
<i>Informal credit from:</i>			409
Friend, neighbor	13.8	163	39.9
Merchant	8.6	101	24.7
Moneylender	1.9	22	5.4
Store credit	5.4	64	15.6
Boss	2	24	5.9
Pawnshop	1.6	19	4.6
Savings club	0.3	3	0.7
Other entity	1.1	13	3.2
Access to informal sources of savings	43.3	511	
			<i>% with respect to:</i>
<i>Informal sources of savings:</i>			665
Tandas	19	224	33.7
Save with someone	1.1	13	2
Save at home	28.5	336	50.5
Lend money	7.8	92	13.8

Table 10: Descriptive statistics of the financial variables in the first wave

	Percentage		
	with respect to:	Number of	
	938	households	
Access to formal deposits	51.9	487	
			<i>% with respect to:</i>
<i>Formal deposits from:</i>			566
Instituciones de ahorro y credito popular	47.7	447	79
Banks	7.6	71	12.5
BANSEFI	4.2	39	6.9
Other entity	1	9	1.6
Access to formal credit	19.4	182	
			<i>% with respect to:</i>
<i>Formal credit from:</i>			187
Instituciones de ahorro y credito popular	17.4	163	87.2
Banks	0.9	8	4.3
SOFOL	0	0	0
Government organizations	1.7	16	8.6
Access to informal credit	19.5	183	
			<i>% with respect to:</i>
<i>Informal credit from:</i>			213
Friend, neighbor	9.3	87	40.8
Merchant	2.8	26	12.2
Moneylender	0.4	4	1.9
Store credit	5.2	49	23
Boss	0.9	8	3.8
Pawnshop	2.2	21	9.9
Savings club	0.3	3	1.4
Other entity	1.6	15	7
Access to informal sources of savings	59.2	555	
			<i>% with respect to:</i>
<i>Informal sources of savings:</i>			677
Tandas	16.3	153	22.6
Save with someone	0.9	8	1.2
Save at home	50.6	475	70.2
Lend money	4.4	41	6.1

Table 11: Descriptive statistics of the financial variables in the second wave

The main sources of current formal deposit facilities (around 80 percent of the depositors) and of current access to formal credit (almost 90 percent of formal borrowers) are also the *instituciones de ahorro y crédito popular*. These proportions represent, in turn, around 50 and 20 percent (for deposits and loans, respectively) of all the households in the samples, in each wave.

These are also the financial institutions that have typically been the focus of the PATMIR project. Given their substantial relative importance in the rural areas, the recent efforts toward the development of an appropriate framework of prudential regulation and supervision will be critical in promoting an expansion of the financial services frontier in the rural areas. Institution building efforts, such as those provided by PATMIR, will allow these institutions to meet the requirements of the new regulation and offer safer and more convenient deposit facilities to poor clients in these areas.

Banks are the second most important place for making a deposit and the third most frequent option for formal borrowing, among households from the two waves. Around 13 percent of the households that have access to formal deposits have a savings account in a bank, while only 4 percent of the households that have access to formal credit have a loan from a bank.

The other two formal sources for depositing are BANSEFI and a variety of other entities. The proportion of households that use these two sources of services is very low, however, even though BANSEFI becomes more important in the second wave. On the credit side, formal loans granted by government organizations have a more important

role for households than banks (around 8 versus 4 percent for banks among households with access to formal credit). According to both samples, access to formal credit from a SOFOL was insignificant (not observed) in either wave.

In Tables 10 and 11, access to *formal credit* and access to *informal credit* are variables constructed with information about the twelve-month period before each survey. The data reflect if the households received at least one loan not earlier than the prior year. Thus, these percentages are lower than those reported in Table 9, which refers to any time before the survey, even if obtained more than one year earlier. Therefore, the information in Table 10 is a subset of the information in Table 9.

The historically higher proportion of households with access to informal credit than to formal credit is a maintained pattern among households from the first wave. This pattern changes in the second wave, when the proportion in each category (formal and informal credit) was around 20 percent of all households each.

This observation reflects a decline in the proportion of households with access to informal sources of credit, from 28 to 20 percent from the first to the second wave. One possible explanation may be the greater incidence of adverse shocks during the first wave (52 percent, compared to 44 percent of the households in the second wave). These shocks may have required emergency informal loans among a larger proportion of the households. During the second wave, in contrast, rather than using formal loans as frequently as earlier, the proportion of households with informal mechanisms for saving increased.

Following the historical pattern, as well, most of the households that have current access to informal credit turn to friends, relatives and neighbors for getting a loan. The second most common source of informal credit among households from the first wave is the merchant that sells on credit, while store credit is the second most important source for households from the second wave. Credit from savings clubs is the least used source for getting an informal loan for households from both waves. Interestingly, there is relatively little access to informal moneylenders.

Access to informal mechanisms of saving becomes more frequent in the second wave (59 percent in the second versus 43 percent of the households in the first wave). Moreover, in the second-wave sample, the proportion of households that use informal savings is higher than the proportion of households that have access to formal deposits (59 versus 52 percent of the households).

The most common alternative for saving money –among the informal mechanisms–seems to be keeping it at home, followed in importance by participating in rotating savings and credit associations (*tandas*). Finally, among rural households in Mexico, keeping savings with someone (e.g., deposit collector) is not a common practice.

Tables 12 and 13 report the proportion of households that have access to different sources of credit and informal savings mechanisms, by type of household (that is, according to households that have access to formal deposit facilities and households that do not have access). In particular, Table 12 reports the disaggregation of households with **prior** access to formal and informal credit according to depositing and non-depositing

households. This table shows that 58 percent of those households with prior access to deposit facilities had access to formal credit in the past, in contrast to only 3 percent among households without access to formal deposits. Thus, the prior experience of these households suggests a strong connection between holding a deposit account and gaining access to formal credit. Moreover, among the two types of households, there is no difference with respect to the proportion that had access to informal credit in the past (around 47 percent). Thus, the demand for credit in the informal market of these households was satisfied independently of their status as formal depositors.

Table 13 reports the access to formal and informal credit and the use of informal savings mechanisms, by type of household and by wave. Overall, households with access to formal deposits are more likely to have access to formal credit (40 versus 2 percent for the first wave and 34 versus 3.5 percent for the second wave). This reiterated observation therefore anticipates a strong positive impact of the variable *access to deposit facilities* on the probability of access to formal credit in the bivariate probit model. It also justifies the incorporation of access to deposits in the explanation of the probability of access to credit and not the other way around.

Moreover, as in Table 12, the likelihood of access to informal credit is almost the same between the two types of household, although the proportions are higher for households from the first than the second wave (around 28 versus 20 percent). As suggested, this observation of a more frequent use of informal credit may be associated with the greater incidence of adverse shocks in the first wave.

Finally, the proportion of households that use informal mechanisms of saving is greater among households with access to formal deposits than among households without access to formal deposits, which may indicate a positive correlation between these two financial alternatives. This is true for the two waves that are used in this thesis.

	Households with access to formal deposits	Households without access to formal deposits
	Percentage with respect to:	
	560	619
Prior access to formal credit	58.4	3.1
<i>Prior formal credit from:</i>		
Instituciones de ahorro y credito popular	54.3	1.8
Banks	2.7	0.2
SOFOL	0.4	0
Government organizations	3.6	1.3
Prior access to informal credit	46.1	48
<i>Prior informal credit from:</i>		
Friend, neighbor	23.6	33.8
Merchant	15.2	12.1
Lender	3.2	3.1
Store credit	10.9	9.2
Boss	2.9	4.7
Pawnshop	3	1.1
Savings club	0.4	0.8
Other entity	3.2	0.2

Table 12: Descriptive statistics of the historical financial variables for households with access to formal deposits and households without access to formal deposits

	Wave 1		Wave 2	
	Households with access to formal deposits	Households without access to formal deposits	Households with access to formal deposits	Households without access to formal deposits
	Percentage with respect to:		Percentage with respect to:	
	560	619	487	451
Access to formal credit	40.2	1.9	34.1	3.5
<i>Formal credit from:</i>				
Instituciones de ahorro y credito popular	36.8	1.5	31.8	1.8
Banks	1.8	0.2	1.2	0.4
SOFOL	0	0	0	0
Government organizations	2.7	0.5	2.1	1.3
Access to informal credit	28.6	27	17.7	21.5
<i>Informal credit from:</i>				
Friend, neighbor	11.1	16.3	6.8	12
Merchant	10	7.3	2.7	2.9
Lender	1.8	1.9	0.4	0.4
Store credit	5.9	5	4.9	5.5
Boss	1.6	2.4	1.2	0.4
Pawnshop	2.5	0.8	2.3	2.2
Savings club	0	0.5	0.4	0.2
Other entity	2.1	0.2	1.8	1.3
Access to informal sources of savings	47	40.1	61	57.2
<i>Informal sources of savings:</i>				
Tandas	22.9	15.5	21.1	11.1
Save with someone	1.4	0.8	1	0.7
Save at home	27.7	29.2	48.9	52.5
Lend money	10.5	5.3	6.2	2.4

Table 13: Descriptive statistics of the financial variables for households with access to formal deposits and households without access to formal deposits

6.3 Econometric results

Tables 14, 15 and 16 report the results of the estimation of the bivariate probit models for the pooled sample, the first-wave, and the second-wave samples, respectively. The coefficients shown in these tables are not marginal effects, but the sign and the level of significance indicate the direction of the effect of each variable on the probability of

access to formal credit and on the probability of access to formal deposits. For the estimations that use the first-wave sample and the pooled sample, the null hypothesis that ρ equals zero is rejected at the 2 and 9 percent levels of significance, respectively. This implies that the disturbances of the probit estimation used to explain the probability of access to formal credit and the probit estimation used to explain the probability of access to formal deposits are correlated. Thus, the decision to estimate a bivariate probit model is justified for these cases.

Probability of access to formal loans		Probability of access to formal deposits	
Travel cost to get a loan	-0.01 (.002)***	Travel cost to make a deposit	-0.01 (.001)***
Locality: 1, rural	0.19 (.067)***		0.21 (.047)***
Sum schooling workers	0.0004 (.004)		0.03 (.002)***
Head household age	-0.004 (.002)*		0.0005 (.002)
Remittances	0.0003 (.002)		0.03 (.004)***
Public sector transfers	-0.02 (.006)***		0.03 (.005)***
Index quality dwelling	0.003 (.029)		0.08 (.022)***
Formal deposits: 1, access	2.11 (.254)***		
Number of observations= 4,471		F-statistic= 771.4 Prob=0.00	
$\rho = -0.35$		Wald test of $\rho = 0$ chi2=2.84 Prob=0.09	
Statistically significant at the *90%, **95% and ***99% confidence level			
Robust standard errors in parenthesis.			
Remittances and total income from public programs are in thousands of Mexican pesos.			

Table 14: Estimations results from a bivariate probit model about the probability of access to formal loans and access to formal deposits using the pooled sample

Probability of access to formal loans		Probability of access to formal deposits	
Travel cost to get a loan	-0.01 (.002)***	Travel cost to make a deposit	-0.01 (.001)***
Locality:1, rural	0.28 (.090)***		0.31 (.063)***
Sum schooling workers	-0.002 (.005)		0.04 (.003)***
Head household age	-0.005 (.003)**		0.004 (.002)**
Remittances	-0.0004 (.003)		0.03 (.005)***
Public sector transfers	-0.02 (.007)***		0.02 (.006)***
Index quality dwelling	-0.02 (.038)		0.10 (.030)***
Formal deposits:1, access	2.37 (.206)***		
Number of observations= 2,513		F-statistic= 729.9 Prob=0.00	
$\rho = -0.41$		Wald test of $\rho = 0$ chi2=6.09 Prob=0.0136	
Statistically significant at the *90%, **95% and ***99% confidence level			
Robust standard errors in parenthesis.			
Remittances and total income from public programs are in thousands of Mexican pesos.			

Table 15: Estimations results from a bivariate probit model about the probability of access to formal loans and access to formal deposits using the first-wave sample

Probability of access to formal loans		Probability of access to formal deposits	
Travel cost to get a loan	-0.012 (.003)***	Travel cost to make a deposit	-0.01 (.001)***
Locality:1, rural	0.11 (.096)		0.11 (.071)
Sum schooling workers	0.007 (.008)		0.02 (.003)***
Head household age	-0.003 (.003)		-0.003 (.003)
Remittances	0.003 (.005)		0.02 (.006)***
Total income from pp	-0.02 (.014)		0.03 (.007)***
Index quality dwelling	0.03 (.046)		0.05 (.033)
Formal deposits:1, access	1.30 (1.03)		
Number of observations= 1,958		F-statistic= 181.6 Prob=0.00	
$\rho = 0.07$		Wald test of $\rho = 0$ chi2=.014 Prob=0.9053	
Statistically significant at the *90%, **95% and ***99% confidence level			
Robust standard errors in parenthesis.			
Remittances and total income from public programs are in thousands of Mexican pesos.			

Table 16: Estimations results from a bivariate probit model about the probability of access to formal loans and access to formal deposits using the second-wave sample

With few exceptions, especially when using the second-wave sample, the results from the bivariate probit estimations about the signs of the coefficients and the levels of significance of the variables are the same when using either one of the three samples. In general, these results confirm the expectations about the determinants of the probability of household access to formal financial services.

The only surprising results from the three regressions are the effects that the type of community and the stock of human capital of household workers have on the probability of access to formal finance.

The community variable (*rurality*) has a positive relationship with both the probability of having a formal loan and the probability of having deposits in a formal financial institution. These results are surprising, given the strong urban bias that has characterized financial development in Mexico. This result may reflect, however, how the sampling was structured. The random sample was selected from localities where households with at least one member in the family was a client of a financial institution; thus, even though many of the households in the sample live in rural areas, in these particular rural areas there are financial institutions that offer facilities for deposits. Those rural communities (the largest number in Mexico) where there are no formal financial institutions at all were not eligible for the sample.

In turn, the surprising lack of significance of the influence of the stock of human capital of household workers on the probability of having access to formal credit (since a positive influence was expected) may be explained as a reflection of the scarce access to formal credit in Mexico and, in particular, in the rural areas of this country. Thus, even though there are people who have enough human capital qualifications, in these areas it is difficult for them to get a formal loan. This access is achieved only when the financial infrastructure has been extended into these communities. This reflects the importance of programs like PATMIR, which attempt to resolve the institution building challenges associated with this expansion. The stock of human capital of household workers,

however, does have a positive and statistically significant impact on the probability of having a deposit account in a financial institution.

A higher quality of housing is a signal of wealth that may have an impact on the probability of access to formal finance. Indeed, the quality of the dwelling is significant in explaining the probability of access to formal deposits, but it is not significant in explaining the probability of access to formal credit, using the pooled and the first-wave sample. Thus, both schooling and wealth have a positive influence on holdings of deposits in financial institutions (in large part from the demand side of the market) but not on access to credit (possibly because of limitations of the supply side). Thus, this may be another consequence of the very limited supply of formal credit in these communities.

The proxy variable for client transaction costs is the travel cost paid by the households to get to the financial institution. As expected, there is a lower probability of having access to formal finance (both loans and deposit facilities) when the household faces high transaction costs, and this influence is statistically significant. One way to lower transaction costs is to expand the network of financial institutions and bring them closer to where the clients are. Other transaction costs, not explicitly included in this estimation, are also important barriers to access to these services. Various policy interventions may be able to reduce the magnitude of these costs.

In the case of the first-wave sample, the age of the head of household shows a significant and positive relationship with the probability of access to formal deposits. In

turn, the relationship of age with access to credit is significant when using the pooled and the first-wave samples, where it has a negative impact on the probability of access to formal loans. These results are compatible with life cycle explanations that predict that younger households will be borrowers and that older households will be depositors.

According to the three estimations, remittances and transfers from public programs are significant variables and have a positive effect on the probability of having formal deposits. Extra liquidity from these sources and the expansion of the household's budget constraint increase the probability of saving and of holding a deposit. In turn, however, total transfers from public programs negatively affect the probability of access to formal credit. The influence of remittances is not statistically significant.

A stable flow of income from public programs may create a *substitution* effect on demanding a formal loan, as the transfer is a source of additional liquidity. Thus, the positive influence of these public transfers (for the case of Progresa) on creditworthiness, as found by Svarch (2008) for another sample in Mexico, does not seem to be sufficiently strong among the households in the PATMIR sample, at least not sufficiently strong to overcome the potential substitution effect and thus reverse the negative influence on access to credit. A similar combination of effects, each one with opposite signs, may explain the lack of significance of remittances in the explanation of the probability of access to credit.

Finally, a very important result relates to the use of deposit facilities by the household, which significantly and strongly influences the probability of having access to

formal credit, when using the pooled and the first-wave samples. This is compatible with hypotheses about the importance of deposits in building the creditworthiness of the client. The result would also provide support to the view that it is important to develop *complete* financial intermediaries, capable of generating economies of scope from the joint supply of both types of services for the institution as well as for the client.

Tables 17, 18 and 19 report the results from the OLS regression analysis used to explain the schooling gap using data from the pooled sample, the first-wave sample, and the second-wave sample, respectively. The results from these estimations can be interpreted as the marginal effects of the variables on the schooling gap of the children.

Most of the coefficients from the regressions show the expected signs. According to these results, however, the coefficient for the variable **gender** shows a negative sign, in contrast with a priori expectations. It seems that in the Mexican context, boys may be more likely to work than girls, because of the types of activities that many rural households undertake. Hence, it is likely that these households decide to pull the boys out of school and keep the girls at school longer.

Schooling gap	
Child age	0.18 (.006)***
Child gender:1, girl	-0.12 (.037)***
Land hectares	-0.0001 (.002)
Shock:1, HH has suffered	0.11 (.036)***
Remittances	0.01 (.002)***
Public transfers (excluding Progresa)	-0.01 (.005)
Progresa	-0.01 (.007)
Dwelling:1, owner	0.12 (.036)***
Overcrowding	0.10 (.015)***
Index quality dwelling	-0.12 (.022)***
Borrower woman:1, at least one in HH	0.22 (.048)***
Dependency ratio	-0.08 (.013)***
Informal sources of savings:1, access	-0.12 (.039)***
Family business:1, HH has	-0.21 (.040)***
Probability deposits	-1.00 (.171)***
Probability formal loans	-0.34 (.078)***
constant	-0.2516 (.118)**
Number of observations=4,471	
<i>F</i> -statistic=1566.44	Prob=0.00
<i>R</i> -squared=0.24	
Statistically significant at the *90%, **95% and ***99% confidence level. Bootstrap standard errors in parenthesis. Remittances and income from public programs are in thousands of Mexican pesos.	

Table 17: OLS Regression model (schooling gap) using the pooled sample

The coefficient for **land area** is not significant in explaining the schooling gap; however, this variable is an important control to absorb the observable heterogeneity among households. The cultivation of land is an important source of income for some households but not for others. Depending on the circumstances, the influence may be negative (when cultivation increases the demand for child labor) or it may be positive (when higher incomes and wealth make it possible to cover educational expenses).

According to the literature, the education of adults strongly influences the human capital formation of children. However, in this thesis, the **sum of the schooling of household workers** had to be omitted from the OLS regressions because it appeared to be highly correlated with the probability of access to formal deposits. Since the influence of access to formal deposits is the focus of this thesis, the human capital of workers would be expected to indirectly influence schooling through its strong influence on the holdings of deposits.

A surprising result is the positive effect that **remittances** have on the schooling gap; nevertheless, the effect of this variable on the schooling gap is very small, for the three samples. The coefficient reported represents the marginal change of the gap for every one thousand Mexican pesos of remittances so, according to the results, the schooling gap increases by one-hundredth of a year for every one thousand pesos of remittances (about US\$ 100). One potential explanation may be that, if remittances increased when the household suffered an adverse shock, some adjustment in school attendance might have been necessary, as well, to cope with the shock.

Schooling gap	
Child age	0.20 (.010)***
Child gender:1, girl	-0.10 (.062)
Land hectares	0.01 (.006)
Shock:1, HH has suffered	0.15 (.055)***
Remittances	0.005 (.002)**
Public transfers (excluding Progresa)	-0.01 (.008)
Progresa	-0.01 (.010)
Dwelling:1, owner	0.09 (.071)
Overcrowding	0.10 (.019)***
Index quality dwelling	-0.10 (.030)***
Borrower woman:1, at least one in HH	0.29 (.067)***
Dependency ratio	-0.09 (.020)***
Informal sources of savings:1, access	-0.09 (.053)*
Family business:1, HH has	-0.22 (.060)***
Probability deposits	-0.93 (.270)***
Probability formal loans	-0.35 (.122)***
constant	-0.2957 (.119)
Number of observations=2,513	
<i>F</i> -statistic=570.55 Prob=0.00	
<i>R</i> -squared=0.25	
Statistically significant at the *90%, **95% and ***99% confidence level. Bootstrap standard errors in parenthesis. Remittances and income from public programs are in thousands of Mexican pesos.	

Table 18: OLS Regression model (schooling gap) using the first-wave sample

Schooling gap	
Child age	0.17 (.007)***
Child gender:1, girl	-0.16 (.060)***
Land hectares	-0.002 (.002)
Accumulation of shocks	0.08 (.030)***
Remittances	0.01 (.003)***
Public transfers (excluding Progresa)	-0.01 (.008)*
Progresa	-0.01 (.008)*
Dwelling:1, owner	0.17 (.055)***
Overcrowding	0.09 (.020)***
Index quality dwelling	-0.14 (.033)***
Borrower woman:1, at least one in HH	0.11 (.078)
Dependency ratio	-0.05 (.019)***
Informal sources of savings:1, access	-0.15 (.058)**
Family business:1, HH has	-0.22 (.061)***
Probability deposits	-0.71 (.380)*
Probability formal loans	-0.51 (.208)**
constant	-0.18 (.233)
Number of observations=1,958	
<i>F</i> -statistic=788.81	Prob=0.00
<i>R</i> -squared=0.23	
Statistically significant at the *90%, **95% and ***99% confidence level. Bootstrap standard errors in parenthesis. Remittances and income from public programs are in thousands of Mexican pesos.	

Table 19: OLS Regression model (schooling gap) using the second-wave sample

To be a **dwelling owner** is a variable that increases the schooling gap in around one-tenth of a year for the pooled sample, while for the second-wave sample it increases the schooling gap in almost one-fifth of a year. This result is the opposite of the expectation about this variable but, according to the descriptive statistics, most of the households are owners of their dwelling and, thus, there is not much variability among households with access to deposit facilities and households without access to deposits. Thus, this variable may be a weak control in the regressions.

Another contradictory sign with respect to the expected outcomes is the positive effect that having at least one **woman borrower** in the household has on the children's schooling gap. Overall, the schooling gap for children from the pooled sample increases one-fifth of a year when there is at least one woman borrower, almost one-third of a year in the case of the first wave and around one-tenth of a year in the case of the second wave. This result may be explained because it is likely that most of the women borrowers are single heads of household; thus, they may find it more difficult to keep their children at school.

The **dependency ratio** negatively influences the schooling gap, in contrast to the expected result (positive). This result implies that, for one more household dependent, the children's schooling gap decreases in almost one-tenth of a year for the pooled and the first-wave samples and in around one-twentieth of a year for the second-wave sample. A possible reason for these results is that most of the dependents among these

households are young children. According to Tables 5 and 7, the average number of elderly members of the household is zero, for both waves, so it may be assumed that most of the dependents among these households are children. In the rural areas, it is more probable that households will keep their younger children at school than the older children, because the latter can work and contribute with money to the household's income. When this is the case, they will no longer be dependents and they will accumulate an increasing schooling gap. Thus, for households with a greater number of dependent young children, the schooling gaps are probably smaller.

The variable **family business** has a negative impact on the schooling gap. This result probably means that schooling is influenced by the level of the household's wealth and by the improved opportunity for consumption smoothing that becomes possible from the implicit diversification. Having a family business diminishes the schooling gap in around one-fifth of a year in the three samples.

All the other control variables have the expected signs; these variables are child age, shock, accumulation of shocks, public transfers (not including Progresa), Progresa, overcrowding, index of quality of the dwelling, and informal mechanisms of saving.

The **older the child**, the greater the schooling gap is. For each additional year of age, the schooling gap increases by almost one-fifth of a year.

A negative **shock** increases the schooling gap by more than one-tenth of a year. Moreover, for households from wave two, the **accumulation of shocks** (which on

average is less than one shock over the two years) increases the schooling gap by less than one-tenth of a year, when controlling for all the other variables.

For every one thousand Mexican pesos of **transfers from public programs** or from **Progresá**, the schooling gap is reduced. However, this reduction is hardly meaningful. Unexpectedly, the effect of the Progresá program is not significant in the analysis using the pooled and the first-wave samples, but it is significant in the analysis for the second-wave sample.

The regression results also indicate that, for higher levels of **overcrowding**, the schooling gap is incremented by one-tenth of a year, in the three samples. Whereas, having better housing, represented by the **index of dwelling quality**, reduces the schooling gap by around one-tenth of a year.

Moreover, access to **informal mechanisms of saving** reduces the children's schooling gap by around one-tenth of a year. Thus, the holdings of savings, per se, have a positive impact on schooling, but this impact become much more pronounced when the savings are held in a formal financial intermediary.

Most importantly, the predicted probabilities –those obtained from the first stage of the analysis– of having access to credit and having access to formal deposits have the expected sign and are significant in the schooling gap regression. This indicates that children from households that have access to formal financial services are indeed able to get more education than children from families without any access to formal financial services. Particularly interesting is the result with respect to access to formal deposit

facilities, as most of the literature has focused on the role of credit in influencing schooling outcomes. To my knowledge, this is the first time that this effect of deposits has been formally detected.

The influence of access to finance on schooling is very strong. In general, the marginal effects represented by the coefficients from the OLS regression are much higher in the case of these two variables related to access to finance than for any other influence directly observed in the econometric exercise. The marginal effects of **having access to formal finance** (both access to formal deposits and access to formal credit) versus not having any access at all are the **sum** of the coefficients for each one of the probabilities, from the OLS regressions. This sum is around 1.3 years less of schooling gap in the cases of the pooled sample and the first-wave sample, and it is around 1.2 years less for the second wave. Therefore, having access to formal deposit and borrowing facilities has a significant and substantial impact on human capital formation among these Mexican households.

Moreover, controlling for everything else, the marginal effect of **access to deposits** is much greater than the marginal effect of **access to formal credit**. In the cases of the pooled and first-wave regressions, the estimated marginal impact of access to deposits on schooling is about three times stronger than the estimated marginal impact of access to loans (namely, one year versus 0.34 of a year in the pooled sample and 0.93 versus 0.35 of a year for the first wave). This difference is still there but it is weaker for the second wave. It seems, therefore, that access to deposit facilities plays a critical and unambiguous role in influence household schooling choices.

To further evaluate the importance of these impacts, Table 20 reports the ratios of the marginal effects given by the coefficients from the OLS analysis with respect to the average schooling gap for each sample (where these gaps are 1.22, 1.27, and 1.16 years, respectively). These ratios indicate how important each marginal effect is compared to the actual schooling gaps. This comparison highlights, in particular, the substantial importance of access to financial services on the schooling gap, as these marginal effects represent between 61 and 82 percent of the gap, in the case of access to deposits, and between 28 and 44 percent of the gap, in the case of access to formal loans. Added together, for a comparison with a household without any class of formal access, the marginal effects are almost as important as the gaps themselves. The next most important influence in reducing the gap is the possession of a family business, equivalent to almost one-fifth of the gap.

In the rural areas, where average schooling is low, the marginal benefit of keeping the children at school longer may be very large. There seems to be, indeed, a big difference between children who attend only until the sixth grade of school or less and children who attend until middle school. The influences of access to financial services seem to play a critical role, therefore, considering the still low accumulation of human capital in the rural areas of a developing country.

Schooling gap	Pooled sample	1st Wave sample	2nd Wave sample
Child age	0.15	0.16	0.14
Child gender:1, girl	-0.10	-0.08	-0.14
Land hectares	-0.0001	0.01	0.00
Shock:1, HH has suffered	0.09	0.12	0.07
Remittances	0.01	0.004	0.01
Public transfers (excluding Progresa)	-0.005	-0.004	-0.01
Progresa	-0.01	-0.01	-0.01
Dwelling:1, owner	0.10	0.07	0.14
Overcrowding	0.08	0.08	0.08
Index quality dwelling	-0.09	-0.08	-0.12
Borrower woman:1, at least one in HH	0.18	0.23	0.09
Dependency ratio	-0.06	-0.07	-0.05
Informal sources of savings:1, access	-0.10	-0.07	-0.13
Family business:1, HH has	-0.17	-0.17	-0.19
Probability deposits	-0.82	-0.73	-0.61
Probability formal loans	-0.28	-0.28	-0.44
Average schooling gap	1.22	1.27	1.16

Table 20: Ratios of the marginal effects given by the coefficients from the OLS estimations with respect to the average schooling gap, for each sample

Tables 21, 22 and 23 report the results from the OLS regressions when the **interaction** of the two probabilities of access to each type of financial service is added as a new variable, for the pooled sample, the first-wave sample, and the second-wave sample, respectively. This interaction term attempts to recognize that access to formal credit and access to deposit facilities usually go hand in hand.

When the interaction term is added to the analysis, the negative impact of the probability of access to deposits on the schooling gap is again obtained for the three samples. However, the probability of access to formal loans now shows a positive impact

on the schooling gap, in all the cases, and this coefficient is statistically significant for the pooled and the second-wave samples.

Moreover, the significance of the coefficient of the interaction between the two types of financial services in all the samples suggests that having simultaneous access to deposits and formal credit is particularly important in the reduction of the schooling gap. This reduction would be 1.9, 1.8 and 4.2 years, respectively, according to the three regression exercises. These findings support the results from Tables 17, 18 and 19.

The probability of access to formal deposits is significant and it has the same sign in the regressions with and without the interaction term, in contrast to the result for the probability of access to formal loans. Thus, there seems to be evidence that the promotion of deposit facilities would be crucial in the rural areas of Mexico, given the extraordinary effects that it may have at the household level (in increasing intertemporal household welfare through higher levels of schooling).

The marginal effect of having **only** access to formal deposits is estimated here as follows: the normal probability density function is evaluated at the means of the variables and multiplied by the coefficient on access to deposits plus two times the coefficient on the interaction multiplied by the mean probability of access to credit. This marginal effect for the pooled sample is 2.5 years less of schooling gap.

According to Tables 21, 22 and 23, in turn, the schooling gap is increased by access to formal loans (that is, the coefficient for the probability of access to credit is positive and significant, for the pooled and the second-wave sample, when the interaction

term is added). There is thus some ambiguity of the thesis results with respect to the probability of access to formal loans on schooling. Whereas Tables 17, 18 and 19 indicate a negative impact, Tables 21 and 23 report a positive impact on the gap.

These conflicting results may reflect that the decisions taken by borrowing households may have opposite effects on schooling. Some households with access to formal loans may decide to keep their children in school, because having access to formal credit helps these households to smooth their income and consumption more efficiently. Nevertheless, some households may face difficulties in repaying their formal loans and then may decide to pull their children out of school, to help in these efforts. Moreover, it is also likely that, in some of these cases, formal loans may have been taken for mostly production and investment rather than for consumption smoothing purposes and that there may be an influence of this type of credit on child labor demand that increases the gap. Thus, the effect of access to formal credit on human capital formation is ambiguous, whereas the promotion of deposit facilities is always beneficial, in terms of the reduction of schooling gaps.

The results presented in this thesis are exceptional in their magnitude, significance, and consequences on policymaking. When poor households gain access to formal deposits there is a favorable impact on the human capital formation of their children. A key difficulty seems to be, however, that the transaction costs that these households have to overcome for accessing formal deposits may be still very high, given the sparse expansion of deposit facilities in the rural areas.

The literature has generally pointed out that having access to credit would typically improve the human capital of the children; however, this thesis has shown that having access to deposit facilities may have a greater impact on the children's schooling. Thus, facilities that provide access to formal deposits may have extraordinary impacts, whereas facilitates for formal credit may have ambiguous effects on schooling. Moreover, not all households can obtain formal credit and sometimes, even though they obtain it, the impact on schooling may not be favorable.

Moreover, a financial system that offers deposit facilities is more inclusive than a financial system that only offers credit. It is impossible to include everyone in a system that has solely credit, not only in terms of the borrower's ability to repay but also in terms of the lower demand by households of this financial service.

Schooling gap	
Child age	0.18 (.007)***
Child gender:1, girl	-0.13 (.039)***
Land hectares	0.0001 (0.002)
Shock:1, HH has suffered	0.10 (.043)**
Remittances	0.01 (.002)***
Public transfers (excluding Progresa)	-0.01 (.006)
Progresa	-0.01 (.006)**
Dwelling:1, owner	0.13 (.045)***
Overcrowding	0.09 (.012)***
Index quality dwelling	-0.11 (.021)***
Borrower woman:1, at least one in HH	0.22 (.046)***
Dependency ratio	-0.08 (.014)***
Informal sources of savings:1, access	-0.12 (.034)***
Family business:1, HH has	-0.22 (.039)***
Probability deposits	-0.51 (.236)**
Probability formal loans	0.57 (.316)*
Interaction of probabilities	-1.90 (.654)***
constant	-0.46 (.134)***
Number of observations=4,471	
<i>F</i> -statistic=1178.57	Prob=0.00
<i>R</i> -squared=0.24	
Statistically significant at the *90%, **95% and ***99% confidence level. Bootstrap standard errors in parenthesis. Remittances and income from public programs are in thousands of Mexican pesos.	

Table 21: OLS Regression model (schooling gap) using the pooled sample with the interaction of probability of loans and probability of deposits

Schooling gap	
Child age	0.20 (.009)***
Child gender:1, girl	-0.10 (.044)**
Land hectares	0.01 (.006)
Shock:1, HH has suffered	0.15 (.057)***
Remittances	0.01 (.002)**
Public transfers (excluding Progresa)	-0.01 (.006)
Progresa	-0.02 (.008)*
Dwelling:1, owner	0.10 (.068)
Overcrowding	0.10 (.022)***
Index quality dwelling	-0.10 (.030)***
Borrower woman:1, at least one in HH	0.29 (.064)***
Dependency ratio	-0.09 (.020)***
Informal sources of savings:1, access	-0.09 (.058)
Family business:1, HH has	-0.23 (.062)***
Probability deposits	-0.40 (.385)
Probability formal loans	0.44 (.350)
Interaction of probabilities	-1.75 (.797)**
constant	-0.67 (.189)***
Number of observations=2,513	
<i>F</i> -statistic=1098.45	Prob=0.00
<i>R</i> -squared=0.26	
Statistically significant at the *90%, **95% and ***99% confidence level. Bootstrap standard errors in parenthesis. Remittances and income from public programs are in thousands of Mexican pesos.	

Table 22: OLS Regression model (schooling gap) using the first-wave sample with the interaction of probability of loans and probability of deposits

Schooling gap	
Child age	0.17 (.009)***
Child gender:1, girl	-0.16 (.049)***
Land hectares	-0.002 (.001)
Accumulation of shocks	0.08 (.033)**
Remittances	0.01 (.004)***
Public transfers (excluding Progresa)	-0.01 (.008)*
Progresa	-0.01 (.008)*
Dwelling:1, owner	0.18 (.061)***
Overcrowding	0.10 (.023)***
Index quality dwelling	-0.13 (.029)***
Borrower woman:1, at least one in HH	0.11 (.072)
Dependency ratio	-0.06 (.018)***
Informal sources of savings:1, access	-0.15 (.065)**
Family business:1, HH has	-0.21 (.063)***
Probability deposits	-0.15 (.368)
Probability formal loans	1.68 (.787)**
Interaction of probabilities	-4.24 (1.49)***
constant	-0.46 (.247)*
Number of observations=1,958	
<i>F</i> -statistic=902.11	Prob=0.00
<i>R</i> -squared=0.23	
Statistically significant at the *90%, **95% and ***99% confidence level. Bootstrap standard errors in parenthesis. Remittances and income from public programs are in thousands of Mexican pesos.	

Table 23: OLS Regression model (schooling gap) using the second-wave sample with the interaction of probability of loans and probability of deposits

CHAPTER 7

CONCLUSIONS

Most studies have examined the impact of access to formal credit on education, but there is nothing on the impact of access to formal deposit facilities. Thus, this thesis is an important contribution to the literature to the extent to which it explores the role of both financial services (deposits and credit) on schooling decisions among rural households.

This thesis finds, without ambiguity, that access to deposit facilities and access to both financial services combined help to reduce the schooling gaps of children. However, the evidence indicates that access to formal credit is not always beneficial in terms of the reduction of the schooling gaps.

In general, there are more barriers to the access to formal loans than to the access to formal deposits and there is a lower demand for credit than for deposit facilities. Deposit facilities may offer a more broadly accessible mechanism to increase and sustain investments in schooling, because even though access to credit may help households to cope with risk and to smooth consumption, access to formal loans may also generate a demand for child labor, which negatively affects human capital formation among children.

In this respect, Maldonado and Gonzalez-Vega (2008) identify that there is a possibility that additional productive activities, made possible by the household's access to microfinance, may change household demands for child labor, either directly, in the newly-created microenterprises or expanded farm and livestock duties, or indirectly, in child care and other household chores.

The descriptive statistics of the variables used in this thesis show that, in general, households with access to formal deposit facilities have different characteristics in comparison with households that do not have access to formal deposits. According to these descriptive results, on average the former group have better housing, higher non-labor incomes from remittances and public sector transfers, higher human capital stocks of the household workers, a higher probability of possessing a family business, a higher probability of having at least one woman borrower, higher dependency ratio, higher degree of use of informal strategies for savings, lower travel costs to get to the financial institution, lower levels of overcrowding at home, and lower probability of having suffered a negative shock in the past twelve months.

The analysis of the financial situation of these rural households indicates that the most common source of formal deposits and formal credit is the category that includes *cajas de ahorro*, *cajas solidarias*, *asociaciones de ahorro y crédito*, cooperatives, and *uniones de crédito*. Moreover, the main source of informal credit are friends, relatives and neighbors; while the most common alternative for saving money among the informal mechanisms seems to be keeping it at home.

The econometric strategy has two stages. The first stage uses a bivariate probit model to obtain the probability of having access to formal deposits and the probability of having access to formal credit. The second stage estimates an OLS model to assess the impact of access to formal finance on the schooling gap. This model takes the probabilities obtained in the first stage as the instruments for access to formal deposits and formal credit, respectively.

Some results from the bivariate probit analysis indicate that there is a lower probability of having access to formal finance when the household faces high transaction costs; while extra income from remittances and public programs, and a greater human capital stock of household workers may increase the probability of saving and holding a deposit. A better quality of housing may have a positive impact on the probability of access to both services; a stable flow of income from public programs may have a substitution effect on having a formal loan, and having access to deposit facilities strongly influences having access to formal credit.

Some results from the OLS analysis report that, in general, having a family business, having income from public programs, having better housing, and having access to informal sources of savings diminish the schooling gap. Furthermore, negative shocks, higher levels of overcrowding at home, and higher child ages increase the gap.

The results from the OLS analysis related to the financial services indicate that having access to formal finance (access to formal deposits and formal credit) versus not having any access reduces the schooling gap in around 1.3 years in the case of the pooled

sample and the first-wave sample and in around 1.2 years in the case of the second-wave sample. Moreover, access to just formal deposits reduces the gap in around 2.5 years when using the pooled sample. This impact is greater because, when an interaction term is included, access to credit actually increases the schooling gap.

When an interaction of the probabilities associated with each service is added in the OLS analysis, only access to deposits has a negative impact on the schooling gap, whereas access to credit shows a positive sign. Moreover, given the significance of the interaction in the three samples, having a simultaneous access to deposits and formal credit is important in the reduction of schooling gap. The marginal effect is 1.9, 1.8. and 4.2 years, respectively.

In conclusion, the probability of access to formal deposits is significant with and without considering the interaction of probabilities. There is thus evidence that the promotion of deposits is crucial in the rural areas of Mexico, not only for the extraordinary effects found at the household level but, also, because deposit mobilization will contribute to further intermediation, with the usual beneficial effects.

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