

IN THE AFTERMATH OF RISKS

COPING WITH RISKS BY MEANS OF CREDIT IN MEXICO



October 2010

In the Aftermath of Risks

Risk Coping by Means of Credit in Mexico

Master Thesis for the chair group *Development Economics*,
submitted for partial fulfilment of the requirements of the
Master of Science degree in
International Development Studies
At Wageningen University,
The Netherlands

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List of Abbreviations

BANRURAL	Public Agricultural Bank
BANSEFI	National Bank of Savings and Financial Services
CNVB	National Commission of Banking and Values
CPI	Consumer Price Index
CURP	Unique Key of Register of Population
GDP	Gross Domestic Product
HH	Household
IFE	Electoral Federal Identification
LPM	Linear Probability Model
MFI	Microfinance Institutions
NAFTA	North American Free Trade Accord
NGO	Non-governmental Organization
SACP	Sector of Savings and Public Credit
SAGARPA	Secretary of Agriculture, Livestock, Rural Development, Fisheries and Food

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1. Introduction

This first chapter will introduce the topic of this master thesis by giving a clear background and problem statement. It provides the main research questions as well as the method to be used.

1.1 Background

Rural and urban households in developing countries face substantial risks, such as climate risks, economic fluctuations and other (idiosyncratic or systematic) shocks, which make households very vulnerable.

The rural households are mostly farmers, who either work in agriculture for their own food or have cash crops as an income source. It is also possible that they have other income sources next to farming. Either way rural households are very vulnerable to risks (e.g. weather related events such as drought as well as health related events such as illness of a household member) in which cases they would have to use coping strategies. Some examples of these coping strategies include taking children out of their schools prematurely to work as well as selling cattle in order to gain some money. However these measures cause the rural households to lose investments (in human capital) and make them even more vulnerable to new risks.

Saving to be able to manage risks is a widely used management strategy, however very difficult to do for the poorest households. The existing theoretical saving models do not always reflect on the poor, or at least no consensus exists on this. The question rises on how the poorest of the poor can save. These households require financial intermediation, on a micro-level, for example in precautionary savings. As Deaton (1990) already stated saving is not only about accumulation, but about consumption smoothing in the face of volatile incomes, and about providing insurance for poor people, whose lives are difficult and uncertain. Economic theory would suggest that the combination of income volatility and borrowing constraints make it therefore necessary for the poor to use their assets, both liquid and semi-liquid, as a buffer against income shocks. However, this is not always possible and the poor households would have to find other ways of coping with risks.

These other ways of handling risks with risk-management and risk-coping strategies include different credit mechanisms. Although meant for investment purposes, formal loans or loans in microfinance programs often also finance consumption because these funds are very fungible. Unfortunately, in many developing economies a problem of weak financial institutions and inefficient markets for credit is present. Morduch (1995) already points out that when households in developing countries have access to financial institutions, they often face borrowing constraints when times are bad and less when times are good. This means that it might be more difficult to access (formal or informal) credit when times are bad, for example in case of a natural disaster. Another reason why high risks, like natural disasters, are not easily insured by formal market mechanisms is because credit and insurance markets are typically absent or incomplete in developing countries.

Next to using formal credit, informal credit is frequently used as well when coping with risk. Informal credit markets appear to adjust the best to high-risk environments. Repayment is in many cases conditional on income outcomes of both borrowers and lenders, with negative shocks translated into more favorable terms for the party experiencing them (Dercon, 2002).

1.2 Problem Statement

Climate risks, economic fluctuation and a large number of other (idiosyncratic or systematic) shocks make households very vulnerable. They are exposed to a variety of risks like drought, flood and frost which may cause harvest failure as well as health related risks. Many studies have reported high income variability related to risks. These risks cause consumption shortfalls for households. The households have different types of strategies that they could use to try to avoid the consumption shortfalls. The amount of empirical literature on this topic is enormous, for example Townsend (1994) and Kinsey and others (1998) who mainly use panel data studies.

Even though much literature can be found on management and coping strategies all over the world, only few studies are found that deal with the different coping strategies within Mexico. Eakin (2005) found out for example that rural households in the communities of Jesu's Nazareno, Los Torres and Plan de Ayala used different kinds of strategies when coping with risk. The main ones include selling livestock, intensifying their participation in non-farm activities, seeking financial support through informal loans, and, when possible, replanting their fields. However no specific literature is found on the use of formal and informal credit within Mexico as a coping strategy.

Formal credit from e.g. microfinance institutions is supposed to be for investment purposes, however, these funds are fungible and are used for consumption smoothing in many cases, but especially after a shock occurred. As is formal credit, informal credit is also used often when coping with risks. Both could contribute to risk resilience of households after the shock, or disaster has happened. As stated earlier, not much research on this has been done yet or was insufficient due to varying measures and definitions, but also to the lack of reliable household data. As stated already in Paxton (2009), in many cases the component of informal credit is absent in country level statistics.

Then, this study aims to fill this gap by using a novel dataset that includes both informal and formal credit as a mechanism to cope with risk variables on household level in Mexico.

1.3 Objective and Research Questions

For this research a main as well as several sub research questions have been formulated. The main research question of this thesis will be:

“What are the roles of formal and informal credit for Mexican households in order to cope with risks?”

This question can be divided into several sub-questions:

- What are the different risks households have to deal with?
- How big is the amount of used formal and informal credit in Mexico?
- Which external factors might influence the use of formal credit among Mexican households and how do these factors influence the use of formal credit as a coping strategy?
- Which external factors might influence the use of informal credit among Mexican households and how do these factors influence the use of informal credit as a coping strategy?
- What is the difference in roles and importance of both formal and informal credit for Mexican households when coping with risks?

1.4 Approach

The research designed to answer these research questions will not involve any fieldwork. It consists out of an analysis of existing data, gathered by the National Bank of Savings and Financial Services in Mexico. As for research that does use primary data, this research will also be based on desk research, by studying different articles and literature. This will be done to get a good insight in the background of the topic and to be able to base the empirical model on clear theory.

Households' ability to cope with risks by using formal and informal credit can be researched using both quantitative, such as household surveys, and qualitative approaches, such as participatory assessment. I don't believe that only qualitative methods can be used to study the risk coping strategies and vulnerability to risks. Although qualitative studies have a local nature which will be able to provide a more detailed understanding it is difficult to compare the results across areas. I think national household surveys, such as the one I will use for my research, will give a better and more objective view on these issues.

Following the above framework, this study attempts to quantify the impact of formal and informal credit on households in Mexico by using existing data. In doing so, a sample of 5,000 households is analyzed, 50% of which (treatment group) is working with formal financial institutions and the rest (50%) works only with informal sources of finance (moneylenders, relatives, friends, etc.). The data gathers more detailed information about the financial behavior of cooperative member households as well as households that choose not to or cannot access financial services from these institutions. This survey started in 2004 with financial support from the Mexican Secretary of Agriculture, Livestock, Rural Development, Fisheries, and Food (SAGARPA) and the National Bank of Savings and Financial Services (BANSEFI). The project targeted several Mexican states identified as having high levels of marginalization.

1.5 Overview of Study

After this introduction, theoretical consideration will be addressed in chapter two through a literature review on risks, risk response mechanisms and formal and informal credit. Within chapter three some studies will be analyzed in the context of Mexico and risk coping strategies to get some insights on available works. Chapter four will explain the methodology of the statistical analysis as well as the construction of the data set from the available data. After this, in chapter five, the conducted analysis will be addressed. Chapter six offers conclusions and finally, this thesis comes to a closure by means of a discussion chapter.

2. Theoretical Framework

This chapter will explain some theoretical concepts, which are used for this research, more in detail. This is done to understand the importance of risk of rural households and their coping strategies. First of all the basic concept of risk will be clarified. Formal and informal credit is one way of coping with risk. However there are many different kinds of risk management and risk coping strategies, therefore these will be discussed before a detailed description of both formal and informal credit will be given.

2.1 Risk

Risks occur in variable situations in which the outcome is uncertain. Main characteristics of risks include that they are unpredictable; it is unknown whether a risk will occur, when it occurs and how often it occurs; and that they always have a negative outcome, so they will involve a loss (Hung, 2007).

Some other characteristics of risks (either natural, health or economic related) include the frequency and intensity and the persistence of their impacts (Murdoch, 1995). For example, smaller shocks, like temporarily illness, may occur more frequent but they are easier to deal with than large shocks, like the death of a household member.

In general, there are three sources of risk (Sebstad, Jennifer and Cohen, 2000):

1. Structural factors such as seasonality, inflation, or the weather;
2. Unanticipated crises and emergencies such as sickness or death of a family member, unemployment, fire, or theft;
3. High-cost, life cycle events such as marriage, funerals, childbirth, homebuilding, festivals, and educating children.

Risks can be divided into common, or covariant or systematic, and idiosyncratic risks (Dercon, 2002). Common risks affect all members of a community, which means they are aggregate, economy-wide and covariate. Individual risks, on the other hand, also called idiosyncratic risks, only affect a particular individual or household. In reality almost no risk is either purely idiosyncratic or common. Idiosyncratic shocks can be dealt with, or insured, within a community. Since everybody is affected in case of a common shock, this is not the case for common shocks, because the risk cannot be shared. Common shocks can only be dealt with by means of formal or informal transfers (credit, insurance, public transfers) from outside of the community.

Some risks may also have a persistent effect, which make them more difficult to cope with. Especially for poor households examples like losing a life and becoming severely ill are a serious threat. In these cases the income of the whole household will be affected. And since most poor households include farmers or laborers (selling one's labor to another party by engaging in waged labor), other risks like floods and pests are risks these households are extra exposed to as well. This implies that rural households already live in environments that are more risky and they are also more vulnerable to these risks due to the persistent effect (Dercon, 2002).

A basic understanding of change in assets over time is necessary to be able to understand the lack of these assets for rural households. Assets can be classified into human, physical, social, financial and natural capital (Pearce, 1993). The concept of human capital is related to the available knowledge, working capacity, skills and health of people. Physical capital is about the basic infrastructure and producer goods, which households use. Social capital can be of great importance to rural households since this includes social networks, membership of (in)formal groups, safety nets (non-contributory transfer programs seeking to prevent the poor or those vulnerable to shocks and poverty from falling below a certain poverty level) and relationships with friends and family. Next to savings, financial capital also includes credits and remittances for rural households. Natural capital is very important for rural households since it includes their land and trees, but also things that are more intangible like the weather.

One can conclude from all above theory that several types of risks exist (Sebstad, Jennifer and Cohen, 2000):

1. Covariant risks affect all households in the same location at the same time;
2. Idiosyncratic risks affect only one or a few households at the same time;
3. Low frequency risks are one-time events that do not repeat;
4. High frequency risks are those that happen repeatedly;
5. Anticipated risks are quite predictable and expected;
6. Unanticipated risks are not expected;
7. Low-impact risks result in temporary shortfalls in income;
8. Severe risks result in sharp and less reversible drops in income.

2.2 Risk Response Strategies by rural households

As argued above, rural households are more exposed to risks, which may imply that the consequences of risks are bigger than for non-rural households. Next to a difference between urban and rural households, a difference between poor and rich households also occurs when coping with risks. Richer households can often rely on their savings, something that the poor households often do not have, even when they do have the potential. Vulnerability to poverty linked to risks is high, even though poor households do use risk management and risk-coping strategies, which involve the ability of households to cope with shocks (Jabeen, 2009). A number of studies have examined income and consumption patterns in the risky environments of developing economies lacking formal safety nets (Agarwal, 1991; Deaton, 1990; Kinsey et al., 1998; Alderman & Paxson, 1992;; Platteau, 1991; Udry, 1994).

Some of these studies (Deaton, 1990; Kinsey et al., 1998; Alderman & Paxson, 1992) have indicated that poor and rich households may respond differently to various shocks. Rich households have better access to insurance and credit facilities and a larger asset base, which may help protect them against the impact of an income shock (Jalan and Ravallion, 2001). Moreover it is shown that the size of the loss has influence on the ability to cope with the risk. A household is better able to cope with a temporarily illness of a household member than a severe drought (Brown & Churchill 2000).

The used risk response strategies by households vary, based on the following characteristics (Sebstad, Jennifer and Cohen, 2000):

- The timing of the strategy;
- The nature of the risk itself (severity and frequency);
- The impact of the strategy on the long-term well-being of the household;
- Whether the strategy involves just the household itself (intra-household measures) or draws upon resources outside of the household (inter-household measures). (Intra-household measures are referred to as self-insurance. Inter-household or group-based measures include informal and formal insurance.)

As said before, households use different risk response strategies in order to cope with shocks. These include both risk management strategies and risk coping strategies. This categorization is based on the characteristic of the timing of the strategy. The difference between these two is that risk management strategies work on the income process *ex ante*, which basically means income smoothing, while risk coping strategies are *ex-post* and deal with the consequences of income risk by smoothing of consumption.

Ex ante management strategies are used for future risks. Examples on how to achieve income smoothing by means of ex ante management strategies include income diversification (combining activities with low covariance) and income skewing (more low-risk activities at low returns) (Dercon, 2002). Individual households also can take other preventative actions to mitigate the impacts of shocks. The households try to prevent risks by means of agricultural-based preventative measures, since the most significant risks facing farmers are production-related (Sebstad, Jennifer and Cohen, 2000). Here one can think of for example, building canals and dikes for irrigation, modifying crop and livestock activities in response to market and price fluctuations and diversifying crops and income earning activities.

Another ex-ante management strategy involves increasing the assets in times of a shock for example by savings. Buffer stock saving behavior can arise from two distinct assumptions. Deaton (1990) explicitly imposes a no borrowing constraint but assumes that a household is always employed and therefore always receives a positive income. Carroll (2001), on the other hand, generates endogenously a no borrowing constraint by assuming that with a very small probability, a household will receive a labor income shock, implying that the household will optimally never want to borrow, given that the marginal utility of zero consumption is infinite. In this formulation, the household may face an unemployment spell but receives zero labor income in that period (Carroll, 2001).

This research focuses on the ex-post strategies, since the ex-ante risk management strategies may fail to achieve an entirely smooth consumption path. In the cases of ex-post risk coping strategies the household tries to deal with a shock after it happened. The households try to raise extra income to compensate for the loss of income due to the shock. They do so by modifying or reducing consumption, raising income and drawing on financial resources, which is reached for example by increasing labor supply (child and woman labor mostly), reducing consumption, migrating to a city (temporarily or not), engaging in other activities, using cash savings, selling cattle, seeking gifts or loans from relatives and friends or, as is stressed upon within this research, use formal and informal credit.

Although all of these coping strategies will have a positive outcome on the short term survival, some of these coping strategies will threaten the long-term survival or security of the household. For example, selling key productive assets like cattle will reduce a household's ability to generate income.

All risk response strategies, both risk management and risk coping strategies, have a social, cultural or economic aspect (Durante, 2009). The social aspect often has an organizational aspect as well; this is because poor households will organize themselves to support each other when a disaster happens. Every member of these formed groups has the same rights as well as obligations. This is observed within extended families, ethnic groups as well as professional networks.

The economic category is most present when talking about income diversification. Income diversification means combining activities with low positive covariance. The last aspect, the cultural one, describes the way people view the disaster. This can be very different from time to time, think about for example a religious point of view, in which disaster is just something that is supposed to happen.

The choice of a household regarding which risk response strategy to use depends for a great extent on the risk itself. For example if the risk is low-impact (resulting in a temporary shortfall in income) or severe (resulting in a sharp and less reversible drop in income). In the case of a low impact risk, strategies like mobilizing labor, reducing expenditures, modifying consumption, drawing down physical stocks, using savings or insurance, borrowing, selling or pawning assets and seeking help from friends and relatives will occur more often than in cases with severe risks (Lekprichakul, 2007). Furthermore strategies like intensifying income-generating activities, postponing marriage or other social obligations, entering asymmetric interpersonal dependencies, migrating and turning to drastic measures such as illegal activities or abandoning children are used more often.

2.3 Formal and Informal Credit as a risk coping strategy

Since using formal and informal credit as an ex post coping strategy is the topic of this thesis, these concepts will be discussed into detail here.

In a developing country context, credit is important for enhancing productive capacity through financing investment by the rural households in their human and physical capital. This credit can be either formal (e.g. provided by formal institutions such as banks, credit and savings associations, cooperatives of credit and savings, microfinance institutions (MFIs), NGOs, etc.) and informal (e.g. provided by family members, relatives, friends, moneylenders, etc.). In many developing countries formal and informal credit markets coexist (Hoff and Stiglitz, 1990).

Governments in developing countries have often imposed certain regulations, for example an interest rate ceiling, to promote formal borrowing. However this has created the informal credit sector in a way (Hoff and Stiglitz, 1990), because lending to the poor is riskier and therefore less profitable to lend to them at rates which are below the interest rate ceiling. Another reason for the fact that formal and informal credit coexist is related to rationing, due to asymmetric information between lenders and borrowers.

Because of the adverse selection and moral hazard problems, formal lenders are only willing to lend when collateral is available, while informal lenders are also willing to lend without this. This is because informal lenders have better information about borrowers (from the inside) and they use different mechanisms to make sure the money will be repaid (Christiaensen & Subbarao, 2005).

So to say, poor households lack access to financial services for efficient risk coping because of the fact that traditional formal institutions typically have no interest in lending to the poor. The households have a lack of viable collateral and high transaction costs associated with the small loans that suit them. The excluded households may then find other options, perhaps by turning to more expensive sources of informal finance to smooth their consumption (Conning & Udry, 2007). Indeed, in the rural areas of developing countries, households use 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*).

Informal credit is accessible to poor households through self-enforcing informal contracts among friends, neighbors and members of the extended family and these contracts are arranged within networks of informal institutions of diverse natures (Fafchamps & Lund, 2001). These non-market informal institutions have often been found to outperform the financial institutions, which governments have set up to serve the rural population, and even some semi-formal (unregulated) institutions which emerged to provide financial services to the poor. Thereby, informal credit markets adjust to high risk environments. Hence, repayments are conditional on the income of the borrowers.

On the contrary, formal credit markets cannot easily insure these high risk environments. Moreover, consumption loans are rare in formal markets (Dercon 2002) although recently this is increasing and made available to poor households which may have some implications in respect to their coping strategies.

Microfinance, as a form of formal credit, is the provision of financial services to low-income clients, including consumers and the self-employed, who traditionally lack access to banking and related services (Tietze, 2007). Contrary to formal banks, MFIs normally provide comprehensive packages, including small loans, saving facilities, payment services, money transfers and in some cases insurance, to poor and low-income households that have no access to formal banks. Microfinance can have impacts on the household level (for example income, assets, children education, food and housing), the individual level (for example empowerment and confidence in the future) as well as the enterprise level (for example assets, employment, revenue and transaction costs) (Hauville, 2005). Some other impacts that are caused by MFIs lay in the fields of child mortality, environmental impacts, social capital and training the clients. Even though packages MFIs offer were originally mended for investment purposes; the credits are now also used as a way to smooth consumption and cope with risks.

Microfinance institutions (MFIs) can provide clients with an important risk coping strategy to meet cash flow needs associated with consumption. This is true for idiosyncratic shocks, such as sickness, birth, marriage as well as for covariate shocks, where vulnerability can be reduced through the emergency assistance during periods of acute natural disasters. The fact that these MFIs can turn into de-facto relief agencies is crucial in sustaining households in case of a natural disaster. But the post-disaster rehabilitation assistance, both financial and other services, might be even more important (Zaman, 1999). Microfinance services can help to build up assets that can be depleted in times of stress. However, when shocks begin to occur more frequently, those households that receive credit are more likely to cope with risks by reducing productive assets. This means that credit may have a negative impact on households' coping strategies, which will be greater among the poorer households (Hauville, 2005). With already low income levels, they have fewer options for coping with the shock while continuing to make payments on the loan. Then, the liquidation of a productive asset may be one of the few options they have for protecting their credit record.

Demand and supply for both formal and informal credit depends on a number of factors. For example total savings or total value of liquid assets relating to production or consumption (Kochar, 1997), but also obstacles like high interest rates, bureaucratic loan process associated with formal loans, collateral risk (Boucher, Carter and Guirking, 2007) and asymmetric information. What is very interesting for this research is that the demand for credit is also dependent on covariate and/or idiosyncratic shocks.

To conclude, informal arrangements (agreements that are not bound by legislation or formalized by contract) can be beneficial for poor people. Moreover, with the microfinance revolution and the expansion of the frontier of rural financial markets, some attention is set to the role that access to formal credit transactions may play in improving the set of household instruments used to cope with risk. Formal loans or loans in microfinance programs do often finance consumption because the funds they provide are fungible.

3 Mexico

This chapter will introduce the Mexican context, as the area of research. It will also elaborate on both formal and informal credit within this Mexican context.

3.1 Description of the context: Mexico

To start, Mexico is a country with 1,964,375 sq. km and 112 million inhabitants which ranks 15th on the global population list. The country is located in North America, bordering the Caribbean Sea and the Gulf of Mexico, between Belize and the United States and bordering the North Pacific Ocean, between Guatemala and the United States.

Mexico City is the capital of the country. The United Mexican States, as Mexico is officially called, consist of thirty-two states and these are also divided into municipalities, the smallest administrative political entity in the country.

Figure 1: Map of Mexico and its states



Source: CIA, 2010

The Mexican economy, with a GDP of \$1.482 trillion (CIA, 2010) contains a mixture of modern and outmoded industry and agriculture, increasingly dominated by the private sector. A devaluation of the peso in late 1994 triggered the worst recession in over half a century. The nation had been making an impressive recovery until the global financial crisis hit in late 2008. Ongoing economic and social concerns include low real wages, underemployment for a large segment of the population, inequitable income distribution, and few advancement opportunities for the largely “Amerindian” population in the impoverished southern states.

In 1994, Mexico entered the North American Free Trade Accord (NAFTA) with the United States and Canada. Under NAFTA Mexico was allowed to continue to protect the domestic maize market for example (Nadal, 2000).

After Mexico entered the NAFTA rapid growth in exports were experienced and the restructuring of the macroeconomic finances had initiated significant results in the reduction of the poverty rate: according to the World Bank, poverty was reduced from 24.2% in 2000 to 17.6% in 2004. Most of this reduction was achieved in rural communities whose rate of poverty declined from 42% to 27.9% in the 2000–2004 period, although urban poverty stagnated at 12%. According to the World Bank, in 2004, 17.6% of Mexico's population lived in extreme poverty, while 21% lived in moderated poverty. The CIA Factbook, on the other hand, reported that 13.8% of the population was under the poverty line, as measured in food-based poverty.

What is very remarkable is that the incidence of the poverty ranges from 35 percent in the northern region to 81 percent in the southern region (Taylor, Mora, Adams & Lopez-Feldman 2005). Households living in the southern states are very poor, and certainly much poorer than households living in the rest of Mexico. The high level of poverty in the south is confirmed by both the Marginality Index (based on access to basic infrastructure services, housing conditions, education attainment, and wage earnings) from the National Population Council (*Consejo Nacional de Población*-CONAPO) and the Human Development Index (HDI) (based on per capita gross domestic product [GDP], educational achievement and enrollment, and life expectancy) from the United Nations Development Programme (UNDP).

The production environment in Mexico today is different from that of the early 1980s. The ways in which smallholder farmers were previously able to accumulate resources have been severely constrained. There is only a limited supply of credit, insurance, and technical support, especially for well-off farmers (those with large land ownership, with liquid collateral, etc.) and given current patterns of social change in rural Mexico, the most viable adaptation strategies may be changing their production strategies (crop diversification) or outside the agricultural sector, via self-employment in the service or manufacturing sector .

Over the past years some major changes in agriculture have been noted. Whereas previously, systems of food production and consumption policies in many Latin American countries were determined largely by national political and socioeconomic objectives, nowadays increasingly national agricultural policies are driven by transnational conditions, such as multilateral regulations on food product quality, regulations on trade and protectionism, quality and quantity demands of transnational agro-industries, and cosmopolitan consumer tastes and preferences (McMichal, 1994 as found in Eakin, 2005).

Adaptation to these conditions has been difficult for rural households in Mexico. Integrating into the global economy only started with the evolution of neo-liberalism, policies designed to liberalized markets and minimized government regulation of resource distribution.

3.2 Formal credit in Mexico

In the early 1990s, the public agricultural bank, BANRURAL, was restructured to meet the needs of farmers identified as commercially viable (Eakin, 2005) eliminating all but a handful of Mexico's 27,470 *ejidos* (the agrarian communities who received land in the land distribution program after the 1910 Revolution) from its portfolios (Wayne & Myhre, 1998). With the loss of credit, the smallholders also lost access to crop insurance and other services.

However, as discussed in the theoretical framework, access to formal credit can be achieved in several ways. It can be done via various formal financial institutions such as cooperatives of credit and savings, credit unions, MFIs, commercial banks and private initiatives. Some offer only credit and savings, while others make cash transfers of remittances and subsidies. Two structures can be identified within these formal institutions which are in most cases regulated entities by the central bank of financial authorities as the National Commission of Banking and Values (CNBV). These include privately owned and publicly owned institutions.

All institutions require a proof of income as collateral. The total amount of savings can serve as collateral when small credit requirements take place but additional collaterals are required when the amounts are higher. In addition to the proof of income, the majority of institutions are requiring official identification for instance, the IFE (Electoral Federal Identification), CURP (Unique Key of Register of Population), the birth certificate and the marriage certificate and others.

In cases of group loans within MFIs collateral is more about social capital than about the other capitals. Because rural communities have tight-knit hierarchical structures information about borrowers is accessible and the enforcement of sanctions via social networks makes collateral unnecessary.

Privately owned

This category exists out of mostly commercial banks who grant credit with reasonable interest rates. These banks have high collateral requirements for the demanding households, which are income related and many documents have to be in order. This sector serves about 25 percent of Mexico's urban adult population, whereas these figures for rural areas are unknown, and next to credit it also facilitates access to savings accounts. Another aspect of this category is that MFIs, who mainly focus on woman in rural areas, set high interest rates but less collateral requirements.

Another aspect of the privately owned institutions is the institutions that are working from the grass-roots. These institutions have been created by local people in urban and rural areas where it is difficult for households to have access to formal credit. Examples of these institutions are those which belong to the Sector of Savings and Public Credit (SACP). In this category are various organizations such as Cajas de Ahorro y Credito Popular (Savings and Credit Associations), Cajas Solidarias, Credit Unions, among others who work at the local level in several dimensions of welfare of their members (not only credit, but also savings, health, education, productive-related aspects, etc.). Here the collateral requirements are less important because the social collateral is most relevant since each member is able to support other members with its own savings in case of idiosyncratic shocks as is the case in rural regions where most of these institutions are operating.

Publicly owned

Within this category a difference can be made between the bigger financial institutions, who serve as first-tier institutions, and the second-tier smaller financial intermediaries, through which the first group grant credit. First-tier financial institutions correspond to this category such as the Development Bank institutes (e.g. Financiera Rural, FIRA, FIRCO) and the Social Bank (BANSEFI - National bank of financial services) that are financing households in both semi-urban and rural areas. Also second-tier smaller financial intermediaries such as Cooperatives of Credit and Savings or Credit Unions are part of this category. The objective of all of these institutions is to provide agricultural credit for productive use and to facilitate access to saving accounts and other financial services such as transfers of remittances and to directly work with the households, so that less collateral is required.

3.3 Informal Credit in Mexico

Informal credit can be provided by family members, relatives and friends as well as by moneylenders and other input suppliers operating in the local market. These transactions are not bound by legislation or formalized by contract and can actually reach more people than formal credit does. One explanation of this is the fact that most rural communities are isolated locations with inexistent formal financial institutions operating in their surroundings. This implies that as soon as a household requires credit, they need to travel and incur in high transaction costs before getting a formal loan. For that reason, in Mexico, households use informal financial services provided by friends and family members, but also by deposit collectors, moneylenders and informal credit and savings associations, known in Mexico as “tandas” or “roscas”. These associations differ from the formal institutions as they require preliminary (in)formal contact and interaction.

4 Models and Data

This chapter will explain in which way the analysis will be dealt with. First the theory behind the empirical model will be discussed, after which the data and the used variables will be discussed. To be followed by the empirical model and the used estimation methods.

4.1 Theoretical models

Within this research the use of credit as a coping strategy is investigated. The use of credit is determined by both supply and demand, therefore it is important to look at the factors influencing the supply and demand side of credit. The household model, the credit market model as well as the livelihood capital model help to understand the theory behind the supply and demand side of credit and the factors influencing these sides.

4.1.1 Household Model

Credit can be used by households for a wide variety of purposes, e.g. for productive or purely consumption reasons. The demand of formal and informal credit when coping with risks is a decision made within the household itself, therefore the farm household model will be the basic theory of this research.¹

Chayanov (1925) and Nakajima (1986) are among the first who believed that behaviors of households were best understood in a household framework, where potentially important interactions exist between nonfarm labor markets, the farm operation, and household consumption (Findeis, 2005). Becker's (1981) unitary household model forms the foundation for the agricultural household model (Singh, Squire and Strauss, 1986), through its assumptions on household decision-making through a single household head. However, the agricultural household model recognizes that agricultural producers both produce and consume the agricultural output produced by the household, which means the model assumes that farm output is consumed by producing households, with the surplus being marketed, a reality for most farm households in developing countries (Singh, Squire and Strauss, 1986). Further, the model incorporates a farm production function, reflecting the returns to farm self-employment. The agricultural household model assumes a nonlinear farm production function, assuming that the marginal returns to labor decline with increases in production. The model is a combination of consumer and producer models into a single model. A household has preferences on an agricultural good X_a , a manufactured good X_m , and leisure X_l defined by the utility function $U(X_a; X_m; X_l)$. The household also has a production technology represented by the production function $Q(L; A)$ where L is labor and A is land. This means that when one of the factors influencing the basic model would change in any possible way, like in case of a shock, the household would be unbalanced and this could lead to an increased demand of credit in order to return to the original state.

¹ For this research not only farmers are taken into account but also people living in urban areas who follow the same household model

However, this approach poses significant demands for data reflecting production, consumption and labor decisions. Due to the stability preferences households may use different strategies like the credit market to maximize utility, especially when shocks occur. This may change over time, which means the household model needs to be extended by an inter-periodical model.

Therefore, extensions on the basic household model in order to fit credit within the model, pose the need for data on sources of formal and informal credit among other behaviors or decisions of particular interest over time. At the same time, household-firm models have the ability to provide answers to important questions (Findeis, 2005), because they explain how the different concepts within them might change in times of shock, which could influence the demand for credit specifically.

4.1.2 Credit market

In developing countries, like for this research, access to formal credit is often rationed (Stiglitz and Weiss, 1981) and access to informal credit is commonly linked to kinship ties, again a function of the household (Swaminathan, 1992).

The supply side of credit is very much characterized by constraints. Credit market imperfections (from the supply side) such as interest rate ceilings, large transaction costs for borrowers in applying for loans, and moral hazard problems increase potential for credit rationing (Carter, 2007; Foltz, 2004). A household is credit rationed if it demands more credit than its supply. On the supply side, lenders may restrict loans to households that can signal their credit worthiness via observable wealth criteria, such as collateral. On the demand side, large transaction costs may impede application for loans. Also, under the interaction between imperfect formal credit institutions and households' risk aversion behavior, rural households will be discouraged to depress their formal credit demand or replace it with informal credit, which is called demand-side credit constraints.

Determinants of the limited access to credit and other financial services available to households of developing countries, such as Mexico, are not well known. Some models do exist on access to credit but they have their shortcomings. The first method tries to detect credit constrained households through tests of violation of the life-cycle or permanent income hypothesis. One of the testable implications of this hypothesis is that in the absence of liquidity and borrowing constraints, transitory income shocks should not affect consumption (Deaton, 1990). Empirical evidence from this methodology regarding presence or absence of credit constraint has been inconclusive, mostly because violation of the implications of the hypothesis is neither a sufficient nor necessary condition for being credit constrained (Diagne et al, 2000). The second method of measuring access and detecting credit constraint collects household-level credit market information directly from household surveys to determine whether or not households are credit constrained. This classification is then used in reduced-form regression equations to analyze the determinants of the likelihood of a household being credit constrained and the effects of this likelihood on various household outcomes. The formulation of credit constraint in this literature focuses on household assets, income, and consumption variables, and abstracts from all the variables related directly to the credit market. The former set of variables does affect credit transactions, but only indirectly (except the case of an asset being used as collateral).

This means that assets, income and consumption variables should be taken into account when analyzing credit as a coping strategy as well.

The credit market can be analyzed as any other commodity market would be, using the concept of demand and supply of credit, with the interest rate being the price of credit. In this framework, the supply and demand curve represents, respectively, the amount the lender is willing to lend and the amount the borrower is willing to borrow at exogenously given interest rates. This simplistic Walrasian equilibrium view of the credit market is, however, not useful for understanding the complete nature of credit transactions (Freixas and Rochet, 1997), because the assumption of price-taking behavior on the part of the lender is hardly realistic, especially in a developing country context and other problems related to information asymmetries and contract enforcement make it difficult to understand everything. Another problem is that interest rates can have a negative effect as well as the real poor households will be only accepted in programs with high interest rates like microfinance programs, which then results in a default within the microfinance program itself.

4.1.3 Livelihood Capital

Both the household model as well as the credit market model emphasize on the importance of assets when dealing with formal and informal credit. In chapter two the classification of assets into the different capitals was already introduced. When clustered, the assets form the livelihood capital of a household. Livelihood capital is the wide range of individual, household and community assets poor people utilize to cope with different levels of vulnerability associated with poverty (Gifford, 2004). They represent an essential component and a starting point for livelihood analysis as they correspond to what the poor have, rather than what they do not have (Moser, 1998). What households have reflects on their capacity to respond to shocks. Accordingly, assets are the basic factors of production and consumption that are controlled by the household (Fofana, 2010). As discussed in the conceptual framework, Scoones (1998) classified assets into natural, physical, human, financial and social capital. In later analysis also the capital of location has been included. In the case of this research, the livelihood capitals fit the contextual framework of credit, where financial capital is the asset that comprises access to formal loans and social capital to informal credit.

Natural capital refers to natural resources such as land, water, forest, and other biological resources used by households to meet their needs for survival. In rural areas, land is one of the most important production factors. In connection to formal and informal credit, land can serve as collateral for lending. Location capital refers to the place the household is located at, e.g. in a rural or urban area or in a specific region.

Human capital refers to the labor available to households and it is related to the education level, skills and health status of people that together enable them to pursue different livelihood strategies and achieve their livelihood outcomes. Labor is a very important factor for the household and it determines its capability to generate a livelihood (Fofana, 2010).

Psychical capital includes agricultural infrastructures like irrigation canals and infrastructures such as roads, electricity, and clean water supplies. These assets are important for the support of livelihood and the development of both rural and urban communities.

Financial capital refers to the stocks of cash that can be accessed by households in order to purchase either production or consumption goods. This also includes the provision of credit.

Lastly, social capital refers to the social networks, associations and relations, in which households participate, and from which they can derive support.

4.2 The Data

From 2004 until 2007, an annual household panel survey was implemented by the Mexican Ministry of Agriculture (SAGARPA) and the National Savings and Financial Services Bank (BANSEFI) through the project 'Program for strengthening Savings, Social Credit and Rural Micro-finance'.

Four waves of the survey have been undertaken (2004, 2005, 2006 and 2007). The total sample size for the survey is about 5,700 households and it gathers detailed information from households, both rural and urban, on assets and liabilities (physical and financial, formal and informal), expenditures, level of income (from labor and non-labor sources), productive activities, insurance and remittances, among other variables (Zapata-Alvarez, 2007). Most interesting here is that the survey also includes information on shocks experienced by different types of households and the type of coping strategies used to deal with these shocks.

By ways of stratified sampling techniques the data was collected on the household level. The technique of probability proportional to the number of clients for each financial institution has been used according to the size of the MFIs. Then, the clients for each organization were selected at random by a client's records which were made available by the institutions. The selection criteria permitted a link to them with equal probability of being selected. Within the group of households several group divisions have been made. First, all the Mexican states have been 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. Finally the institutions have been grouped, in turn, into very small (0-1,500 clients), small (1,501-10,000 clients), medium (10,0001-100,000 clients), and large (100,001 or more clients) institutions.

Also, all the interviewed households have been divided into two groups according to their access to financial institutions. This meant a difference between households that have at least one member in the family who is a client of a financial institution (treatment group) and households that do not have any member in the family who is a client of a financial institution (control group). Both groups display similar socio-economic characteristics. During the period of the survey 1,721 households went from the control group to the treatment group and 1,424 left the survey, which means that some attrition occurred.

The survey was designed to gather more detailed information about the financial behavior of cooperative member households as well as households that choose not to access, or are unable to access financial services from institutions. The detailed information of the panel survey allows changes to be tracked over time at the household level in 27 states.

4.3 Construction workable data set

As discussed above the used panel set has been made available by SAGARPA and BANSEFI. However, as a direct result from the fact that the panel set is unbalanced, or in other words, contains households that drop from one year to the other and that not all questionnaires are the same for every year, it is difficult to merge the data over the different years. Therefore only data from 2004 and 2005 has been used.

The chosen variables will be explained into further detail in the next section of the empirical model; however it should be noted that some variables have monetary values. Because data from both 2004 and 2005 is used, it was necessary to correct the monetary values of the data for inflation. This is accomplished by dividing these variables by the Consumer Price Index (CPI). The year of 2004 has been used as the start year and for 2005 the CPI deflator of 0.96165192 is used.

In some variables, missing values have been found and corrected by recoding or only the sample without the missing values has been used. Also, it was found that in the year 2004 some observations were included in the survey as repeated. Therefore, these observations have been taken out of the data. Then new variables were created by making calculations with the data provided by SAGARPA and BANSEFI. How these were exactly calculated can be found in appendix I.

From this work a summary was made of all statistics used for the analysis in chapter five, extended information on how all variables have been calculated can be found once again in appendix I.

Table 1: Summary of variables used

Variable	Label	Obs	Mean	Std. Dev.	Min	Max
Formal credit coping strategy	Dummy	10385	.0145402	.1197087	0	1
Informal credit coping strategy	Dummy	10385	.0327395	.1779626	0	1
Formal credit	Amount, deflated	10385	306260.6	2237639	0	1.22e+08
	Dummy	10385	.1603274	.3669271	0	1
Informal credit	Value, deflated	10385	147349	1300750	0	7.58e+07
	Dummy	10385	.2358209	.4545312	0	1
# shocks	As reported by the HH	10385	.6161772	.836043	0	6
Death HH	Shock death HH member	10379	.0366124	.1878173	0	1
Illness	Shock illness HH member	4550	.2114286	.4083665	0	1
Disaster	Shock natural disaster	4551	.1711712	.3766999	0	1
Low Prices	Shock lower sale price	4549	.0683667	.2524018	0	1
Low Quantity	Shock drop sales	4549	.2484062	.4321361	0	1
Joblessness	Shock joblessness	4549	.4688943	.4990864	0	1
Job lost	Shock losing job	4549	.1026599	.3035476	0	1
Equipment	Shock equip breakdown	4549	.0505606	.2191227	0	1
Savings *	Log of savings, deflated	10385	3.459897	5.2388	0	16.7
Productive assets *	Log and deflated	10385	122400.3	1503404	0	5.09e+07
Animals *	Log of the value, deflated	10385	3.562415	5.61626	0	19.4
Dependency ratio	# dependent HH members / # total members	10384	.3720341	.2671335	0	1
Working	# working HH members	10385	2.703996	1.456088	0	12
Education	# years education head	10385	5.84805	4.678145	0	23
	# years education adults	10378	6.493951	3.866126	0	21
Age	Of the head	10380	47.91859	15.60216	17	99
	Average of the HH	10380	31.99148	16.36948	7.5	97
Gender	1 if head is male	9909	.8395398	.3670508	0	1
Civil status	1 if head married	10385	.6440058	.4788365	0	1
Indigenous	1 if indigenous language	10354	.2387483	.4263392	0	1
Water	1 if access to water	10360	.9189189	.2729728	0	1
Electricity	1 if access to electricity	10290	.9687075	.1741156	0	1
Telephone	1 if access to telephone	10074	.5053603	.6406442	0	1
Land	# hectares	10382	1.342478	10.13125	0	502
South	1 if living in south region	10385	.4961001	.5000089	0	1
Central	1 if living in central region	10385	.324988	.4683929	0	1
Urban	1 if urban	10385	.5223881	.4995226	0	1
Year	1 if 2004	10385	.5410688	.4983345	0	1
Income	Total income, deflated	10385	1.06e+07	1.21e+08	0	9.17e+09
Expenditures	Total expenditures, deflated	10385	9035144	9179182	0	3.25e+08
Consumption	Total consumption, deflated	10385	8164417	8370761	0	3.24e+08
Insurance	# insured HH member/ # total	10258	.1307519	.3083297	0	1
Tandas	Being part of	10384	.1714176	.3768916	0	1
Remittances	International, deflated	10385	28613.93	224324.6	0	1.15e+07
HH memb	# HH members	10384	4.40678	1.981805	1	18

* the log of these variables was constructed to be able to fit them into all the estimation models

4.4 Empirical Model

This research has been designed to estimate the amount of formal and informal credit, used as a coping strategy to deal with risks in Mexico. Therefore formal credit and informal credit are the dependent variables for this estimation. From the theoretical models discussed in 4.1, the conclusion can be drawn that several sets of variables determine the dependent variables. The concepts of all three models discussed there have been combined by dividing them under the five capitals of Scoones (1998) (financial, human, natural, physical, social and the extra location capital) as well as some shock related variables, to be able to model these for this research.

The variables defining financial capital include financial savings as liquid assets, productive assets and value of animals. All these variables are important because they determine the possibilities a household has in order to deal with risks. The more assets a household possesses the more possibilities to sell capital in case of shocks. This could mean that having financial capital makes credit unnecessary. On the other hand, financial capital is also used as collateral requirement by credit institutions. A poor household, with fewer assets, has fewer options to obtain (formal) credit because it cannot provide collateral.

Other financial variables, which cannot be accounted for capital of a household, like total household income, remittances, expenditures and consumption have endogeneity and inter-correlation problems. These problems are the cause of the fact that the earlier mentioned variables will not be estimated within the empirical model. Endogeneity can arise as a result of measurement error, auto regression with auto-correlated errors, simultaneity, omitted variables, and sample selection errors (Baum, 2006). In this case it means that a loop of causality between the independent and dependent variables leads to endogeneity. Because this research talks about data in time series, some independent variables are actually dependent for their value in period t on the values of other variables in period $t-1$. Within the analysis this will result in the fact that these particular variables cannot be used as independent variables.

At the same time, remittances can become complicated because this variable might be a risk coping strategy itself and influence the amount of formal and informal credit used as a coping strategy at the same time.

For human capital many variables could be identified. Average age of the household members as well as the specific age of the head of the household, marital status, gender, average education for all adults in the households as well as only for the head, dependency ratio, amount of working family members, insurance ratio and speaking the indigenous language. All these variables might have an influence on using formal and informal credit as a coping strategy. Only the insurance ratio (amount of insured household members divided by the total amount of household members) is experiencing endogeneity problems, which is why it is not included in the empirical model. Education can cause some households members to find other, better paid jobs. In this process age and gender do also have an influence, older men or woman will encounter more difficulties in finding off farm jobs for example. Poor households often tend to have more household members, which gives them more labor but at the same time also more mouths to feed.

For natural capital only the amount of hectares of land a household owns is identified, because this can be used as collateral when applying for a loan.

Access to water, electricity and owning a telephone are determinants for physical capital. These are very important for the development of a household and so the ability to cope with shocks. When a household has access to water and electricity it is a household which is better-off in terms of welfare. When it has access to a telephone it is easier to communicate with possible money lenders, both formal and informal. Also, in rare cases these variables of physical capital can be used as collateral for obtaining a loan.

Social capital is very difficult to measure, in this case the variable of being part of roscas, or tandas could be used. Of course this would give more opportunities of obtaining an informal loan when this variable would be positive. However this causes also the endogeneity problems encountered. Because of these problems social capital will be left out of this empirical model.

The extra capital, the locational capital, includes both variables on living in a rural or urban area as well as in the specific regions of southern and central Mexico. When a household lives in an urban area it has easier access to formal credit institutions, however the MFIs are more focused on rural areas. The southern region of Mexico is the poorest region of Mexico, as discussed in chapter three; this implies that the households living on the south possess few assets that could be used as collateral for credit.

Next to the different assets, also the shocks experienced itself have an influence on the dependent variables of formal and informal credit used as a coping strategy. That is why the total number of shocks a household reported as well as the eight different types of shocks is included in the empirical model. These risks include frequent less severe risks as well as very severe risks and risky events. The latter includes the death of a household member as well as severe illness to one of the household members. These risks bring along extra costs for a funeral or hospital admission and at the same time the household may be faced with a loss of income. Another severe risk, but covariant instead of the earlier idiosyncratic risks, is the risk of a natural disaster, this includes drought, excessive rainfall, floods as well as pest and diseases in livestock and crop.

Some moderate severe risks include a lower price for products, a drop in the sales, being joblessness and losing a job. All these risks result in income shortfalls, which can be positively changed over time. An example of less severe risks includes the breakdown of equipment or vehicle. Other risks, which are less interesting for this research, include lower wages, birth, theft, divorce, fire and death of livestock.

As a control variable the time variable of the year 2004 will be investigated. Of course it is important to look at the time-aspect, if the household reports in 2004 or 2005, because a panel data set will be used to estimate the empirical model.

The variables that encounter endogeneity problems are left out of the empirical model, however they will be calculated and estimated in order to achieve a better insight in the characteristics of the households; they can be found in the summary of the variables in table 1 and how they are calculated and defined has been included in appendix I.

The variables that will be used as explanatory variables can be found, together with their expected causality for both coping strategies in table 2. In appendix I a list with clear definitions and specific concepts of all variables can be found. Apart from that the dependent variables of formal and informal credit used as coping strategy have been described.

Table 2: Explanatory Variables and Expected Causality

Variable	Causality	Expected Correlation Formal Credit	Expected Correlation Informal Credit
SHOCK RELATED²			
Number of shocks as reported by the HH	The higher the intensity of shocks the more all coping strategies will be used.	+	+
Death HH member	If this shock is experienced, more credit will be asked for to pay for the funeral for example.	+	+
Illness /accident	Hospital bills can be paid by credit.	+	+
Natural disaster	Because this is covariant, less access to formal credit and more to informal.	-	+
Lower sale price	Leads to fewer assets to be used as collateral, informal credit can be used to cope.	-	+
Drop of sales	Leads to fewer assets to be used as collateral, informal credit can be used to cope.	-	+
Joblessness	Leads to fewer assets to be used as collateral, informal credit can be used to cope.	-	+
Losing job	Leads to fewer assets to be used as collateral, informal credit can be used to cope.	-	+
Equipment breakdown	Money to fix or replace the equipment can quickly be obtained by informal credit.	+/-	+
FINANCIAL CAPITAL			
Savings (Stock Savings)	The more savings, the higher the probability of using a formal loan as this can be used of collateral, however the probability of informal credit will reduce because it will first use savings as coping strategy.	+	-
Productive assets (equipment, machinery, animals)	The fewer assets a HH has the fewer possibilities to cope with risks, which implies a positive correlation with both dependent variables.	+	+
Value of animals	Animals can be used as collateral for both formal and informal credit.	+	+
HUMAN CAPITAL			
Dependency ratio	The more family members are dependent, the less flexible a HH is and in case of shocks it will use less credit and instead lower consumption.	-	-
Number of working HH members	When many HH members work, the HH will have more possibilities to cope with risk using other strategies.	-	-

² The variables within this section were expected to also show endogeneity problems, however when taking them out of the model, the other variables did not change as can be seen in both appendices IV and V.

Education (head)	More human capital by means of education gives a responsible image to the HH and enlarges the access to formal and informal credit.	+	+
Education (adults)	More human capital by means of education gives a responsible image to the HH and enlarges the access to formal and informal credit.	+	+
Age (head)	If age increases, the HH will be seen as more reliable for obtaining formal and informal credit.	+	+
Age (HH)	If age increases, the HH will be seen as more reliable for obtaining formal and informal credit.	+	+
Gender (head)	If the head is female, it will be easier to access formal credit since many of these target women due to moral hazard problems. Informal credit is more accessible to men.	-	+
Civil status (head)	Being married extends your informal network as well as your reliability for a formal loan, because the document can be showed.	+	+
Indigenous	When only speaking the indigenous language documentation cannot be provided or read which is needed for loans.	-	-
PHYSICAL CAPITAL			
Access to water	Water can be rare in rural areas, which means it can be seen as an indicator for welfare which increases the credit coping strategies.	+	+
Access to electricity	Electricity can be rare in rural areas, which means it can be seen as an indicator for welfare which increases the credit coping strategies.	+	+
Access to telephone	Communication means increase a formal and informal network.	+	+
NATURAL CAPITAL			
Number of hectares of land	Land can be used as collateral, which will increase both dependent variables.	+	+
LOCATION CAPITAL			
Region: south	In the south HH are poorer and face more shocks but they are also more risk-averse, which leaves the causality of both variables doubtful.	+/-	+/-
Region: central	In the central region, HH are richer, but also face more shocks. Due to the possibilities of coming with collateral, positive correlation is expected.	+	+
Urban	HH in urban areas have more access to formal institutions, while rural HH to informal ones. This is because microcredit programs have normally been implemented in rural areas of developing countries	+	-
CONTROL			
Year	2004 has a lot more reported shocks than 2005, which implies more use of both coping strategies.	+	+

4.5 Estimation methods

As explained in paragraph 4.3, data will be used over the time span of 2004 and 2005. Because a censored panel data set is available it would be very interesting to use a linear probability model and a XT logit model, both holding for fixed effects. Unfortunately these models only take these observations into account that change of time (go from 0 to 1 or from 1 to 0) which left the analysis with a sample that was too small to get significant outcomes.

It has also been attempted to get more interesting results by running a truncated model and a double hurdle model on a censored sample of the data. However, only few observations were counted for when analyzing formal and informal credit as a coping strategy. This is why neither the truncated nor the double hurdle model was taken into the estimation methods.

A normal linear probability model (LPM) has been run, after which the data has been tested and corrected for residuals, outliers and heteroskedasticity. The results of these robustness checks can be found in appendix III.

In the end, the empirical model described above has been estimated while running two probit models and a tobit model; on this will be elaborated in chapter five. In the following paragraph a short insight in these methods is given.

4.5.1 Probit Model

Probit models are used to model a relationship between a binary dependent variable Y and one or more independent variables X. The independent variables are presumed to affect the choice or category or the choice maker, and represent beliefs about the causal or associative elements of importance in the choice or classification process.

A probit model, as any other regression, has some basic assumption, namely:

- Y is caused by or associated with the X's, and the X's are determined by influences 'outside' of the model.
- There is uncertainty in the relation between Y and the X's, as reflected by a scattering of observations around the functional relationship.
- The distribution of error terms must be assessed to determine whether a selected model is appropriate.

A probit model looks like this:

$$\Pr(y_i=1)=F(x_i'b)$$

Here b is a parameter to be estimated, and F is the normal cdf. The logit model is the same but with a different cdf for F.

The coefficients that are the result from this probit model need to be supplemented with the marginal effects, to be able to see the change in probability. Also, the method of maximum likelihood that selects values of the model parameters that maximize the likelihood function need to be applied.

4.5.2 Tobit Model

The tobit model is an econometric model which is used to describe the relationship between a censored dependent variable Y and an independent variable X . Within this model, the dependent variable is censored, which means y_i^* is not observed. The model is:

$$y_i^* = \beta x_i + u_i \text{ where } u_i \sim N(0, \sigma^2)$$
$$y_i = y_i^* \text{ if } y_i^* > y_0, \text{ and } y_i = y_0 \text{ otherwise } y_i \text{ is observed}$$

The tobit and probit models are similar in many ways for this research. They both use the same structural model, but they differ in measurement models i.e. how the y^* is translated into the observed y . In the tobit model, we know the value of y^* when $y^* > 0$, while in the probit model we only know if $y^* > 0$.

5 Analysis

This chapter will elaborate on the data, the variables and the relationships between them. It will start with a description of the data and the variables and conclude by means of the actual analysis while referring to the background theories.

5.1 Household characteristics

Within the panel survey many different types of households have answered the questionnaires. The households, with an average of 4.4 members, of which in average 2.1 is man and 2.3 is woman and 2.7 working, live for 47% in rural areas as compared to 53% in urban, of which 1,858 live in the northern region; 5,176 in the southern and 3,500 in the central region. The average age of the head of the household (which is a man in 80% of the observations) is 47.8 years, whereas the average age of all members is 31.9; the head of the household has followed an average of 5.8 years of education and the average of all adults of the household is 6.4 years.

The ability to cope with risks is highly related to an average of 0.13 insurance ratio, an average of 28,614 pesos received international remittances and an income of 10,600,000 pesos per year. Also, an average expenditure of 9,035,144 pesos is experienced, of which 8,164,417 belongs to consumption, per year.

5.1 Shocks

As said before the survey was held under 5,700 household all over Mexico. As part of the questionnaire the households were asked if they experienced any shocks during the past twelve months. These shocks include the death of a household member, severe illness to one of the household members, the risk of a natural disaster, a lower price for products, a drop in sales, being joblessness, losing a job, breakdown of equipment or vehicle and other risks. These other risks, which are less interesting for this research, include lower wages, birth, theft, divorce, fire and death of livestock.

In table 3 the specific number of shocks that have been experienced can be found as well as these experienced shocks as a percentage of the amount of observations of that variable.

Table 3: Experienced shocks in 2004 and 2005

Type of shock	Frequency		Total
	'04	'05	
Death of HH member	195 (3,4%)	193 (4,1%)	388
Illness of/ accident with HH member	526 (19,4%)	456 (23,5%)	982
Natural disaster	451 (16,6 %)	338 (20,6%)	789
Lower sale price	198 (7,3%)	132 (6,8%)	330
Drop of sales	743 (27,4%)	439 (22,6%)	1,182
Joblessness	1312 (48,4%)	857 (44,2%)	2,169
Losing job	242 (8,9%)	243 (12,5%)	485
Equipment/ vehicle breakdown	163 (6,0%)	83 (4,3%)	246
Other	5 (0,2%)	3 (0,2%)	8
Total (N)	3,835	2,744	6,579

Percentage of amount of observations in parentheses

The most important risks to take into account in both 2004 and 2005 are drop of sales, illness of a household member, natural disasters and by far joblessness.

Mexico is often threatened by natural phenomena such as earthquakes, flooding, volcanic activity, hurricanes and tropical storms. In the year of 2005, Mexico was even in the top 10 of countries most hit by natural disasters (International Disaster Base). In 2004 and 2005 a high unemployment rate was present in Mexico (Instituto Nacional de Estadística Geografía e Informática) which is the direct cause of the high number of joblessness observations in this data set.

The low GDP of 1% in 2004 and 1.3% in 2005 is the direct result of the fact that many households face cases of drop in sales. When research would have been done on later years, most probably this amount of cases of drop in sales would be less. If looked at illness over the years, this risk is always reported high however it cannot be seen as a constant variable since different households every year report this shock.

Some households reported more than just one shock for each year, in 2004 an average of 0.65 shocks were reported and in 2005 this was 0.58. However, when only taking the observations that reported at least one shock into account, the average amount of shocks is 1.40 for 2004 and 1.41 for 2005.

An important notion is that the variables are based on responses of the households themselves; it could be that a shock like equipment breakdown was important enough for one household to report, while another (most probably richer) didn't. Therefore a closer look needs to be taken at the relationship of the total amount of shocks reported and the welfare level of these households. Two factors are of influence when looking at this relationship: poor household may report relatively small shocks sooner than rich households do and poor households may be more exposed to shocks than rich households. Income cannot be used here as an indicator for welfare due to the fact that this income has been experienced after the shock, which could have caused big fluctuations. Since urban and rural households behave differently according to their welfare level, a separation is made between them. The following table looks at the relationship between the amount of shocks and the quantiles of amount of hectares of land for the rural population and the quantiles of assets for the urban households.

Table 4: Total reported shocks per region and quantiles of land (rural) and assets (urban)

	#Shocks '04	# HH reporting	Average per HH reporting	# Shocks '05	# HH reporting	Average per HH reporting
North	505	364 (35.7%)	1.39	411	317 (37.8%)	1.30
South	2,014	1,440 (51.1%)	1.40	1,435	1,020 (43.7%)	1.41
Central	1,136	806 (45.2%)	1.41	898	604 (38.0%)	1.49
Urban	1,787	1,279 (43.1%)	1.40	1,318	1,022 (44.2%)	1.29
Rural	1,863	1,331 (50.2%)	1.40	1,426	919 (37.4%)	1.55
Q1 Land	999	736	1.36	800	593	1.35
Q4 Land	844	582	1.45	614	419	1.47
Q1 Assets	504	363	1.39	371	259	1.43
Q4 Assets	402	281	1.43	289	200	1.45

Percentage of amount of households in the sample in parentheses

For urban households, one can draw the conclusion that reporting shocks is not correlated with welfare, since there is almost no difference between the average amount of shocks per household as well as the total reported shocks for households in the first quantile of assets and the fourth quantile. For rural households, where hectares of land are taken as a welfare indicator, it turns out that the more land a household possesses, the more shocks it reports. Main cause for this is that land is heavily exposed to shocks like natural disasters. However, since this can be reasoned in other ways, it is not proven that welfare and number of reported shocks are correlated and therefore the variable total number of shocks will be seen as rather reliable.

It is remarkable that a high proportion of households that have faced shocks were concentrated in the south of the country, where poverty is relatively higher and natural disasters occur more frequent. Also remarkable, the difference in shocks reported between rural and urban areas is not of a significant value, which means that not only rural areas are vulnerable to shocks, which was expected at forehand.

5.3 Formal and Informal Credit

Within Mexico several institutions for both formal and informal credit exist in which the households of this sample obtained a monetary value of credit.

Table 5: Formal and Informal Credit

	Formal credit		Informal Credit	
	# HH reported	Average Amount*	# HH reported	Average Amount*
Total	1,665 (16.0%)	1,910,220	2,449 (23.6%)	624,834.3
Region: North	288 (15.5%)	2,097,857	463 (24.9%)	590,547.1
Region: South	783 (15.2%)	2,122,542	1,230 (23.9%)	667,632.6
Region: Central	594 (17.6%)	1,539,365	756 (22.4%)	576,200.8
Urban	820 (15.1%)	2,369,574	1,227 (22.6%)	756,905.6
Rural	845 (17.0%)	1,464,456	1,222 (24.6%)	492,222.6

Percentages of total households per variable are in parentheses

*amounts are in pesos and are deflated over time

Although the share of the population that has formal and informal credit do not differ that much between urban and rural households, the amount is almost doubled for urban households. This is partly due to the fact that urban households have access to formal institutions which give out higher loans than the rural-oriented ones and partly to the fact that the share of the population living in urban areas has a higher income level.³ The latter explains that the urban households have more income and abilities to lend informal credit of a higher amount than in rural areas.

For all regions the amount of households that use informal credit is twice as big as the amount of households that use formal credit. This stresses again on the easier access to informal than formal credit.

³ For urban areas 32% of the households lay in the upper quartile of income, while 18% lays in the lower quartile. For rural areas this is 17% versus 32% respectively.

This overview displays both formal and informal credit in general, however for this research it is especially interesting to see this when both types of credits are used as a risk coping strategy.

5.4 Formal and Informal Credit used as coping strategy

Earlier, the different shocks a household reported have been discussed. Within the survey, the households have been asked what strategies they use to cope with risks. Possible answers included getting a loan with interest (formal and informal), lowering consumption, stop paying debts, use savings and other strategies. Since the latter needed to be specified, a list of 48 answers was created, which has been placed in appendix II. Because this research is about formal and informal credit as a coping strategy, and these factors had not been directly asked for, these variables needed to be created. For informal credit the answers loan without interest, credit of friends and family and participate in tandas have been combined. Formal credit consists out of request from the cooperative as well as loan with interest. The latter, loan with interest, had to be split up into informal and formal credit by means of the dummy variables total formal credit and total informal credit. Households reporting formal credit have been put under formal credit as a coping strategy and households reporting informal credit have been put under informal credit as a coping strategy.

In table 6 the use of formal and informal credit as a coping strategy is displayed, which is done by means of a number of observations that reported to have loans. Also, a percentage is calculated of the number of observations that use credit to cope with a specific risk, divided by the number of observations that have actually experienced that risk.

Table 6: Use of formal and informal credit as a coping strategy

Type of shock	Formal Credit		Informal Credit	
	'04	'05	'04	'05
Death of HH member	17 (8,7%)	6 (3,1%)	50 (25,6%)	8 (4,1%)
Illness of/ accident with HH member	69 (13,1%)	17 (3,7%)	152 (28,9%)	32 (7,0%)
Natural disaster	17 (3,8%)	5 (1,5%)	30 (6,7%)	6 (1,8%)
Lower sale price	8 (4,0%)	6 (4,5%)	11 (5,6%)	8 (6,0%)
Drop of sales	25 (3,4%)	14 (3,2%)	54 (7,3%)	11 (2,5%)
Joblessness	31 (2,4%)	10 (1,2%)	135 (10,3%)	20 (2,4%)
Losing job	6 (2,5%)	3 (1,2%)	22 (9,1%)	5 (2,1%)
Equipment/ vehicle breakdown	22 (13,5%)	6 (7,2%)	28 (17,2%)	4 (4,8%)
Other	1 (20%)	-	1 (20%)	-

Percentage of households reporting a specific shock in parentheses

As can be seen, informal credit is used more often than formal credit is. Also, both ways of obtaining credit is mostly used in cases of temporary and immediate risk, for example the illness of a household member.

The difference in used credit between 2005 and 2004 come as a direct result of simply having more shocks experienced in 2004. In almost 30% of the observations, the same household reported credit as a coping mechanism for more than one shock that the household experienced, as can be seen in table 7.

Moreover a percentage is given of the amount of observations that have reported to use credit as a coping strategy, compared to the amount of households which have reported to have experienced shocks.

Table 7: Simultaneous shocks and coping by means of formal and informal credit

# shocks experienced	Formal Credit		Informal Credit	
	'04	'05	'04	'05
1	54 (3,0%)	20 (1,5%)	140 (7,8%)	31 (2,3%)
2	37 (5,9%)	9 (2,1%)	95 (15,1%)	14 (3,2%)
3	16 (11,3%)	5 (4%)	33 (23,4%)	6 (4,8%)
4	5 (13,2%)	1 (3,7%)	12 (31,6%)	3 (11,1%)
5	-	2 (25%)	-	1 (12,5%)
6	-	-	1 (100%)	-

Percentage of amount of observations per row in parentheses

When a household faces one specific shock it has many options to cope with the results of these, however when it will face more and more simultaneous shocks it will become more difficult to cope with these, using other coping strategies. From this table, clearly, the conclusion can be drawn that the more shocks a household faces, the more it will use both types of credit as a coping strategy.

5.5 Formal Credit used as a Coping Strategy

Now, the relationship between the dependent variable formal credit and all the independent variables, as indicated in the empirical model, will be analyzed by running two probit and one tobit regression.

Before doing so, a normal linear probability model (LPM) has been run, after which the data have been tested and corrected for residuals, outliers and heteroskedasticity. The results of these robustness checks can be found in appendix III. By comparing the LPM to the probit model, the estimation model has been checked for robustness as well.

Because it is interesting to see the change in formal credit in general, as well as formal credit used as coping strategy, two probit models have been run. Another reason for running two probit models has been to be able to account for the fact that reported use of formal credit might not be the same as the observed use of this. The first probit model has been run by taking the whole sample of observations, whereas for the second model, formal credit used as coping strategy is taken as dependent variable for only those observations that report one or more shocks. Only one tobit model has been run, in which the amount of credit has been used as the dependent variable, as compared to the dummy of the first probit model. No tobit model for amount of formal credit used as coping strategy could be run, because this amount could not be calculated based on the information available.

The results of these models have been placed in table 8. For each model the marginal effects as well as the standard errors have been included.

In appendix IV the complete output of these analyses can be found.

Table 8: Estimation Results on the Probability of using Formal Credit as Coping Strategy

	Formal Credit		Formal credit as coping strategy
Variable	Probit (dummy)	Tobit (amount)	Probit (dummy)
SHOCK RELATED			
Number of shocks as reported by the HH	-0.0719 (0.1313)	-0.1077 (0.0749)	-0.1486*** (0.03721)
Death HH member	+0.0976 (0.1860)	+0.1479 (0.1319)	+0.8562*** (0.0234)
Illness /accident	+0.1153 (0.1765)	+0.1486 (0.1164)	+0.7423*** (0.0566)
Natural disaster	+0.0839 (0.1695)	+0.1337 (0.1169)	+0.6857*** (0.0735)
Lower sale price	+0.1353 (0.2048)	+0.1796 (0.1419)	+0.7612*** (0.0875)
Drop of sales	+0.1275 (0.1755)	+0.1551 (0.1138)	+0.5318*** (0.0714)
Joblessness	+0.0663 (0.1353)	+0.0980 (0.0801)	+0.1824*** (0.0377)
Losing job	+0.0885 (0.1802)	+0.1859 (0.1409)	+0.7467*** (0.0790)
Equipment breakdown	+0.1298 (0.2047)	+0.2085 (0.1512)	+0.9260*** (0.0298)
FINANCIAL CAPITAL			
Savings (log)	+0.0187*** (0.0010)	+0.0134*** (0.0007)	+0.0040*** (0.0007)
Productive assets (log)	+0.0027* (0.0014)	+0.0020* (0.0011)	+0.0009 (0.0007)
Value of animals (log)	+0.0030*** (0.0030)	+0.0012* (0.0007)	+0.0010** (0.0005)
HUMAN CAPITAL			
Dependency ratio	-0.0088 (0.0277)	+0.0064 (0.0246)	-0.0208 (0.0167)
Number of working HH members	+0.0054 (0.0051)	+0.0058 (0.0055)	+0.0010 (0.0027)
Education (head)	+0.0008 (0.0022)	-0.0016 (0.0020)	+0.0008 (0.0012)
Education (adults)	+0.0061** (0.0028)	+0.0092*** (0.0023)	-0.0008 (0.0017)
Age (head)	+0.0008 (0.0006)	+0.00038 (0.0005)	-0.0001 (0.0003)
Age (HH)	-0.0006 (0.0007)	-0.0002 (0.0005)	-0.0004 (0.0004)
Gender (head)	-0.0309 (0.0210)	-0.0315 (0.0192)	+0.0016 (0.0105)
Civil status (head)	+0.0704*** (0.0129)	+0.0516*** (0.0109)	-0.0017 (0.0087)
Indigenous	+0.0028 (0.0138)	+0.0070 (0.0119)	+0.0048 (0.0084)
PHYSICAL CAPITAL			
Access to water	+0.0268 (0.0167)	+0.0223 (0.0115)	+0.0108 (0.0078)
Access to electricity	+0.0746*** (0.0187)	+0.0614*** (0.0132)	+0.0137 (0.0075)

Access to telephone	+0.0364*** (0.0097)	+0.0410*** (0.0069)	+0.0065 (0.0051)
NATURAL CAPITAL			
Number of hectares of land	+0.0002 (0.0004)	+0.0001 (0.0003)	+0.0003 (0.0003)
CONTROLS			
Region: south	-0.0462*** (0.0159)	-0.0238* (0.0136)	-0.0201** (0.0101)
Region: central	-0.0093 (0.0162)	-0.0126 (0.0128)	-0.0095 (0.0072)
Urban	-0.0572*** (0.0118)	-0.0426*** (0.0092)	-0.0097 (0.0068)
Year	+0.1233*** (0.0101)	+0.1117*** (0.0091)	+0.0212*** (0.0067)
R ²	0.2370	0.322	0.2776
N	4124	4124	1264

Standard errors in parentheses

* significant on 0.10 level ** significant on 0.05 level *** significant on 0.01 level

The amount of observations of the models defining formal credit equals 4,124 and the probit model for formal credit as a coping strategy shows 1,264, which means the observations with missing values for any of the variables have been taken out. Also all R² show that the models as a whole fit significantly better than an empty model.

Financial capital can be used as collateral for obtaining formal credit. This is the reason that all variables have a significant impact on the amount of credit. A marginal change from the average in savings, productive assets and value of animals is associated with a 1 % increase in formal credit. For this formal credit to be used as a coping strategy, only animals and savings have showed significant influence, as these will make access to the formal credit institutions easier.

Human capital was expected to have a very big influence on formal credit, however from the analysis can be concluded that in order to obtain a formal loan only the average amount of years of education of all the adults in the household, as well as the civil status make a difference in formal credit. Both indicators require documents: the more adults in the household have at least obtained a high school diploma, the more reliable the household becomes in the eyes of a credit supplier. Also a marriage certificate is an important document as requirement to access to some specific formal institutions and this official marriage is then preferred over the numerous civil status's which are not legally written down in a document. Furthermore, the demand for formal credit rises when education level increases, since well-educated households have a preference of formal credit over informal credit (Holden, 1998).

As expected, physical capital showed to have a high influence on formal credit. Having access to a telephone and electricity showed a positive effect of 3.6% and 7.4% respectively on formal credit. Electricity can be seen as an indicator for welfare and having a telephone means making easier contact with the formal institutions as a way of communication. Also, telecommunication brings institutions closer, which increases the demand for formal credit.

As discussed earlier, the southern region of Mexico is a very poor and vulnerable region. It comes as no surprise that living in this region has a negative effect on formal credit, because households living in this region have a lower welfare level and can therefore provide less collateral. The demand for formal credit as a coping strategy in the south is lower than in other regions, as other coping strategies, which cost less money, like reducing consumption are easier to apply for the poor in the southern region.

However, it has been expected that urban areas would have easier access to formal credit in comparison to rural households. The opposite turned out to be true, which would mean that the focus of formal institutions on rural areas is very effective.

Furthermore, in the year 2004 more shocks occurred and were reported by the households in the sample, which made the control Year very significant for both obtaining formal credit as well as using this formal credit as a coping strategy.

The more shocks a household faces, the lower the probability that it will use formal credit as a coping strategy. Nevertheless, all shocks turned out to have a positive effect on the probability of using formal credit as a coping strategy. Immediate shocks, like death of a household member and the breakdown of equipment are responsible for the biggest effects. Joblessness, which is a more permanent shock, has a smaller significant influence on the probability of using formal credit as a coping strategy.

5.6 Informal Credit used as Coping Strategy

Now, the relationship between the dependent variable informal credit and all the independent variables, as indicated in the empirical model, will be analyzed by running two probit regressions and one tobit regression.

Before doing so, a normal linear probability model (LPM) has been run, after which the data has been tested and corrected for residuals, outliers and heteroskedasticity. The results of these robustness checks can be found in appendix III. By comparing the LPM to the probit model, the estimation model has been checked for robustness as well.

Because it is interesting to see the change in informal credit in general, as well as informal credit used as coping strategy, two probit models have been run. Another reason for running two probit models has been to be able to account for the fact that reported use of informal credit might not be the same as the observed use of this. The first probit model has been run by taking the whole sample of observations, whereas for the second model, informal credit used as coping strategy is taken as dependent variable for only those observations that report one or more shocks. Only one tobit model has been run, in which the amount of credit has been used as the dependent variable, as compared to the dummy of the first probit model. No tobit model for amount of informal credit used as coping strategy could be run, because this amount could not be calculated with the information available.

The results of these models have been placed in table 9. For each model the marginal effects as well as the standard errors have been included.

In appendix V the complete output of these analyses can be found.

Table 9: Estimation Results on the Probability of using Informal Credit as Coping Strategy

	Informal Credit		Informal credit as coping strategy
Variable	Probit (dummy)	Tobit (amount)	Probit (dummy)
SHOCK RELATED			
Number of shocks as reported by the HH	-1.7893*** (0.0402)	-1.3700*** (0.3548)	-0.6169*** (0.0577)
Death HH member	+0.8686*** (0.0055)	+0.9034*** (0.0520)	+0.9821*** (0.0036)
Illness /accident	+0.9695*** (0.0023)	+0.9748*** (0.0171)	+0.9784*** (0.0061)
Natural disaster	+0.9492*** (0.0032)	+0.9607*** (0.0253)	+0.9581*** (0.0139)
Lower sale price	+0.8497*** (0.0055)	+0.8882*** (0.0578)	+0.9746*** (0.0001)
Drop of sales	+0.9784*** (0.0020)	+0.9821*** (0.0116)	+0.8985*** (0.0262)
Joblessness	+0.9883*** (0.0018)	+0.9635*** (0.0226)	+0.5821*** (0.0332)
Losing job	+0.8882*** (0.0050)	+0.9146*** (0.0474)	+0.9724*** (0.0087)
Equipment breakdown	+0.8256*** (0.0062)	+0.8715*** (0.0638)	+0.9774*** (0.0040)
FINANCIAL CAPITAL			
Savings (log)	-0.0068*** (0.0016)	-0.0029*** (0.0002)	-0.0004 (0.0015)
Productive assets (log)	+0.0033* (0.0020)	+0.0015*** (0.0007)	+0.0015 (0.0019)
Value of animals (log)	+0.0013 (0.0014)	2.70e-06 (0.0003)	+0.0009 (0.0013)
HUMAN CAPITAL			
Dependency ratio	+0.0218 (0.0381)	-0.0040 (0.0083)	-0.0375 (0.0408)
Number of working HH members	-0.0056 (0.0072)	-0.1009*** (0.0011)	-0.0107 (0.0070)
Education (head)	-0.0011 (0.0032)	-0.0028*** (0.0001)	-0.0019 (0.0035)
Education (adults)	-0.0041 (0.0040)	+0.0030* (0.0016)	-0.0039 (0.0042)
Age (head)	+0.0001 (0.0009)	+0.0003 (0.0002)	-0.0008 (0.0009)
Age (HH)	-0.0054*** (0.0009)	-0.0028*** (0.0006)	-0.0014 (0.0010)
Gender (head)	+0.0318* (0.0224)	+0.0367** (0.0154)	+0.0289 (0.0194)
Civil status (head)	-0.0057 (0.0185)	+0.0031 (0.0061)	-0.0162 (0.0190)
Indigenous	+0.0045 (0.0186)	-0.0051 (0.0029)	-0.0169 (0.0167)
PHYSICAL CAPITAL			
Access to water	+0.0342 (0.0233)	+0.0195 (0.0113)	+0.0391 (0.0166)
Access to electricity	+0.0144 (0.0349)	+0.0124 (0.0097)	-0.0334 (0.0429)

Access to telephone	+0.0163*	+0.0196**	-0.0058
	(0.0143)	(0.0099)	(0.0140)
NATURAL CAPITAL			
Number of hectares of land	-0.0006	-0.0005	+0.0003
	(0.0005)	(0.0001)	(0.0008)
CONTROLS			
Region: south	-0.0626**	-0.0068*	-0.0597***
	(0.0213)	(0.0039)	(0.0226)
Region: central	-0.0389*	-0.0228***	-0.0441**
	(0.0219)	(0.0017)	(0.0182)
Urban	-0.0022	+0.0136	-0.0047
	(0.0161)	(0.0087)	(0.0161)
Year	+0.3428***	+0.2253***	+0.1198***
	(0.0127)	(0.0611)	(0.0150)
N	4124	4124	1264
R ²	0.1505	0.109	0.1921

Standard Errors in parentheses

* significant on 0.10 level ** significant on 0.05 level *** significant on 0.01 level

The amount of observations of the models defining formal credit equals 4124 and the probit model for formal credit as a coping strategy 1264, which means the observations with missing values for any of the variables have been taken out. Also all R² show that the models as a whole fit significantly better than an empty model.

From these estimation models it shows that for informal credit, having savings has a negative impact on the probability of having informal credit, because people will not grant households any money when they have savings themselves. Also, the demand for informal credit will be lower when households have savings, because they simply do not need credit in these cases.

However, having a marginal positive change in productive assets is associated with an increase of informal credit. This can be explained by looking at the collateral requirements for informal credit; assets are used in many cases as collateral (Das, 2009).

The average age of the household members has a significant negative influence on informal credit. Older farmers have more difficulties to gain income and are thus less capable to pay back loans. Another theory (Fafchamps, 2001) says that older farmers do not want to obtain informal credit from family and friends because of age-related respect issues.

What is certain is that having a male as the head of the household positively influences the amount of households that use informal credit by 3%. Males are being regarded as more reliable in comparison to females, especially in rural areas, because generally, they will be guarding the money and assets of monetary value.

Other variables within human capital (number of working household members, education of all adults as well as the of the head) turned out to have a significant effect on the amount of informal credit when looked at both the sample using any value of informal credit and the ones that don't use it all. However for this research it is most interesting to see that these variables turned out to not be significant when looking at the households that do use informal credit.

Having access to a telephone is an important factor in obtaining informal credit. This is due to the fact that first of all it is easier for the borrowers to contact the lenders, which increases the demand, but at the same time telecommunication makes it easier for the lenders to track down the borrowers when repayment needs to be done, which increases the supply.

Both the southern and the central region have a negative impact on informal credit in comparison to the northern one. Households in the southern and central regions are poorer, therefore they can also loan less money to other households. Poor households are also more risk-averse, which decreases the demand of informal credit in these regions as well. As for formal credit, 2004 was also a year in which informal credit was used more than in 2005; 2004 causes a 34% difference for informal credit in general and a 12% for it used as coping strategy.

As could already be seen in the descriptive paragraph earlier in this chapter, informal credit is used very often as coping strategy. Therefore all the risks have a positive impact on the probability of using informal credit as a coping strategy. All risks, with an exception of joblessness, have a percentage of over 90% higher probability to do so. However, when a household faces more than one shock, the probability of using informal credit gets less. This is because there is a limit to the amount of informal credit that can be borrowed. When the credit of the first shock has not been repaid yet it is impossible to get new informal credit when the second shock hits.

5.7 Difference between Formal and Informal Credit

Not only formal and informal credit used as coping strategy as independent factors are interesting to investigate, but also the differences between those two factors. Of course the correlation between the two has to be taken into account here as well. The interdependent relationship has a significant pair wise correlation of 0.25, which means that using formal credit is complementary to using informal credit as a coping strategy. The explanation of this is that access to informal credit increases the probability of access to formal credit.

When comparing the use of formal credit to the use of informal credit, immediately all shock variables draw the attention. Formal credit seems to be used for many other purposes than to cope with risks, because the different shocks have no significant influence on formal credit in general. This may be explained because that there is simply no need to use formal credit as a coping strategy or because other coping strategies have been chosen.

Special attention should be given to the fact that an increase in the number of shocks resulted in a decrease in the use of both formal and informal credit as a coping strategy.

Credit only has the character of coping with risks in small amounts: the more shocks a household faces, the less collateral will be left over to be able to obtain loans. Also, a household that faces many simultaneous shocks will have a lower welfare-level and a higher risk-averse attitude associated with this.

All individual risks have a positive effect on informal credit in general, as well as informal credit used as a coping strategy, as for formal credit used as a coping strategy. Joblessness has the smallest influence on these factors, because this shock is very time-spread whereas the other shocks have a more immediate character. The marginal effects of the individual shocks on informal credit are higher than on formal credit, which implies that informal credit is used more often as a coping strategy. This could already be concluded from the descriptive part, earlier in this chapter.

Related to financial capital, savings is the most interesting variable to look at. Savings are needed in order to obtain a formal credit but in order to receive informal credit, savings are not always needed. This is how the different signs of the effect to the dependent variable can be explained. When having savings, access to formal credit is easier (supply related) and in case of informal credit this will not be asked for because the household will use its own savings first (demand related).

Education, age, gender and civil status are the influencing factors of human capital. The dependency ratio, amount of working household members and speaking the indigenous language proved to have no significant effect on formal and informal credit. Gender was expected to influence the demand for formal credit, as women often participate in MFIs, however no significant influence for formal credit has been found. This does not necessarily mean that in reality there really is no influence, because gender was only estimated for the head of the household. A male-headed household can still have women participating in MFIs. As for informal credit, males do seem to have a higher probability rate, but the same rationing could be applied, which means that even though the household is male-headed it could be the women participating in informal credit schemes.

The different types of physical capital have turned out to be of greater importance for formal credit than for informal credit, as these can be used as collateral. Having access to a telephone on the other hand has a positive effect on both types of credit as this makes it easier for the household to communicate with the credit institute, as well as the other way around.

Living in rural areas increases the probability of formal credit used as coping strategy, where this was more expected for informal credit. For informal credit it does not matter whether the household is located in an urban or a rural area.

Living in the south has a negative effect on the use of both types of credit, simply due to the facts that people in the south are poor and cannot access credit easily and that these household are more risk-averse which lowers the demand for credit. A last very remarkable fact is that in 2004 both formal and informal credit has been used a lot more compared to 2005. More credit has been given out in that year.

6 Conclusions

The research discussed within this thesis contributes to the existing literature on risk coping strategies and specifically on both formal and informal credit by giving special attention to the Mexican context of these. This is very relevant given that no earlier studies have been done on the relationship between the use of formal and informal credit as a coping strategy and the factors of influence.

Within this thesis the factors influencing the use of credit as a coping strategy have been explored and by these means also the role that these credits play in coping with risks within Mexico. Households within Mexico, both rural and urban, encounter all types of risks, which can be both covariant and idiosyncratic. To be able to investigate the role of credit when attempting to cope with these risks, information of a database consisting out of 5,700 observations in Mexico has been used.

The specific researched risks include mostly idiosyncratic risks, namely the death of a household member, illness of a household member, a lower price for sales, a drop in sales, joblessness, losing a job and equipment or vehicle breakdown. Also cases of natural disaster have been investigated. It turned out that over the time period of 2004-2005 the shocks that were experienced the most were joblessness, drop of sales, illness of a household member and natural disasters.

The figures on formal and informal credit in general, so not only used as a coping strategy, could be derived from the database as well. As a sum of the observations of 2004 and 2005 1,665 households (16% of the total amount of households) had formal credit, with an average monetary value of 306,261 pesos (compared to 10,600,000 pesos of average income). Whereas for informal credit 2,449 households (24% of the total households) had some type of informal credit with an average of 147,349 pesos (compared to 10,600,000 pesos of average income).

Most hypotheses on the influential factors were confirmed by the research. When looked at formal credit in general, savings, productive assets, value of animals, education of the adults, civil status and access to electricity and telephone have a positive effect on formal credit because these are important factors to satisfy the requirements of collateral. Also from the demand side these factors play a role, as households that possess more assets tend to behave less risk-averse than households that possess fewer assets.

Interesting to see was that living in rural areas also had a positive effect on formal credit, which was expected because formal institutions are focusing more and more on the rural instead of the urban areas.

As for formal credit in general, savings and value of animals, also had a positive effect on formal credit used as a coping strategy. Households with many of these financial capital factors will demand more formal credit as a coping strategy, and these households will also experience fewer supply-constraints.

But the most important variables that were influential on formal credit as a coping strategy were the shock related ones. The occurrence of all individual shocks had a positive effect, meaning that the probability of using formal credit as a coping strategy gets higher once one of these shocks were experienced. Equipment breakdown as well as the death of a household member had the biggest effect as these require specific funding for e.g. the funeral or renewal of the equipment.

Talking about informal credit in general, variables like savings, productive assets, age, gender and access to telephone had an influence. The demand for informal credit is lowered when a household possesses savings, because there is simply no need for additional credit. Males are seen as more reliable within many areas and access to telephone makes communication easier as a way to control the relationship between lender and borrower. It is remarkable however that the younger a household is, the more informal credit is used, not only in general but also specific for the use of informal credit as a coping strategy.

However, by far the most influential variables on informal credit used as coping strategy are the different shocks a household faces. Death of a household member, illness of a household member, breakdown of equipment, lower sales price, losing a job, natural disaster, drop of sales and joblessness (in that order) have a very high positive impact on informal credit used as a coping strategy, even that much that this impact is also relatively high among informal credit in general.

When comparing the use of both informal and formal credit in general, the most logical differences are derived from the financial and physical capital aspects. These are used as collateral for formal credit, whereas informal credit does not always need these. On the contrary, when a household possesses savings, it will demand less informal credit because it can use its own money. All these expected relations turned out to be significantly true.

Another interesting difference is that gender seems to only affect informal credit; males have a higher probability of obtaining this. However it was very much expected that females would have easier access to formal credit, due to the focus of MFIs on women, which turned out to be false. Formal credit in Mexico consists out of several types of formal institutions, which partly holds as the main reason for this hypothesis to not be true. Also, a male-headed household can still have women within its household that obtain formal credit. No objective conclusion can therefore be drawn based upon the relationship of the gender of the head of the household and the use of informal and formal credit.

Region and time variables were proofed to be highly important as well. Living in the south has a negative impact on both formal credit (in general and as a coping strategy) and informal credit (in general and as a coping strategy), whereas the year 2004 has a positive impact on all dependent variables. These are taken of the fact that the south region is poorer and faces more shocks than other regions and more credit was supplied within 2004 as compared to 2005.

All individual shock variables turned out to have a high, significant positive effect on the use of formal and informal credit as a coping strategy. Informal credit is used more often as a coping strategy than formal credit, which is the cause of the higher effects on the probability of the use of informal credit than on formal credit. Informal credit is an easy and quick way of obtaining some money to be able to cope with risks, whereas formal credit needs more work to fit the requirements and takes a longer period of time to really get a hold of the credit.

In contrast to this very high positive impact of the individual shocks on both formal and informal credit used as a coping strategy, there is a negative effect of the total number of shocks experienced by a household. This means that the more shocks a household faces the lower the probability that it will use informal or formal credit to cope with these simultaneous shocks. First of all this is due to the fact that when the household already took out credit for a first shock, it will be more difficult to obtain new credit when a new shock is experienced. Also, when a household experiences simultaneous shocks this will involve a lowering in assets and because of this a higher risk-averse attitude. Summing up, a high amount of total shocks faced by the household involves lower demand as well as supply for both types of credit used as a coping strategy.

7 Discussion

This research has increased the knowledge on the roles of formal and informal credit when coping with risks. It looked at a big sample of Mexican households and the outcomes might be interesting to policy makers, formal institutions, NGOs etc. working in Mexico; however some questions remain to be unanswered.

Because a big sample of Mexican households was used as a whole by doing quantitative research, differences between specific regions or areas were generalized. The southern region turned out to highly affect all outcomes within this research. For further research it is recommended to take only a sample with the households living in the south, because this could give a totally different and very interesting outcome.

Also, for some outcomes the reasoning behind the answers to the questions has not been clear. For example, when the average age of the household members showed a significant negative effect on informal credit, it could not be said that older households will demand less informal credit or that younger households have easier access to informal credit. This cannot be guaranteed until qualitative research is conducted.

It was very interesting to see the different coping strategies on household level. However, as argued in the thesis itself, then the data relies entirely on the responses of households itself. For example, the amount of shocks a household reports could actually be an indicator for welfare, as poor households may suffer more of a shock than richer households do. Also, on this household level only few households reported to use credit as a coping strategy, which is mainly due to the fact that the questionnaire on which the information used is based upon was not designed for this purpose. Therefore it would be interesting to not only see the shocks and coping strategies on a household level, but also on a municipality level, state level or even regional level.

Another limitation to this research might have been the calculation of the variables. Although this is done in the author's best way possible, some arguments might exist on including or excluding some concepts. For example, savings can also include both stock savings in formal institutions and cash savings at home.

The different types of coping strategies are worth researching, although this has not been the objective of this research, it is recommended to do so in the future. For this research the focus has been on using formal and informal credit as a way to cope with risks. However it could be very interesting to see the interaction between all used coping strategies. Now, it is very difficult to say something about the impact of the coping strategies used and because of this it is not possible to say something about the advantages of using formal or informal credit as a coping strategy. As a result it is not feasible to measure the consequences of these coping strategies.

The major limitation of this research has been that the data used has not been collected for the purpose of this research. Therefore only few observations could be used and information that could have been very interesting has been missing. Social capital, for example, would be very interesting to look at, because it is assumed to have a big influence on informal credit. However, no information was available on this, or it encountered endogeneity problems. Also, only the gender of the head of the household has been known, where it would be more interesting to see the gender of all household members. Also, it turned out that the questionnaires changed from year to year a little bit. This made it difficult to use all available information and merge the different data sets into one big panel set. For further research it is therefore highly recommended to use data that does allow to see the difference over time and that has all the information needed to fully conduct a research for the use of formal and informal credit as a coping strategy.

Bibliography

Agarwal, B. (1991) *Social security and the family: Coping with seasonality and calamity in rural India* Oxford: Clarendon Press.

Alderman, H., & Paxson, C. (1992) *Do the poor insure? A synthesis of the literature on risk and consumption in developing countries* Discussion Paper 1008. Washington, DC

Armendariz, B. & Morduch, J. (2007) *The Economics of Microfinance* Cambridge: Massachusetts Institute of Technology

Balcha, Y.A. (2006) Analysis of the Relationship between Farm Households and Rural Institutions in Tigray Region, Ethiopia *MSc Thesis Development Economics*

Barnum, H. and Squire, L. (1979) An Econometric Application of the Theory of the Household. *Journal of Development Economics* 6: 79-102

Baum, C.F. (2006) *An Introduction to Modern Econometrics Using Stata* Texas: Stata Press

Becker, G. (1981) *A Treatise on the Family* Cambridge, MA: Harvard University Press

Boucher, S.R., Carter, M., and Guirkinger, C. (2007) *Credit Constraints and Productivity in Peruvian Agriculture* Working Paper No. 07-005. Department of Agricultural and Resource Economics, University of California - Davis.

Brown, W. and Churchill, C. (2000) *Insurance provision to low-income households: Part 2: initial lessons from micro-insurance experiments for the poor* Microenterprise Best Practices Project

Carreón, V.G. & Svarch, M. (2007) *El Mercado de crédito en México* CIDE Número 392

Carroll, C.D. (2001) *A Theory of the Consumption Function, with and without Liquidity Constraints* Journal of Economic Perspectives, American Economic Association, vol. 15(3), pages 23-45

Carter, M.R. et al (2007) *Poverty Traps and Natural Disasters in Ethiopia and Honduras* World Development 35, 835-856

Chaudhuri, S, Jalan, J. and Suryahadi, A. (2002) Assessing Household Vulnerability to Poverty from Cross-sectional Data: A Methodology and Estimates from Indonesia *Discussion Paper #:0102-52*

Chaudhuri, S. (2003) Assessing vulnerability to poverty: concepts, empirical methods and illustrative examples *Department of Economics Columbia University*

Chayanov, A.V. (1925) *Peasant farm organization* Homewood, Illinois: Richard D. Irwin, Inc.

Christiaensen, L.J. and Subbarao, K. (2005) Towards an Understanding of Household Vulnerability in Rural Kenya *Journal of African Economies*, Volume 14, Number 4, pp 520-558

Conning, J. and Udry. C. (2007) Rural financial markets in developing countries *Handbook of Agricultural Economics*, Vol. 3, pp. 2857-2908

Crabb, P.R. and Keller, T. (2004) A Test of Portfolio Risk in Microfinance Institutions

Das, N.C. (2009) *The Impact of Asset Transfer on Livelihoods of the Ultra Poor in Bangladesh* Research Monograph Series No. 39, Research and Evaluation Division, BRAC, Dhaka.

Deaton, A. (1990) Saving in Developing Countries: Theory and Review *The International Bank for Reconstruction and Development*

Dercon, S. (2002) Income Risk, Coping Strategies, and Safety Nets *The World Bank Research Observer* vol. 17 no. 2, pp. 141-166

Dercon, S., Hoddinott, J. and Woldehanna, T. (2005) *Shocks and Consumption in 15 Ethiopian Villages, 1999-2004* Journal of African Studies 45, 559-585

Diagne A., Zeller M. and Sharma M. (2000) *Empirical measurements of households' access to credit and credit constraints in developing countries: Methodological issues and evidence* Discussion paper n° 90, Food Consumption and Nutrition Division, International Food Policy Research Institute (IFPRI), Washington DC, USA.

Durante, R. (2009) Risk, cooperation and the economic origins of social trust: an empirical investigation

Eakin, H. (2005) Institutional Change, Climate Risk, and Rural Vulnerability: Cases from Central Mexico *World Development* Vol. 33, No. 11, pp. 1923–1938

Fafchamps, M. and Lund, S. (2001) Risk-Sharing Networks in Rural Philippines

Fafchamps, M. and Guber L. (2006) The Formation of Risk Sharing Networks

Field, A. (2005) *Discovering Statistics Using SPSS* London: SAGE Publications Ltd

Findeis, J., H. Swaminathan, and A. Jayaraman (2005) Agricultural Households in the U.S.: Participation in Labor, Decision-making, and the Effects of Farm Asset Control *Economie Rurale* 289-290:44-62.

Fofana, N.B. (2010) *Efficacy of micro-financing woman's activities in Cote d'Ivoire* Wageningen Academic Publishers

Foltz, J. (2004) *Credit market access and profitability in Tunisian agriculture* Agricultural Economics 30: 229–240

Freixas and Rochet (1997) *Microeconomics of Banking* MIT Press

Garcia-De la Cruz, M. (2008) Impact of Access to Formal Deposit Facilities and Loans on Schooling: Evidence From Rural Households in Mexico

Gifford, R.M. (2004) The CO₂ fertilising effect – does it occur in the real world? *New Phytol* 221-225.

Harrower, S. and Hoddinott, J. (2004) Consumption Smoothing and Vulnerability in the Zone Lacustre, Mali *FCND Discussion Paper* No. 175

Hauville, A. (2005) Micro-credit, a typology of clients and non-clients *MSc Thesis: Development Economics Group*

Heltberg, R & Lund, N. (2009) *Shocks, Coping and Outcomes for Pakistan's Poor: Health Risks Predominate* *Journal of Development Studies* 45, 301-321

Hoddinott, J. (2006) *Shocks and their consequences across and within households in rural Zimbabwe* *Journal of Development Studies* 42, 889-910

Hoff, K. and Stiglitz, J.E. (1990) *Introduction: Imperfect information and rural credit markets - puzzles and policy perspectives* *The World Bank Economic Review* 4(3): 235-250

Holden, C. (1998) Education for Citizenship: the contribution of social, moral and cultural education *Economic Research*, 13 (2):293-299

Hung, D.V. (2007) *Assessing Opportunities for Agricultural Insurance and Risk Coping Strategies* *Microfinance Opportunities*

Jabeen, Z. (2009) *Sukuk: Sharia' and Regulatory Implications* Mohammad Ali Jinnah University, Islamabad

Jalan, J. & Ravallion, M. (2001) *Household income dynamics in rural China* *Policy Research Working Paper Series* 2706, The World Bank

Kelly, P.M. and Adger, W.N. (2000) Theory and practice in assessing vulnerability to climate change and facilitating adaption *Climate Change* 47: 325-352

Kinsey, A. C. et al. (1998) *Sexual Behavior in the Human Female* Philadelphia: W.B. Saunders; Bloomington: Indiana U. Press

Kochar, A. (1997) An empirical investigation of rationing constraints in rural credit markets in India *Journal of Development Economics*, Vol. 53, pp. 339-371.

Laibson, D. (1998) Life-cycle consumption and hyperbolic discount functions *European Economic Review* 42, 861-871

Lekprichakul, T. (2007) *Impact of 2004/2005 Drought on Zambia's Agricultural Production: Preliminary Results* Working Paper No. 2008-003

Ligon, E. and Schechter, L. (2003) Measuring Vulnerability *The Economic Journal*, Vol. 113

Maldonado, J. H. (2004) Relationships among poverty, financial services, human capital, risk coping, and natural resources: Evidence from El Salvador and Bolivia

McMichael, P.(1994) *The global restructuring of agro-food systems* Cornell University Press, Ithaca and London

Morduch, J. (1995) Income smoothing and consumption smoothing. *Journal of Economic Perspectives*, 9(3), 103-114.

Moser, C. (1998) *The Asset Vulnerability Framework: Reassessing Urban Poverty Reduction Strategies* World Development, 26: 1-19

Nadal, A. (2000) *The environmental and social impacts of economic liberalization on corn production in Mexico* OXFAM-GB-WWF-International, Oxford

Nakajima, C. (1986) *Subjective Equilibrium Theory of the Farm Household* Amsterdam: Elsevier

Namizata Binaté Fofana (2010) Efficacy of micro-financing women's activities in Côte d'Ivoire: evidence from rural areas and HIV/AIDS-affected women *PhD Thesis: Development Studies*

Okurut, F.N., Schoombee, A. and Van der Berg, S. (2005) Credit Demand and Credit Rationing in the Informal Sector in Uganda *South African Journal of Economics* Vol. 73:3

Olivares-Polanco, F. (?) Commercializing Microfinance and Deepening Outreach? Empirical Evidence From Latin America

Paxton, J. (2006) Analysis of Mexico's PATMIR Project. SAGARPA, Mexico.

Paxton, J. (2007) *Technical Efficiency in a Semi-Formal Financial Sector: The Case of Mexico* Oxford Bulletin of Economics and Statistics, 69

Paxton, J. (2009) Liquidity Profiles of Poor Mexican Households: The Role of Economic Shocks and Banking

Pan, L. (2009) Risk Pooling through Transfers in Rural Ethiopia

Pearce, D.W. and Atkinson, G.D. (1993) *Capital theory and the measurement of sustainable development: an indicator of "weak" sustainability* Ecological Economics Volume 8, Issue 2, October 1993, Pages 103-108

Platteau, J.P. (1991) *Traditional Systems of Social Security and Hunger Insurance* Oxford: Clarendon Press

Ray, D. (1998) *Development Economics* Princeton University Press

Scoones, I. (1998) Sustainable rural livelihoods. A framework for analysis. *IDS Working Paper No. 72*. IDS, Brighton.

Sebstad, Jennifer and Monique Cohen (2000) *Microfinance, Risk Management and Poverty*, USAID, Washington D C

Servin, R. and Lensink, R. (2009) Can household welfare benefit from micro-finance? Evidence from a panel survey of Mexican microfinance organizations

Singh, I., L. Squire, and J. Strauss (1986) *Agricultural Household Models* Baltimore: Johns Hopkins University Press

Skoufias, E. (2005) PROGRESA and Its Impacts on the Welfare of Rural Households in Mexico *Research report 139 International Food Policy Research Institute Washington, DC*

Stiglitz, J.E. & Weiss, A. (1981) Credit Rationing in Markets with Imperfect Information

Swaminathan, M. (1992) *El Papel Cambiante Del Crédito formal e informal en el México rural* Documento de Trabajo 1

Taylor, J.E., Mora J., Adams R., Lopez-Feldman A.(2005) *Remittances, Inequality and Poverty: Evidence from Rural Mexico* Department of Agriculture and Resource Economics, University of California, Davis, Working Paper No. 05-003

Thaler, R.H. (2001) *Save More Tomorrow: Using Behavioral Economics to Increase Employee Saving*

Tietze. J. (2007) *Credit and microfinance needs in inland capture fisheries development and conservation in Asia* FAO Fisheries Technical Paper. No. 460

Townsend, R.M. (1994) Evaluating the Impact of Financial Services in Mexico: A Proposal using a Structural Equilibrium Approach

Townsend, R. and Woodruff, C. (2006) Measuring the Reach of PATMIR: An examination of the Characteristics of PATMIR Clients using the BANSEFI/SAGARPA Household Panel Survey

Vinne, E.C. van der (2000) Credit Delivery Methodology: two cases from Zambia *MSc Thesis: Development Economics*

Udry, C. (1994) Risk and Insurance in a Rural Credit Market: An empirical Investigation of Northern Nigeria *Review of Economic Studies* 61(3): 495-526

- Varian, H.R. (2006) *Intermediate Micro Economics* London: W.W. Norton & Company, Inc.
- Villagómez, A. & Zamudio, A. (1997) *Household Saving in Mexico* CIDO Número 78
- Wagstaff, A. & Lindelow, M. (2010) *Are Health Shocks Different?* Policy Research Working Paper, Vol. 5335
- Wayne A.C. and Myhre, D.(1998) *The Transformation of Rural Mexico: Reforming the Ejido Sector* La Jolla, CA.
- Woodruff, C. (2006) Characteristics of the unbanked and banked in the popular financial sector in Mexico: An analysis of the BANSEFI household panel survey.
- Woodruff, C. and Martinez, J. (2008) Assessing Changes in Household Access to Financial Services in Mexico: An Analysis of the BANSEFI/SAGARPA Panel Survey 2004-2007.
- Zaman, H. (1999) *Assessing the Poverty and Vulnerability Impact of Micro-credit in Bangladesh: A Case Study of BRAC* Office of the Chief Economist, World Bank: Washington
- Zapata, G. (2007) Enabling Policies for the Development of Integrated Financial Services in Mexico's Marginal Rural Areas: Lessons from the Rural Microfinance Technical Assistance Project (PATMIR)
- Zeller, M. (1999) Towards Enhancing the Role of Microfinance for Safety Nets of the Poor *ZEF- Discussion Papers On Development Policy* No. 19, pp. 30

Appendices

Appendix I: Calculation of Variables

Formal credit

Formal Credit is calculated by summing up all credit coming from the financial institutions NAFINSA, FIRA, BANRURAL or FINANCIERA RURAL and CREDITO A LA PALABRA, SOFOL, all commercial banks and the Cajas de Ahorro, Cajas Solidarias, Sociedades de Ahorro y Préstamo and the Credit Unions.

Informal credit

Informal Credit is calculated by adding up all credits of family and friends, moneylenders, informal credit supplier and others.

Shocks

This is a sum of all the dummies of the separate shocks.

Savings

It includes stock savings in formal institutions such as credit and savings cooperatives, Cajas Solidarias and commercial banks.

Productive assets

This corresponds to the opportunity cost (estimated value) of working animals (bulls, mules, horses, donkeys and machinery and equipment being used in the different business the household is operating in.

Dependency Ratio

Amount of dependent household member (<15 & >65)/ total amount of household members.

Urban

According with the definition given by the INEGI (Instituto Nacional de Estadística y Geografía)/ National Institute of Geography and Informatics) a community is considered as being rural when it has less than 2,500 inhabitants, whereas the urban is that where are living more than 2,500 people.

South region

States of Campeche, Chiapas, Guerrero, Oaxaca, Puebla, Quintana Roo, Tabasco, Tlaxcala, Veracruz and Yucatán.

North region

States of Aguascalientes, Baja California, Baja California Sur, Chihuahua, Coahuila, Durango, Nuevo León, San Luis Potosí, Sinaloa, Sonora, Tamaulipas and Zacatecas.

Central region

The states of Colima, Distrito Federal, Estado de México, Guanajuato, Hidalgo, Jalisco, Michoacán, Morelos, Nayarit and Querétaro are included here.

Income

- sell or rent of house' durable goods: washing machine, fridge, stove, sewing machine, TV, radio, video, bicycle, motorcycle, car, jewelry, computer equipment,
- interests from savings accounts in formal financial institutions
- interest from savings coming from other persons who received the money
- governmental program (subsidies):
 - Oportunidades Program (welfare program)
 - Procampo Program (Agricultural Program)
 - Jovenes Oportunidades (welfare Program)
- Other public or welfare programs
- income compensation in case of risk-related losses
- grants or gifts coming from relatives or friends
- pensions
- inheritances, lottery, etc.
- sell or rent of land
- agricultural products
- rent of working animals
- agricultural byproducts income (milk, eggs, meat, honey, wool)
- sell of cows, bulls, horses, mules, donkeys, sheep, pigs, chickens, honeycomb, other animals
- family business operation
- sell of business & offices
- rent of offices
- rent of machinery and equipment
- sell or rent of vehicle
- Income from several jobs 1, 2, 3, etc.
- Income from rent or sell of house, department
- computer equipment pawn income
- sell or rent of constructions
- sell or rent of house
- total remittances (national and International): USA, CANADA & Mexico
- other means
- sell of land
- agricultural production
- tools
- animals
- animal byproducts: milk, eggs, meat, honey, wool, cows, bulls, horses, mules, donkeys, sheep, pigs, goats, rabbits, poultry, other animals
- business 1, 2, 3
- sell of business
- sell or rent of office
- sell of equipment, tools and machinery

Consumption

This corresponds to the amount of money spent during the previous year in only household consumption items (durables and non-durables). This concept does not include the production side expenditure.

Remittances

Flow in funds coming from national and international destinations, mainly from migrants living in USA, CANADA in some urban cities in Mexico.

Appendix II: Answers coping strategies

Respondents were asked for their coping strategies per shock, by taking some items the variables of formal and informal credit used as coping strategy were calculated.

	Used for formal credit	Used for informal credit
Loan with interest	X	X
Reduce household consumption		
Stop paying debts		
Use savings		
Temporary job		
Loan without interest		X
Lower prices		
Buy where things are cheaper		
Help in any way possible		
Social security		
Product promotion		
Give better service		
Search for a job		
Debian		X
Sell property		
Cooperative Funeral	X	
Credit of the family		X
Credit from friends		X
Find a cheaper doctor		
Close down business		
Participate in tandas		X
Introduce new products		
Buying less merchandize		
Help of the government		
Cure myself		
Work extra hours		
Buy a new one		
Fix it myself		
Request money on the street		
Compensation		
Open a business		
Change address		

Appendix IV: Output Formal Credit as Coping Strategy

Probit formal credit

Iteration 0: log pseudolikelihood = -1922.1433
 Iteration 1: log pseudolikelihood = -1486.0082
 Iteration 2: log pseudolikelihood = -1466.8766
 Iteration 3: log pseudolikelihood = -1466.5816
 Iteration 4: log pseudolikelihood = -1466.5815

Probit regression, reporting marginal effects

Number of obs = 4124

Wald chi2(29) = 722.87

Prob > chi2 = 0.0000

Pseudo R2 = 0.2370

Log pseudolikelihood = -1466.5815

d_form	dF/dx	Robust Std. Err.	z	P> z	x-bar	[95% C.I.]
no_sho~h	-.0718981	.131929	-0.55	0.586	1.39985	-.330474 .186678
death~b*	.0975692	.1859963	0.61	0.540	.082929	-.266977 .462115
d_illn~s*	.1153044	.1764786	0.75	0.455	.21096	-.230587 .461196
d_disa~r*	.0839131	.1695324	0.56	0.578	.177255	-.248364 .41619
d_low~s*	.1353144	.204838	0.80	0.425	.066198	-.266161 .536789
d_low~d*	.1275637	.1755454	0.83	0.407	.242726	-.216499 .471626
d_job1~s*	.0662724	.135337	0.50	0.619	.470902	-.198983 .331528
d_job1~t*	.0884976	.1802285	0.57	0.572	.097963	-.264744 .441739
d_mach~n*	.1297508	.2047103	0.77	0.444	.049709	-.271474 .530976
log_sa~l	.0186906	.0010272	18.55	0.000	3.20591	.016677 .020704
LOG_pr~l	.0026581	.0013953	1.90	0.057	1.9582	-.000077 .005393
log_an~l	.0029571	.0009635	3.06	0.002	4.29566	.001069 .004846
no_has	.0001927	.0003729	0.52	0.605	1.58265	-.000538 .000924
depend~o	-.0088152	.0277178	-0.32	0.751	.36658	-.063141 .045511
n_work~y	.0053553	.0050682	1.06	0.291	2.81377	-.004578 .015289
head_e~l	.0007519	.0021993	0.34	0.732	5.39816	-.003559 .005062
averag~s	.0061204	.0028111	2.18	0.029	6.14423	.000611 .01163
age_head	.0008336	.000606	1.38	0.169	48.0558	-.000354 .002021
avg_ag~h	-.0005545	.0006711	-0.83	0.409	31.4564	-.00187 .000761
sex_head*	-.0309295	.020997	-1.55	0.120	.849418	-.072083 .010224
head_m~d*	.0704339	.0129024	5.01	0.000	.671435	.045146 .095722
indige~s*	.0028452	.0137983	0.21	0.836	.257032	-.024199 .029889
dwater~y*	.0267729	.0167223	1.49	0.136	.909311	-.006002 .059548
delect~m*	.0745628	.0187522	2.80	0.005	.963628	.037809 .111316
d_telp~e	.0363606	.0097188	3.75	0.000	.448594	.017312 .055409
regi~uth*	-.0461895	.0158516	-2.95	0.003	.553831	-.077258 -.015121
region~l*	-.009269	.0161866	-0.57	0.571	.29195	-.040994 .022456
urban*	-.0571803	.0118143	-4.81	0.000	.474054	-.080336 -.034025
d_2004*	.1232744	.0101549	10.79	0.000	.581959	.103371 .143178
obs. P	.1765276					
pred. P	.1208192	(at x-bar)				

(*) dF/dx is for discrete change of dummy variable from 0 to 1
 z and P>|z| correspond to the test of the underlying coefficient being 0

Tobit amount of formal credit

```
Tobit regression                                Number of obs   =      4124
                                                F(   29,   4095) =      3.18
                                                Prob > F        =      0.0000
Log pseudolikelihood = -13102.669              Pseudo R2       =      0.0322
```

(Std. Err. adjusted for 3280 clusters in folio)

formc_real	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
no_shocks_hh	-3621610	2581858	-1.40	0.161	-8683454	1440234
death_hhmem	3644629	2584326	1.41	0.159	-1422053	8711312
d_illness	3923517	2568594	1.53	0.127	-1112322	8959357
d_disaster	3530077	2581347	1.37	0.172	-1530766	8590921
d_low_prices	4204165	2634205	1.60	0.111	-960309.3	9368639
d_low QUAN~d	4146102	2566393	1.62	0.106	-885421.9	9177627
d_Jobless	3201487	2546196	1.26	0.209	-1790441	8193415
d_joblost	4392131	2786212	1.58	0.115	-1070359	9854621
d_machiner~n	4670267	2632849	1.77	0.076	-491547	9832082
log_saving~l	451167.4	86841.03	5.20	0.000	280911.8	621423
LOG_prod_a~l	68036.03	39661.68	1.72	0.086	-9722.42	145794.5
log_animal	39250.68	23823.32	1.65	0.100	-7455.973	85957.34
no_has	5037.569	9739	0.52	0.605	-14056.16	24131.3
dependency~o	213819.3	841956.8	0.25	0.800	-1436874	1864512
n_workfamily	194722.5	207736.8	0.94	0.349	-212554.5	601999.5
head_educ~l	-53087.89	70393.88	-0.75	0.451	-191098.1	84922.36
average_ed~s	309375.9	100214.2	3.09	0.002	112901.6	505850.2
age_head	12688.52	15650.28	0.81	0.418	-17994.54	43371.58
avg_age_hh	-6414.814	17088.94	-0.38	0.707	-39918.42	27088.79
sex_head	-981157.5	664447.8	-1.48	0.140	-2283836	321521.3
head_married	1861348	435543.3	4.27	0.000	1007447	2715250
indigenous	230015.3	387002.3	0.59	0.552	-528719.5	988750.1
dwater_sup~y	809738.6	458738.8	1.77	0.078	-89638.72	1709116
delectrici~m	2813512	985597.5	2.85	0.004	881205	4745819
d_telphone	1379366	365390.7	3.78	0.000	663001.2	2095730
region_south	-792368.1	409345.4	-1.94	0.053	-1594908	10171.4
region_cen~l	-432834.9	447002.4	-0.97	0.333	-1309203	443532.8
urban	-1442947	381330.2	-3.78	0.000	-2190561	-695332.4
d_2004	3985716	647716.6	6.15	0.000	2715840	5255593
_cons	-1.76e+07	3480371	-5.07	0.000	-2.45e+07	-1.08e+07
/sigma	5739170	1059352			3662263	7816076

```
Obs. summary:      3396 left-censored observations at formc_real<=0
                   728 uncensored observations
                   0 right-censored observations
```

Marginal effects after tobit

y = Pr(formc_real>0) (predict, pr(0,.))
= .09623039

variable	dy/dx	Std. Err.	z	P> z	[95% C.I.]	X
no_sho~h	-.1076711	.07493	-1.44	0.151	-.254523	.039181	1.39985	
death_~b*	.1479193	.13199	1.12	0.262	-.11077	.406608	.082929	
d_illn~s*	.1485878	.11638	1.28	0.202	-.07952	.376695	.21096	
d_disa~r*	.1337235	.11692	1.14	0.253	-.095428	.362875	.177255	
d_low~s*	.179648	.14187	1.27	0.205	-.098404	.4577	.066198	
d_low~d*	.1551336	.11379	1.36	0.173	-.067895	.378162	.242726	
d_job1~s*	.0980102	.08007	1.22	0.221	-.058924	.254944	.470902	
d_job1~t*	.1858789	.14099	1.32	0.187	-.09045	.462208	.097963	
d_mach~n*	.208536	.15116	1.38	0.168	-.087728	.5048	.049709	
log_sa~l	.0134133	.00074	18.19	0.000	.011968	.014858	3.20591	
LOG_pr~l	.0020227	.00111	1.83	0.068	-.000147	.004192	1.9582	
log_an~l	.0011669	.00067	1.73	0.083	-.000152	.002485	4.29566	
no_has	.0001498	.00029	0.51	0.608	-.000422	.000721	1.58265	
depend~o	.0063569	.02462	0.26	0.796	-.041903	.054617	.36658	
n_work~y	.0057891	.00552	1.05	0.294	-.005024	.016602	2.81377	
head_e~l	-.0015783	.00198	-0.80	0.426	-.005467	.00231	5.39816	
averag~s	.0091978	.00229	4.01	0.000	.004701	.013695	6.14423	
age_head	.0003772	.00047	0.80	0.424	-.000547	.001302	48.0558	
avg_ag~h	-.0001907	.00052	-0.37	0.713	-.001206	.000824	31.4564	
sex_head*	-.0314965	.01924	-1.64	0.102	-.069212	.006219	.849418	
head_m~d*	.0515797	.0109	4.73	0.000	.030218	.072941	.671435	
indige~s*	.0069257	.01188	0.58	0.560	-.016362	.030214	.257032	
dwater~y*	.0223068	.01149	1.94	0.052	-.000214	.044827	.909311	
delect~m*	.0614198	.01315	4.67	0.000	.03564	.087199	.963628	
d_telp~e	.0410088	.0069	5.95	0.000	.027492	.054526	.448594	
regi~uth*	-.0237987	.01358	-1.75	0.080	-.050421	.002824	.553831	
region~l*	-.0126084	.01278	-0.99	0.324	-.037666	.012449	.29195	
urban*	-.0426148	.00922	-4.62	0.000	-.060689	-.024541	.474054	
d_2004*	.1116611	.00915	12.21	0.000	.093735	.129587	.581959	

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Probit formal credit as a coping strategy

```

Iteration 0: log pseudolikelihood = -273.40184
Iteration 1: log pseudolikelihood = -206.15008
Iteration 2: log pseudolikelihood = -198.15444
Iteration 3: log pseudolikelihood = -197.50425
Iteration 4: log pseudolikelihood = -197.49628
Iteration 5: log pseudolikelihood = -197.49599
Iteration 6: log pseudolikelihood = -197.4959
Iteration 7: log pseudolikelihood = -197.49587
Iteration 8: log pseudolikelihood = -197.49586
Iteration 9: log pseudolikelihood = -197.49585
Iteration 10: log pseudolikelihood = -197.49585
Iteration 11: log pseudolikelihood = -197.49585
Iteration 12: log pseudolikelihood = -197.49585
Iteration 13: log pseudolikelihood = -197.49585
Iteration 14: log pseudolikelihood = -197.49585
Iteration 15: log pseudolikelihood = -197.49585
Iteration 16: log pseudolikelihood = -197.49585
Iteration 17: log pseudolikelihood = -197.49585

```

Probit regression, reporting marginal effects

Number of obs = 1264

Wald chi2(28) = .

Prob > chi2 = .

Pseudo R2 = 0.2776

Log pseudolikelihood = -197.49585

d_form~l	dF/dx	Robust Std. Err.	z	P> z	x-bar	[95% C.I.]
no_sho~h	-.1486302	.0372422	-17.55	0.000	2.30459	-.221624 -.075637
death~b*	.8562157	.0234026	.	.	.141614	.810347 .902084
d_illn~s*	.7422886	.0565975	18.01	0.000	.349684	.631359 .853218
d_disa~r*	.6857466	.0735077	14.67	0.000	.274525	.541674 .829819
d_low~s*	.7612025	.0874952	12.32	0.000	.174051	.589715 .93269
d_low~d*	.5318272	.071368	16.50	0.000	.397943	.391948 .671706
d_job1~s*	.18242	.037656	14.85	0.000	.642405	.108616 .256224
d_job1~t*	.7467144	.0790077	12.94	0.000	.207278	.591862 .901567
d_mach~n*	.9260253	.0297985	17.37	0.000	.116297	.867621 .984429
log_sa~l	.0040636	.0007616	6.27	0.000	3.44288	.002571 .005556
LOG_pr~l	.0009175	.000723	1.28	0.201	2.42263	-.0005 .002335
log_an~l	.0010324	.000497	2.05	0.040	4.64193	.000058 .002006
no_has	.0003142	.0002663	1.20	0.230	1.63994	-.000208 .000836
depend~o	-.020888	.0167238	-1.23	0.217	.360552	-.053666 .01189
n_work~y	.0010615	.0027007	0.39	0.696	2.93829	-.004232 .006355
head_e~l	.0007674	.001226	0.62	0.533	5.44146	-.001636 .00317
averag~s	-.0008423	.0016927	-0.49	0.627	6.26877	-.00416 .002475
age_head	-.0000502	.0003372	-0.15	0.882	48.129	-.000711 .000611
avg_ag~h	-.000371	.0004325	-0.87	0.386	31.0407	-.001219 .000477
sex_head*	.0016179	.0105114	0.15	0.882	.871044	-.018984 .02222
head_m~d*	-.0017453	.0087048	-0.20	0.838	.701741	-.018806 .015316
indige~s*	.0047695	.0084166	0.61	0.544	.254747	-.011727 .021266
dwater~y*	.0104804	.0078166	1.04	0.298	.909019	-.00484 .025801
delect~m*	.0137445	.0074665	1.16	0.246	.963608	-.00089 .028378
d_telp~e	.0065097	.0051222	1.23	0.220	.5	-.00353 .016549
regi~uth*	-.0200696	.0100655	-2.11	0.035	.563291	-.039798 -.000342
region~l*	-.0095371	.0071803	-1.19	0.235	.295886	-.02361 .004536
urban*	-.0097167	.0067545	-1.46	0.145	.47231	-.022955 .003522
d_2004*	.0212065	.0066959	3.22	0.001	.578323	.008083 .03433
obs. P	.0561709					
pred. P	.0177927	(at x-bar)				

(*) dF/dx is for discrete change of dummy variable from 0 to 1
z and P>|z| correspond to the test of the underlying coefficient being 0

Appendix V: Output Informal Credit as Coping Strategy

Probit Informal Credit

```

Iteration 0: log pseudolikelihood = -2509.6421
Iteration 1: log pseudolikelihood = -2142.0078
Iteration 2: log pseudolikelihood = -2132.0352
Iteration 3: log pseudolikelihood = -2131.9029
Iteration 4: log pseudolikelihood = -2131.8773
Iteration 5: log pseudolikelihood = -2131.8699
Iteration 6: log pseudolikelihood = -2131.8676
Iteration 7: log pseudolikelihood = -2131.8669
Iteration 8: log pseudolikelihood = -2131.8667
Iteration 9: log pseudolikelihood = -2131.8666
Iteration 10: log pseudolikelihood = -2131.8666
Iteration 11: log pseudolikelihood = -2131.8666
Iteration 12: log pseudolikelihood = -2131.8666
Iteration 13: log pseudolikelihood = -2131.8666
Iteration 14: log pseudolikelihood = -2131.8666
Iteration 15: log pseudolikelihood = -2131.8666
Iteration 16: log pseudolikelihood = -2131.8666
Iteration 17: log pseudolikelihood = -2131.8666
Iteration 18: log pseudolikelihood = -2131.8666

```

Probit regression, reporting marginal effects

Number of obs = 4124

Wald chi2(28) = .

Prob > chi2 = .

Pseudo R2 = 0.1505

Log pseudolikelihood = -2131.8666

d_inf	dF/dx	Robust Std. Err.	z	P> z	x-bar	[95% C.I.]
no_sho~h	-1.78933	.0402439	-60.99	0.000	1.39985	-1.86821 -1.71045
death~b*	.8685557	.0054667	45.13	0.000	.082929	.857841 .87927
d_illn~s*	.9695183	.0022694	55.08	0.000	.21096	.96507 .973966
d_disa~r*	.9492152	.0032307	48.25	0.000	.177255	.942883 .955547
d_low~s*	.8497048	.0054839	.	.	.066198	.838957 .860453
d_low~d*	.978414	.0019456	47.84	0.000	.242726	.974601 .982227
d_Jobl~s*	.9882891	.0018137	53.65	0.000	.470902	.984734 .991844
d_jobl~t*	.8881698	.0050341	49.98	0.000	.097963	.878303 .898036
d_mach~n*	.8256102	.0063251	40.70	0.000	.049709	.813213 .838007
log_sa~l	-.0068391	.0015577	-4.38	0.000	3.20591	-.009892 -.003786
LOG_pr~l	.0032998	.0020046	1.64	0.100	1.9582	-.000629 .007229
log_an~l	.0012676	.0013702	0.92	0.355	4.29566	-.001418 .003953
no_has	-.0005591	.0005429	-1.03	0.303	1.58265	-.001623 .000505
depend~o	.0218433	.0381201	0.57	0.567	.36658	-.052871 .096557
n_work~y	-.0055959	.0072248	-0.77	0.439	2.81377	-.019756 .008564
head_e~l	-.0010939	.0032342	-0.34	0.735	5.39816	-.007433 .005245
averag~s	-.0041017	.0040115	-1.02	0.306	6.14423	-.011964 .003761
age_head	.0000626	.000869	0.07	0.943	48.0558	-.001641 .001766
avg_ag~h	-.0053701	.0009404	-5.68	0.000	31.4564	-.007213 -.003527
sex_head*	.031784	.0224346	1.38	0.167	.849418	-.012187 .075755
head_m~d*	-.0057265	.0185154	-0.31	0.757	.671435	-.042016 .030563
indige~s*	.0044547	.0186317	0.24	0.811	.257032	-.032063 .040972
dwater~y*	.0342155	.0233106	1.42	0.155	.909311	-.011473 .079903
delect~m*	.0144138	.0349238	0.41	0.684	.963628	-.054035 .082863
d_telp~e	.0163154	.0142742	1.14	0.253	.448594	-.011662 .044292
regi~uth*	-.052636	.0212851	-2.48	0.013	.553831	-.094354 -.010918
region~l*	-.0388864	.0218575	-1.75	0.081	.29195	-.081726 .003954
urban*	-.0022357	.0160507	-0.14	0.889	.474054	-.033695 .029223
d_2004*	.3427984	.0126759	22.88	0.000	.581959	.317954 .367643
obs. P	.2972842					
pred. P	.257738	(at x-bar)				

(*) dF/dx is for discrete change of dummy variable from 0 to 1
z and P>|z| correspond to the test of the underlying coefficient being 0

Tobit Informal Credit

Tobit regression

Number of obs = 4124
F(29, 4095) = 4.22e+07
Prob > F = 0.0000
Log pseudolikelihood = -21224.114
Pseudo R2 = 0.0109

(Std. Err. adjusted for 3280 clusters in folio)

infc_real	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
no_shocks_hh	-1.80e+07	46606.38	-386.51	0.000	-1.81e+07	-1.79e+07
death_hhmem	1.88e+07	58710.36	320.61	0.000	1.87e+07	1.89e+07
d_illness	1.88e+07	46754.94	401.27	0.000	1.87e+07	1.89e+07
d_disaster	1.82e+07	46583.18	390.77	0.000	1.81e+07	1.83e+07
d_low_prices	1.90e+07	55428.49	342.86	0.000	1.89e+07	1.91e+07
d_low_quant	1.86e+07	76026.62	245.18	0.000	1.85e+07	1.88e+07
d_jobless	1.82e+07	51733.38	350.89	0.000	1.81e+07	1.83e+07
d_joblost	1.85e+07	45870.36	402.55	0.000	1.84e+07	1.86e+07
d_machinery	1.92e+07	53281.44	361.21	0.000	1.91e+07	1.94e+07
log_saving	-38587.41	7346.947	-5.25	0.000	-52991.42	-24183.4
LOG_prod_a	19217.37	4217.576	4.56	0.000	10948.63	27486.11
log_animal	35.52737	4233.008	0.01	0.993	-8263.468	8334.523
no_has	-6322.507	1211.217	-5.22	0.000	-8697.151	-3947.863
dependency	-52263.67	122887.4	-0.43	0.671	-293189.7	188662.4
n_workfamily	-144080.8	22805.32	-6.32	0.000	-188791.6	-99369.98
head_educ	-37018.72	9369.304	-3.95	0.000	-55387.65	-18649.79
average_ed	39522.2	10855.69	3.64	0.000	18239.15	60805.26
age_head	3561.158	1754.065	2.03	0.042	122.2377	7000.079
avg_age_hh	-37239.87	2529.888	-14.72	0.000	-42199.83	-32279.92
sex_head	503711.3	78516.48	6.42	0.000	349776.3	657646.3
head_married	40281.38	70253.95	0.57	0.566	-97454.54	178017.3
indigenous	-67399.13	54863.59	-1.23	0.219	-174961.6	40163.32
dwater_sup	263112.6	84464.06	3.12	0.002	97517.12	428708
delectrici	166250	87693.99	1.90	0.058	-5677.894	338177.9
d_telphone	257606.3	63580.51	4.05	0.000	132953.9	382258.6
region_south	-89583.69	72918.71	-1.23	0.219	-232544	53376.61
region_cen	-304254.8	67410.7	-4.51	0.000	-436416.4	-172093.2
urban	178240.6	68847.59	2.59	0.010	43261.88	313219.3
d_2004	3175971	42874.92	74.08	0.000	3091913	3260029
_cons	-5018092	88678.15	-56.59	0.000	-5191949	-4844234
/sigma	3599423	21354.51			3557557	3641290

Obs. summary: 2898 left-censored observations at infc_real<=0
1226 uncensored observations
0 right-censored observations

Marginal effects after tobit

y = Pr(infc_real>0) (predict, pr(0,.))
= .19273574

variable	dy/dx	Std. Err.	z	P> z	[95% C.I.]	X
no_sho~h	-1.370023	.35484	-3.86	0.000	-2.0655	-.674551	1.39985	
death~b*	.9034191	.05202	17.37	0.000	.801471	1.00537	.082929	
d_illn~s*	.9748461	.01708	57.07	0.000	.941367	1.00833	.21096	
d_disa~r*	.9606623	.02528	38.01	0.000	.911123	1.0102	.177255	
d_low~s*	.8882436	.05784	15.36	0.000	.774886	1.0016	.066198	
d_low~d*	.9820718	.01164	84.37	0.000	.959257	1.00489	.242726	
d_job1~s*	.9635147	.02264	42.55	0.000	.919134	1.0079	.470902	
d_job1~t*	.9146366	.04747	19.27	0.000	.821588	1.00769	.097963	
d_mach~n*	.871516	.06379	13.66	0.000	.746493	.996539	.049709	
log_sa~l	-.0029348	.00024	-12.14	0.000	-.003409	-.002461	3.20591	
LOG_pr~l	.0014616	.00067	2.17	0.030	.000144	.002779	1.9582	
log_an~l	2.70e-06	.00032	0.01	0.993	-.00063	.000635	4.29566	
no_has	-.0004809	.00006	-8.73	0.000	-.000589	-.000373	1.58265	
depend~o	-.0039749	.00831	-0.48	0.632	-.02026	.01231	.36658	
n_work~y	-.010958	.00114	-9.65	0.000	-.013183	-.008733	2.81377	
head_e~l	-.0028154	.0001	-28.39	0.000	-.00301	-.002621	5.39816	
averag~s	.0030059	.00161	1.87	0.062	-.000148	.006159	6.14423	
age_head	.0002708	.0002	1.33	0.185	-.000129	.000671	48.0558	
avg_ag~h	-.0028323	.00055	-5.15	0.000	-.003911	-.001754	31.4564	
sex_head*	.0366693	.01543	2.38	0.017	.00643	.066908	.849418	
head_m~d*	.0030585	.00611	0.50	0.617	-.008922	.015039	.671435	
indige~s*	-.0051058	.0029	-1.76	0.078	-.010786	.000574	.257032	
dwater~y*	.0194885	.01128	1.73	0.084	-.00262	.041597	.909311	
delect~m*	.0124082	.00969	1.28	0.201	-.006593	.031409	.963628	
d_telp~e	.0195922	.00991	1.98	0.048	.000168	.039016	.448594	
regi~uth*	-.0068211	.00385	-1.77	0.077	-.01437	.000728	.553831	
region~l*	-.0227845	.00173	-13.14	0.000	-.026184	-.019386	.29195	
urban*	.0135708	.00871	1.56	0.119	-.003499	.03064	.474054	
d_2004*	.2253051	.06112	3.69	0.000	.105511	.345099	.581959	

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Probit Informal Credit used as Coping Strategy

```
Iteration 0: log pseudolikelihood = -458.42643
Iteration 1: log pseudolikelihood = -375.55832
Iteration 2: log pseudolikelihood = -370.49212
Iteration 3: log pseudolikelihood = -370.37658
Iteration 4: log pseudolikelihood = -370.37483
Iteration 5: log pseudolikelihood = -370.37432
Iteration 6: log pseudolikelihood = -370.37415
Iteration 7: log pseudolikelihood = -370.3741
Iteration 8: log pseudolikelihood = -370.37408
Iteration 9: log pseudolikelihood = -370.37408
Iteration 10: log pseudolikelihood = -370.37407
Iteration 11: log pseudolikelihood = -370.37407
Iteration 12: log pseudolikelihood = -370.37407
Iteration 13: log pseudolikelihood = -370.37407
Iteration 14: log pseudolikelihood = -370.37407
Iteration 15: log pseudolikelihood = -370.37407
Iteration 16: log pseudolikelihood = -370.37407
Iteration 17: log pseudolikelihood = -370.37407
```

Probit regression, reporting marginal effects

Number of obs = 1264

Wald chi2(28) = .

Prob > chi2 = .

Pseudo R2 = 0.1921

Log pseudolikelihood = -370.37407

d_inf~l	dF/dx	Robust Std. Err.	z	P> z	x-bar	[95% C.I.]
no_sho~h	-.6168814	.0577043	-26.10	0.000	2.30459	-.72998	-.503783	
death~b*	.9821683	.003555	22.71	0.000	.141614	.975201	.989136	
d_illn~s*	.9784736	.0061075	28.41	0.000	.349684	.966503	.990444	
d_disa~r*	.9580944	.0138636	20.73	0.000	.274525	.930922	.985267	
d_low~s*	.9745506	.000054	.	.	.174051	.974445	.974657	
d_low~d*	.8985401	.0261811	19.31	0.000	.397943	.847226	.949854	
d_job1~s*	.5821181	.0332132	23.43	0.000	.642405	.517021	.647215	
d_job1~t*	.9724864	.0087478	21.01	0.000	.207278	.955341	.989632	
d_mach~n*	.9773746	.0039628	22.49	0.000	.116297	.969608	.985141	
log_sa~l	-.0004494	.0014906	-0.30	0.763	3.44288	-.003371	.002472	
LOG_pr~l	.0015397	.0018747	0.82	0.414	2.42263	-.002135	.005214	
log_an~l	.0009536	.0012636	0.75	0.451	4.64193	-.001523	.00343	
no_has	.000308	.0007932	0.39	0.699	1.63994	-.001247	.001863	
depend~o	-.0374702	.0408341	-0.91	0.361	.360552	-.117504	.042563	
n_work~y	-.0107386	.0070389	-1.53	0.127	2.93829	-.024535	.003057	
head_e~l	-.0018842	.0034922	-0.54	0.589	5.44146	-.008729	.00496	
averag~s	-.0038634	.0041707	-0.93	0.354	6.26877	-.012038	.004311	
age_head	-.0008445	.0009708	-0.87	0.385	48.129	-.002747	.001058	
avg_ag~h	-.0013734	.0010273	-1.34	0.181	31.0407	-.003387	.00064	
sex_head*	.0288844	.0193724	1.30	0.193	.871044	-.009085	.066854	
head_m~d*	-.0162243	.019009	-0.88	0.376	.701741	-.053481	.021033	
indige~s*	-.0169463	.0167164	-0.97	0.330	.254747	-.04971	.015817	
dwater~y*	.03906	.016649	1.91	0.056	.909019	.006429	.071691	
delect~m*	-.0334335	.0429179	-0.89	0.376	.963608	-.117551	.050684	
d_telp~e	-.0058096	.0140494	-0.41	0.680	.5	-.033346	.021727	
regi~uth*	-.0596825	.0225796	-2.75	0.006	.563291	-.103938	-.015427	
region~l*	-.0440694	.0182152	-2.19	0.028	.295886	-.079771	-.008368	
urban*	-.0046752	.0161401	-0.29	0.772	.47231	-.036309	.026959	
d_2004*	.1197757	.0149822	7.15	0.000	.578323	.090411	.14914	
obs. P	.1178797							
pred. P	.0734175	(at x-bar)						

(*) dF/dx is for discrete change of dummy variable from 0 to 1
z and P>|z| correspond to the test of the underlying coefficient being 0