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SUSTAINABILITY OF MICROFINANCE AND HOUSEHOLD ACCESS TO CREDIT: EVIDENCE FROM CÔTE D'IVOIRE

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The opinions found in this dissertation have to be considered as my own opinion. They do not engage the University of Felix Houphouët Boigny

ABSTRACT

The attainment of sustainability is critical for the long term viability of microfinance institutions (MFIs), which provide a set of financial products to all those excluded from formal financial system, in particularly to the low income households. But, such preoccupations force some MFIs to divert from their social missions in favor of profit. This thesis is out to propose mechanisms that will permit MFIs not only to be long lasting but also to reduce the credit burdens on households in Côte d'Ivoire, in other to mutually satisfy MFIs and households

By using simultaneous equations and Heckman two steps models as well as the model of Stackelberg, the study brings out that a good capitalization or equity and the low administrative costs have important effects on the sustainability of the MFIs. Then, Savings and the grants remain only the resources facilitating the accessibility to the credit of the poor borrowers. However, as it is shown in this thesis by the model of Stackelberg, the usage of subsidy as a way of financing the extension of credit in the low-income households is effective only if the proportion of rich borrowers is high. Besides, from the analysis of credit source choice, the results reveal the size of the loan, agricultural purpose, the geographical area where households live and ethnicity as factors influencing the choice for formal sources.

Keywords: Credit access, Heckman Two steps, Microfinance, Simultaneous equations, Stackelberg model, Sustainability

RESUMÉ

La quête de la pérennité financière est importante pour la survie à long terme des institutions de microfinance (IMF), qui fournissent un ensemble de produits financiers à tous ceux qui sont exclus du système financier classique ou formel, en particulier aux ménages à faible revenus. De telles préoccupations contraignent à terme certaines IMF à privilégier la réalisation de profits aux dépens de la performance sociale. L'objet de cette thèse est de proposer un mécanisme permettant aux IMF d'être pérennes tout en octroyant des crédits aux ménages en Côte d'Ivoire, de façon à satisfaire mutuellement les deux parties.

A l'aide des modèles d'équations simultanées et de Heckman ainsi que du modèle de Stackelberg, il ressort de l'étude qu'une bonne capitalisation et des coûts administratifs faibles ont des effets importants sur la pérennité financière des IMF en Côte d'Ivoire. En outre, l'épargne et la subvention restent les ressources facilitant l'accessibilité au crédit des emprunteurs pauvres. Cependant, comme le démontre le modèle de Stackelberg développé dans cette thèse, la subvention comme mode de financement de l'extension du crédit aux ménages à faible revenu n'est efficace que si la proportion de riches emprunteurs est élevée. Par ailleurs, l'analyse de la demande révèle aussi que la taille des prêts, les prêts pour motif de production agricole, la localisation géographique sont des éléments important dans les décisions d'emprunts des ménages.

Mots clés : Accès au crédit, Equations simultanées, Heckman modèle, Microfinance, Modèle de Stackelberg, Pérennité financière

DEDICATION

To my parents and my kids

ACKNOWLEDGEMENTS

LIST OF ACRONYMS

AfDB	African Development Bank
AISFD-CI	Association Interprofessionnelle des Systèmes financiers et décentralisés de Côte d'Ivoire
BCEAO	Banque Centrale des Etats de l'Afrique de l'Ouest
CEDEAO	Communauté Economique des Etats de l'Afrique de l'Ouest
CGAP	Consultative Group to Assist the Poor
CNM	Commission Nationale pour la Microfinance
FCFA	Franc de la communauté Française Africaine
FINCA	Foundation for International community Assistance
FSS	Financial Self Sufficiency
GDP	Gross Domestic Product
GDPpc	Gross Domestic Product per capita
GTZ	Gesellschaft fürTechnische Zusammenarbeit
GNP	Gross National Product
HIPC	Highly Indebted and Poor Country
IMF	Institutions de Microfinance
KMO	Kaiser Meyer Olkin
MFIs	Microfinance Institutions
MUCREFAB	Mutuelle de Crédit et d'Epargne des Femmes d'Aboisso-Bonoua et Grand Bassam
MUCREFBO	Mutuelle de crédit et d'épargne pour les femmes de la Région de Bouaflé
NGOs	NonGovernmental Organizations
OECD	Organization for Economic Cooperation and Development
OSS	Operational Self Sustainability
PARMEC	Programme d'Appui à la Réglementation des Mutuelles d'Epargne et de Crédit.
PCA	Principal Component Analysis
ROA	Return on Assets
RCMEC-CI	Réseau des Caisses Mutuelles d'Epargne et de Crédit de Côte d'Ivoire
ROE	Return on Equity
ROSCAs	Rotating Savings and Credit Associations
SCAs	Savings and Credit Associations
SDI	Subsidy dependence Index
3SLS	Three Stage Least Square
2SLS	Two Stage Least square
UEMOA	Union Economique et Monétaire Ouest Africaine
UMOA	Union Monétaire Ouest Africaine
UNACOOPEC-CI	Union Nationale des COOPEC de Côte d'Ivoire
UNCDF	United Nations Capital Development Fund
UNDP	United Nations Development Program
USAID	United States Agency for International Development
VIF	Variance Inflation Factor
WAEMU	West African Economic Monetary Union
WOCCU	World Council of Credit Union

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INTRODUCTION

1. Context of study

Exclusion of poor people[1] from formal financial system is a social development problem, which remains the main concern of various governments in developing countries. The strategy undertaken by these governments for the poor ones is the provision of financial services through specific economic activities.

Between the 1950s and 1970s, governments and donors focused their efforts in providing subsidized agricultural credit to small and marginal farmers; a policy planned to raise productivity and incomes in developing countries. According to Bardhan and Udry (1999), two reasons justified such interventions. First, credit was conceptualized, especially agricultural credits as a factor of production. In the second place, the increase of credit supply which may cause a push up in production and income because informal financial transactions are exploitative and immoral.

Subsidizing agricultural credit for small and marginal farmers didn't live up to the expectations of productivity and incomes. For Deshmukh-Ranadive and Murthy (2005), the repayment schedules were based on the income flow expected from the investment. However, returns were often over estimated. Agricultural production depends heavily on unpredicted weather conditions. Besides, subsidized agricultural credit relied on the fluctuation of the priorities of governments and donor agencies. Hence, credit provision for the poor is intermittent and limited.

Consequently, facing the challenge of rural financing, governments decided to explore other alternatives ways for internal financing. Microcredit programs became the option which had been adopted by governments. The success of some micro enterprise credit programs led to the emergence of microfinance institutions (MFIs). The shift from microcredit to microfinance is due to the inclusion of new features. The move towards microfinance is justified by the fact that households can benefit from access to financial services more broadly defined and not just credit for microenterprises.

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[1] – Exclusion of the poor from formal financial systems can be partial in developed countries and total or full in developing countries (Brau and Woller, 2004).

[1]

1.1. What should you learn from microfinance?

The practice of microfinance is old. Credit cooperatives and charities providing loans to young entrepreneurs have been documented since the 18th century in Europe (Hollis and Sweetman, 1998). Some common examples are the German credit cooperatives in the late nineteenth century; mostly located in the rural areas, and the Revolving Savings and Credit Associations(ROSCAs) popularly known as "tontine" in West Africa. However, these West African informal institutions are characterized by a limited and irregular supply of financial services, higher interest rates and fees and lack of securities (Pagura, 2003). Modern microfinance system is an adaptation of the informal traditional one.

There is no conventional definition of microfinance. Some ideas adopted by practitioners and researchers identify the microfinance business as a collection of banking practices (built around) providing typically small loans without collateral and accepting tiny saving deposit. Microfinance therefore, refers to small-scale financial services provided by some financial organizations to the farmers or shepherds operating in the microenterprises that produce goods; provide small-scale services; or people who works for wages or commissions at local levels in the rural and urban areas of developing countries. Microfinance includes savings, remittances, risks mitigation products (insurance), financial counselling, and money transfer and so forth. Microfinance institutions exploit new contractual structures and organizational forms that reduce the risks and costs of making small, uncollateralized loans and offer cheap loans. The aim of microfinance is that of serving microenterprises and poor households.

MFIs are specialized financial institutions which are soared; serving more than 100 million clients worldwide by 3300 MFIs that grew by 26% during 2005-2007 (Cull et al., 2009). These institutions provide loans and savings products to poor people. The number of people who received credit from these institutions rose from 13.5 million to 113.3 million (84% of them being women) during the period 1997 to 2005 (Daley-Harris, 2006). In the case of the WAEMU[2] zone, a report from the Central Bank of West African States (CBWAS) notes that savings and loans products from microfinance represented 8.6% and

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[2] WAEMU means West African Economic and Monetary Union. This union includes height (8) countries which are: Benin, Burkina Faso, Côte d'Ivoire, Mali, Niger, Senegal, Togo and Bissau Guinea.

7.2%, respectively for credit and Savings in the overall economy in 2008. In addition, she argues that, from 1993 to 2007, beneficiaries from MFIs services went up to the average of more than 25%, while deposits and outstanding credit showed a growth rate of 28% and 29%, respectively.

1.2. Features of Microfinance

Microfinance has several features that distinguish it from other kinds of financial institutions, especially, commercial banks. Microfinance services are provided by various sources, more related to fragmented credit markets in Developing countries. This dualism is reflected by the coexistence of formal and informal financial sectors. The formal financial sector operates under the rules defined by legal systems and, frequently, under the regulation and supervision of the monetary and financial authorities. All the transactions are recorded and documented, and contracts are enforced in the courts of justice. The formal sector is typically made-up of commercial banks, non-bank financial intermediaries, and specialized banks, Credit unions, etc. The informal sectors involve small and flexible transactions and are based on personal contact. Contracts are enforced through non-judicial mechanisms, and transactions require no legal documentation. The informal sector includes friends, relatives, Rotating Savings and Credit Associations (ROSCAs), pawnbrokers, moneylenders, traders and other marketing agents.

Between formal and informal sources exists the semi-formal foundation. Semi-formal lenders are usually institutional sources of credit that use alternative lending technologies in reaching non-traditional clienteles. The semi-formal sector encompasses cooperatives, self-help groups (SHGs), and other non-governmental organizations (NGOs) that offer one or several types of financial services. Sometimes, talking of microfinance refers to services providers such as formal and semi-formal institutional.

In the WAEMU zone, the operational structure of these MFIs depends on legal form and mission. Concerning the legal form, a relative diversity exists. There are the Savings and Credit Cooperatives (SACCOs) or mutual funds, Direct Credit Institutions (DCI) and Credit Projects (CP). Saving predetermines the process of loans in the SACCO's financial environment. Then 85% of MFIs in WAEMU depends on the amount of savings. The DCI

places credit and credit distribution as their priority. It represents 7% of all the MFIs. Credit projects are instituted by MFIs even though credit is not their main activity. It represents 8% of all the activities of MFIs (Camara, 2006). Amongst the different types of MFIs, SACCOS are cost-effective and show impressive outreach[3].

However, in order to accomplish this social mission, most of the microfinance institutions are still receiving subsidies from external donors. But the growth of MFIs has encouraged competition. As a result, donors require that the microfinance institutions should be sustainable in order to be eligible for subsidies (UNCDF, 2004). The Consultative Group to Assist the Poorest (CGAP), a donor consortium housed at the World Bank and the United States Agency for International Development (USAID), have been urging this approach in their guidelines and literature by conditioning further grants and loan guarantees on the attainment of specific performance and sustainability targets (Conning, 1999).

Rising competition amongst the growing number of MFIs has made the financial performance necessary for most of the institutions, if not, all MFIs at large. Many MFIs are in the process of undertaking this transformation or at least, considering it. As a result, the world of microfinance has changed over the past decade from a subsidy oriented focus to a focus on sustainability; from a project approach[4] to a focus on building sustainable microfinance institutions; from a perception of the poor as beneficiaries to a treatment of people as customers, and from providing credit only to providing a range of financial services (Robinson, 2001). From now on, some financial programs and cooperatives of a number of NGOs (non-conventional financial institutions) are becoming financially sustainable, and are formalizing or seeking for legal status (Kidder, 1999). They also try to operate without subsidies. Then, the change in the language has brought about a change in orientation. Financial services are geared towards the "less poor" households and

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[3] All efforts to extend microfinance services to the people who are underserved by financial institutions are classified as outreach. Outreach can be measured in terms of breadth — number of clients served and volume of services (i.e., total savings on deposit and total outstanding portfolio)or how many people the program is reaching — or depth — the socioeconomic level of clients that MFIs reach. (Lafourcarde et al., 2006; Olivares-Polanco, 2005, Conning, 1999).

[4] The project approach can be defined in terms of number of clients that have received credit. These clients are often perceived as beneficiaries of the project. The project provides credit directly or through a "modality". (UNCDF,2004)

towards the establishment of commercially oriented and fully regulated financial entities (Armendáriz and Morduch, 2005). This change has brought the integration of the microfinance institutions and the formal financial market (UNCDF, 2004; Vázquez, 2005).

The Microfinance Institutions in the WAEMU space have followed suit with commercializing microfinance[5]. Consequently, for insuring their sustainability[6] at a rate of repayment about 100%, the MFIs have centered their activities on the urban entrepreneurs and few on the agricultural farm of medium size. These changes are observed in Ivorian microfinance industry. In fact, since 2000, the international donors had reduced subsidizing in the leading Ivorian MFIs. That leads them to move from the objective of social ends to profit ends. For this reason, and to insure their sustainability, and a rate of repayment about 100%, the MFIs have centered their activities on the urban entrepreneurs, civil servants, private formal workers and few activities on the agricultural farm of medium size. They also employ tighter loan screening procedures and strict rule of functioning for their clients (Jallais, 2000). This will be reflected by the low rate of savings transformation into credit. This rate is approximated around 43%. It is the lower rate than the other countries.

Table 1: A benchmark of some West African Credit Union

	Credit union	Members	Penetration[a] (%)	Saving(US$)	Loans(US$)	Loan to deposit ratio[b] (%)
Benin	85	1 175 282	27.07	89 494 993	154 951 418	173.14
Burkina Faso	50	1 141 392	15.67	83 949 952	85 058 156	101.32
Côte d'Ivoire	25	1 796 070	17.63	160 898 711	69 364 301	43.11
Ghana	275	202 390	1.52	60 922 631	41 331 780	67.84
Mali	104	1 115 388	19.06	79 933 468	104 020 306	130.13
Senegal	310	1 329 137	19.32	162 171 832	189 840 728	117.08
Togo	62	541 485	17.17	75 870 724	61 228 759	80.7

Source: WOCCU, 2006
   a Penetration rate is calculated by dividing the total number of reported credit union members by the economically active population.
   b Computation from author

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[5] Commercializing microfinance refers to profitability, competition, and regulation of microfinance institutions.
[6] Sustainability is defined as "a program's capacity to remain financially viable in the absence of domestic subsidies or foreign support" (Woolcock, 1999)

Commercialization has also brought a move from a group lending to individual-based lending. Cull et al. (2007)' study shows that MFIs that mainly provide individual loans perform better in terms of profitability, but the fraction of poor borrowers and female borrowers in the loan portfolio is lower than for institutions that mainly provide group loans. The group lending represents 10.12% of the set of the lending in 2004 (BCEAO, 2004). For those financial institutions, sustainability requires private profitability without needs of subsidies. This study also suggests that individual-based MFIs increasingly focus on wealthier clients.

2. Problem statement

The interest for sustainability provided on the debate between financial system approach and poverty lending approach in 1990s (Robinson, 2001). The first camp states that the MFIs must be able to cover the cost of lending money out of the income generated from the outstanding loan portfolio and to reduce operational costs as much as possible. For the poverty lending approach, the use of credit is to help overcome poverty, primarily by providing credit with subsidized interest rates (Hermes and Lensink, 2011). In this debate, most of the microfinance experts, policymakers, and researchers give a great importance for the financial sustainability. According to Hermes and Lensink (2011), the main argument to support their view is that large scale outreach to the poor on a long-term basis cannot be guaranteed if MFIs are not financially sustainable. Therefore, the quest for sustainability and eventual self-sufficiency appears as a best practice in the microfinance industry.

Vinelli (2002) offers some positive arguments that explain why sustainability is important. In one hand, it helps to ensure the continued existence of organization and the continuous provision of a financial service that is desired by many micro business owners. In the other hand, MFIs that price their products at the market levels will be able to attract the target population of non-bankable (but potentially viable) borrowers who have no access to cheaper products. Sustainability facilitates the ability to raise capital from a variety of sources. In fact, sustainable MFIs are better for the economy. Furthermore, defaults may increase if borrowers believe that a lender is not permanent or if they believe that a lender

will not punish them (Schreiner and Morduch, 2002; Bhatt and Tang, 2001; Gonzalez-Vega, 1998; Bates, 1995).

Robinson (2001), through a study of sixteen (16) different MFIs from all over the world, pointed out that having access to MFIs' services leads to an enhancement in the quality of life of clients, increase in their self-confidence, and helps them diversify their livelihood, security strategies and thereby, increases their incomes. That shows the important role that can play microfinance institutions in a country. Also, as described by Doyle (1998), microfinance in a post-conflict context must be a multi-use tool. Firstly, it can restart and boost local economic development by providing access to financial services. Secondly, it can be a component of immediate post-conflict rehabilitation assistance. Microfinance can encourage the reintegration of refugees, returnees and demobilized soldiers, by facilitating the development of economic activities, collaboration with local populations and fulfillment of entrepreneurial spirit (Larson, 2001).

Wright (2000), on his side, affirmed that from the little research that has been conducted on the impact of MFIs interventions on health and education, nutritional indicators seem to be improved where MFIs have been working. Microfinance interventions have been shown to have a positive impact on the education of clients' children, because one of the first things that poor people do with new income from micro-enterprise activities are to invest in their children's education (Littlefield et al., 2003). Taking an advantage of all the benefits of microfinance, it is important to create MFIs that are viable in the long term. This requires, as all entity of economy, the adoption of a good governance practice.

However, although most of MFIs try to adopt these good practices, few MFIs seems attain financial sustainability. According to Hermes and Lensink (2011), only 1-2% of all MFIs in the world are financially sustainable. That concerns the large, mature, regulated and well-known MFIs. By adding those who are close to being profitable, the percentage increase to 8% of all MFIs. These MFIs have the characteristics to be commercial organizations, and with the main focus on profitability and /or sustainability. But, the low results appeal to known the factors driving to sustainability since most of the MFIs are focusing on sustainability but fail to reach it.

[7]

Nevertheless, the change of MFIs into formalized banking institutions does not only have positive consequences for the poor (Cull et al., 2011). Hermes et al., (2011) affirms also that aiming for sustainability does compromise the social goals of MFIs. Therefore, focusing on Sustainability and/or profitability has several implications: firstly, it might lead MFIs to seek for better-off clients for larger loans. The tendency is to earn higher profits per loan since transactions costs tend to decrease with loan size (Morduch and Rutherford, 2003). In fact, they gain the economies of scale that would minimize expenses per loan as well as increase the probability of repayment. Secondly, microfinance institutions will proliferate in urban areas rather than rural areas (Lashley, 2004); a phenomenon that is common in rural areas of West Africa. For instance, there is no deposit collectors in villages located more than 15 kilometers from cities (Chao-Beroff, 2003). Besides, the diversification of products to reach out to new clients and the search of financial sustainability could limit credit to households; thus, exclusion of some individuals from the credit market is likely.

Such an inclusive strategy of the MFI that moves towards sustainability would once again leave the poor with limited access to capital. Most of the MFIs provide credit on the basis of initial wealth endowments, something that preserves the vicious circle of poverty. Indeed, the lack of credit may prevent the start up and the development of a business and may prevent individuals from reaching higher living standards. Therefore, they may turn unto a wage labor, stay in traditional farming, or take other paths that are less desirable and less profitable (Armendáriz and Morduch, 2005). According to Diagne and Zeller (2001), the inaccessibility to credit has significant negative consequences on households at several levels, such as technological adoption, agricultural productivity, food security, nutrition, health, child education and overall household welfare. The quest for sustainability without inclusion of social mission in the MFI's objectives could contribute to enforce the poverty situation of the poor.

Examining the relationship between household income shocks, access to credit, and child labor, Beegle et al. (2003) find that inaccessibility to credit plays a central role in determining the prevalence of child labor. Jacoby (1994) examines the relationship between borrowing constraints and progression through school amongst Peruvian children. He concludes that lack of access to credit perpetuates poverty because children

in households with borrowing constraints begin withdrawing from school earlier than those with access to credit.

Besides the direct exclusion as a result of the sustainability policy, another consequence of intensive quest of sustainability is self-exclusion. There are potential clients who refuse to join programs even though the products offered are supposedly designed for them. Despite the fact that they are in need, they don't look for credit as they are convinced that their application will certainly be turned down. The fact that many, in the target-population refuse to apply, supposes that something may be wrong (Meyer, 2002). According to Lashley and Lord (2002), this is due to lack of appreciation of the specific contingent circumstances that surround the delivery of microfinance. That could constitute one of the main hindrances to the success of microfinance. One implication is that even MFIs are sustainable, others factors could be the barriers to the access to credit by the poor people in the long term. That threatens the social objective attainment and the institutional sustainability.

These micro levels consequences have major implications on the overall economy in developing countries. Indeed, the consequence of lack of access to credit goes beyond the increase of the household poverty. Financial exclusion brakes on development which retards economic growth and increases poverty and inequality as developed by Beck and Demirguc–Kunt (2007). That induces the skilled labor migration that the most direct effect is to reduce the number of educated workers who are critical to productivity and a developing country's economic growth (Lowell and Findlay, 2001). In developing countries where the economy depends on the agricultural and the informal sector, the lack of credit will be prejudicial in the long term. That leads to food insecurity and inducing the rural exodus towards the urban towns, with side effects like urban poverty and crime. The major consequence is the slowdown of the economy (Low investment and savings, etc.).

Finally, if improving access to credit and having sustainable MFIs are better for the development, how do we find the balance between both? Abundant literature gives a strong evidence of the trade-off between sustainability and outreach, rendering difficult to attain the objectives simultaneously but not impossible. Only few studies attempt to

investigate on the probable conciliation of the sustainability and poor outreach goals (Wydick et al., 2011; Woller and Schreiner, 2006). That is a third paradigm[7] which has emerged, recently.

The third paradigm promotes a balance between the goals of poverty alleviation both be obtainable, contingent on the adoption of appropriate strategies. These strategies include charging a high real rate of interest, making productive use of loan officers, paying appropriate salaries, and keeping administrative costs low (administrative efficiency high). For Woller and Schreiner (2006), a useful framework for pursuing both financial and social ends is a so-called "blended value" approach[8]. They apply this to six aspects of outreach defined by Schreiner. Their findings suggest that financial self-sufficiency need not decrease when depth of outreach increases. This approach rests mainly on the Microfinance services providers'side, suggesting the taking into account of one aspect of the problem. Permanent financial sustainability must so take into account all aspects of credit market while ensuring that microfinance mission does not deviate from the original mission; i.e. the mission of serving the poor.

A potential resolution must integrate the social, environmental and cultural context of developing countries. The paper from Wydick et al. (2011) focuses on the use of existing social networks between existing and potentially new microfinance clients. The authors suggest that MFIs could make more use of these networks when reaching out to the poor as it turns out that households may be willing to apply for microfinance because other households in the same network do so as well. Using these networks is a low-cost strategy for MFIs when reaching out to new clients.

In summary, any progress towards a potential resolution of this problem depends on a better understanding of the link between sustainability and poor outreach under microcredit. It passes also necessary toward a better assessment of the profile of

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[7] Note that the two previous paradigms are financial self-sustainability approach and poverty alleviation approach

[8] According to Emerson (2000) cited in Woller and Schreiner (2006), blended value approach means all investments are understood to operate simultaneously in both economic and social realms. There is no tradeoff between the two, but a concurrent pursuit of value, both social and financial.

borrowers and the development of a lending model with concrete parameters. These parameters should be adjusted to the local conditions on borrower characteristics.

This dissertation belongs to the third Paradigm which assumes a balance between these two goals of microfinance would be possible. Finding this balance in the Ivorian context requires answering to a number of important questions that are: What are the determinants of MFIs sustainability? What is the behavior of a household towards the choice of a credit program? How could they increase the number of low income households to credit access? Are subsidies the only mechanism to allow access to credit by low income households? In overall, how can the goal of sustainability of MFIs and the access to credit by low income households be reconciled?

3. Objectives

The overall objective of this study is to examine the mechanisms that help in the achievement of sustainability and the extension of access to credit to low income households in Côte d'Ivoire. This study is specifically intended to:

1 Identify the determinants of sustainability. In other words, show the conditions under which a microfinance institution can achieve goal sustainability.
2 Understand the behavior of a household in a matter of choice of formal sources of loan.
3 Investigate the effects of subsidies by improving access of households to credit

4. Relevance of the study

Provided some answers to the above research questions, as said Hermes and Lensink (2011), it will be relevant for policy makers when deciding on whether or not to subsidize microfinance; for microfinance practitioners for their decisions to further improve the efficiency of their operations; and it is relevant for commercial investors, especially those who aim for socially responsible investments. The rationale of this study is defined in several levels that are: theoretical level, and Economic level.

4.1. At the theoretical level

This work inserts in the large debate on the sustainability and poverty outreach. In effect, innumerable studies have been made on sustainability and outreach or the tradeoff between them. However, few studies attempt to investigate on the manner to attain the two goals simultaneously. This dissertation tries to fill this gap. Furthermore, since microfinance provides a way to circumvent imperfections in financial markets, becoming sustainable would contribute to alleviate the frictions in financial markets in order to ensure economic efficiency. In fact, a sustainable MFI could be used as a tool for redistributing scarce resources in the fighting against a poverty (implementation of some social policies), and in the promotion of gender equality by facilitating women participation in economic activities as suggested by the International Monetary Fund.

Then, this dissertation contributes on the thinking on the financial inclusion in the less developed countries

4.2. At Ivoirian's economic level

In 1995, the microfinance sector contributed to the GDP for about 20% and created more than 30% of employment[9]. By 2007, the microfinance sector recorded about 1257 employees. During the war, MFIs played the role of banks in the rebel areas, uncontrolled by the government. Nevertheless, access to credit constitutes a main obstacle to the progress of the sector because of a misunderstanding about the role of microfinance by MFIs in poverty alleviation and financial assistance to poor customers (CNM, 2005). That could alleviate if MFIs would play an important role in the current post conflict situation by offering loans adapted to consumers' needs. Consequently, the lessons drawn by this dissertation could be useful at several levels in Côte d'Ivoire.

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[9] www.uncdf.org/francais/countries/**cote_divoire**/index.php

4.2.1. For the Households

The credit policies that are well oriented and adapted to the needs of households will be beneficial to this latter. They will be running their tiny businesses to survive, to support their families, and to educate their children. Then, the use of savings facilities by low-income households enables them to store funds for future use and build credit history. In fact, microfinance contributes to reduce the vulnerability from risk, and stabilize the consumption patterns. The decrease in vulnerability from unplanned shocks increases the probability that low income households will engage in riskier and higher yielding activities that could increase their incomes. Therefore, the households would gain to participate to credit program but that would be possible if the products offered match the households' needs.

4.2.2. For the microfinance institutions

The results of this dissertation are useful for MFIs in a sense where they would know the determinants of their sustainability and how to avoid the high rate of non-repayment. They could emphasize on these aspects to improve their performance. Indeed, these mechanisms could lead to improve portfolios management which is important to the attainment of financial sustainability. Furthermore, the critics argue that the win-win logic underlying microfinance theory developed by Morduch (1999) is much more complicated in nature than it seems. Its success depends on aspects that have been mostly ignored like the environment in which the borrowers evolve or the use of the loans, or the reason why they would choose to borrow from the MFIs. The results of this dissertation could also give an answer to such preoccupations.

4.2.3. For policy makers

An understanding and identification of the factors which could bias credit policies can help in the reformulation of future social policies. Those factors will be highlighted through the determination of the factors driven household to borrow. In addition, a

knowledge of the funding mechanism of the microfinance' social mission will be helpful. Furthermore, the revival of economic activities after the crisis requires that microfinance policies should be well orientated.

5. Hypotheses

By performing this analysis, several hypotheses will be tested. These hypotheses are derived from the literature on how get the balance between sustainability and outreach. Those are:

Hypothesis 1: The interest rate has a positive effect on the sustainability.

Hypothesis 2: The improvement of the administrative efficiency, measured by the administrative expense, contributes positively to the sustainability. That means higher administrative expense lower sustainability.

Hypothesis 3: Production purposes have a positive effect on the choice of microfinance credit program.

Hypothesis 4: Subsidy has a positive effect on extending the credit to low income households.

6. Plan of study

Given the importance of sustainability and accessibility to credit for the developing countries like as Côte d'Ivoire, this dissertation is structured in two parts. The first part concerns the definition of these concepts and the relevance of this study for the Côte d'Ivoire. The second part deals with the empirical analysis. More precisely, in terms of chapters, this dissertation is structured as follows: Chapter 1 makes an analysis of the situation of microfinance in Côte d'Ivoire. It permits to know whether the problems of sustainability and accessibility are important for the Ivorian microfinance institutions. Then, the chapter 2 debates the literature on the sustainability's and access to credit, and their measurements. The chapter 3 deals with the methodological issues to be used and the data. Finally, the last chapter presents the main findings for Ivorian microfinance industry.

CHAPTER 1: AN OVERVIEW OF MICROFINANCE INDUSTRY IN CÔTE D'IVOIRE

Providing the poor with access to savings and credit services as a poverty alleviation strategy has gained much importance in the past ten years. This has resulted from the emergence of models such as microfinance that have shown increasing success in terms of their ability to reach the poor and sustaining the delivery of financial services. In 1976, Côte d'Ivoire launched her first program of microfinance, oriented towards rural areas in order to fund rural activities. In the beginning, it was known as "Caisse Rurale d'Epargne et de Prêts (CREP)". It worked essentially in the rural areas. In 1995, it extended activities to urban areas and changed its name as UNACOOPEC-CI. By 1996, MFIs spread all over the country in the form of credit and savings union institutions[10]. Even though more expectations were found in this expansion, the results remain lower as compared to the social and financial performances.

This chapter investigates on the magnitude of problems of sustainability and accessibility for the Cote d'Ivoire. For that, the chapter presents an overview of the Ivorian microfinance industry, and it is organized as follows: section 1.1 provides a description of the financial sector and microfinance development in the Ivorian context. Section1.2 gives the MFIs performance in matter of accessibility. Then, section 1.3 makes an analysis of the financial performance of MFIs. Finally, section1.4 summarizes the main ideas of this chapter.

1.1. Côte d'Ivoire – general context

Located on the Gulf of Guinea, Côte d'Ivoire (which means "Ivory Coast"), is a West African country. It is made up of savannah (northern part) and forest (western and southern parts). It is a member of several sub-regional integration organizations. The most important one is the West African Monetary Union known is in French as *Union Economique et Monétaire Ouest Africaine"* (UEMOA) and the Economic Community of West African States (ECOWAS) called in French CEDEAO. Based on that membership,

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[10] Credit Union institutions are often termed as Savings and credits cooperatives

the monetary and credit policy of the country are under the care of the Central Bank of the West African States (BCEAO).

Côte d'Ivoire has a population of about 18.6 millions, which has been growing at about 3.5% per year. 51% of the population is made up of men and 49% are women. The structure of the population is youthful, with only 2.2% aged 65 and over, while 51.8% aged between 15 and 64, and 46% under 15 years. The population comprises five (5) major ethnic groups: Kru, Akan, Volta, Mande, and Malinke. They dwell in both the savannas and the rain forest zones. The statistics given by Human Development Report (2007/2008) indicate that 55% of the populations were in rural areas and 45% in urban areas in 2005. They also indicates that in 2006 poverty rate was estimated at 43.2%, based on a poverty line of XOF 162 800 per capita in annual expenditure. Poverty is most severe in the savanna of the north (54.6 percent) and the rural forest of the East (46.6 percent), followed by the urban regions (33.8 percent) apart of Abidjan, the western rural forest (24.5 percent) and Abidjan (11.1 percent). The Ivoirian economy is largely, a market-oriented one and depends heavily on the agricultural sector. The Agricultural sector accounted for 24% to GDP, and between 60% and 70% of Ivoirian active population are engaged in some forms of agricultural activity. Considering the poverty of its population, the government of Côte d'Ivoire decided to make poverty alleviation a priority in its socio-economic programs.

1.1.1. Financial sector of Côte d'Ivoire

The financial sector consists of a banking network driven by local and regional banks, microfinance institutions and insurance companies. This sector has been heavily impacted by the different crisis that had to cross the country. He recorded a sharp rise in the cost of risk, a weakening of loan portfolios and a sharp deterioration in the profitability of the banking system (BAfD et al., 2012). Indeed, it faces major structural problems, including: a low level of banking which is between 7% and 10%, the virtual absence of long-term credits, or 6% of total loans in 2008, a low level of financing of the economy and a low level of capitalization (République de Côte d'Ivoire, 2012).

The financial sector in Côte d'Ivoire as well as in all the developing country is characterized by a limited outreach of the commercial banking system, which operates with a high urban unfairness. Banks are located in the capital city, with just a few or no branches at all in the rural areas. Rural people and urban people living with low income, resort to informal financial sources to satisfy their needs. Between the classical banks and informal financial sector, there are Microfinance institutions.

Microfinance, which appeared in the early 90s, has experienced strong growth since 1995. However, the rate of market penetration of microfinance Institutions (MFIs) remains low (16.5% in 2006), especially in rural areas. This low penetration rate mainly due to: failure in security of savings of non-repayment of funds in case of bankruptcy of the lack of staff training at both the guardianship of MFIs and the low ability of MFIs to innovate and offer products that meet the financing needs of the most disadvantaged populations. To this is added the poor performance of the business of credit, retained earnings and negative results. Deficit of UNACOOPEC who owns more than 80% of the market that pose a systemic risk to the sector.

The insurance industry is composed of 33 institutions for a turnover of 167 billion FCFA to 376 billion and financial resources and is growing since 2000 at an average rate of 5.3%, with a peak of 8% between 2004 and 2008 due to the growth of the market for life insurance. Despite its dynamism and its development potential, the sector, however, faces problems of minimum capitalization, capital allocation model and pension reform.

In order to solve these structural problems, several reform measures are undertaken. These financial sector reforms include: strengthening the capacity of the Committee of Financial Sector Development; the continued consolidation of the financial sector is the decentralized MFIs characterized by a gross degradation remains high through the organization of regular audits and strengthening the conditions of approval and (strengthening the primary market by issuing Treasury Specialists value (SVT). as the insurance market, a major reform is necessary for financial viability.

1.1.2. The Expansion of microfinance in Côte d'Ivoire

The growth of this sector is mainly due to the failure of state owned banks meant to finance the rural people, and all the difficulties to mobilize savings from informal activities. The African development bank and the Organization for Economic Cooperation and Development (AFDB / OECD) produced a report in 2008 where the Ivorian microfinance sector accounts for 6% in the financial business in Côte d'Ivoire. They operate not only in the informal sector, but extend financial assistance to civil servants, private workers and micro enterprises. For example, MFIs are present in all the economic sectors of the country.

In 2005, the total Investment is evaluated at 18.8 billion FCFA, including 30% for trade sector, 13.5% craft industry, and 10.1% agriculture (CNM, 2005). Employment rise from 600 employees in 2004 up to 800 employees in 2005. The increase through direct job shows the dynamism of MFIs in the Ivoirian economic system. That persuaded the government to define the following overall goals as follows: "*to dispose of a professional, viable, and sustainable microfinance sector. Should also be diversified, innovated and integrated to the financial sector; ensure a good coverage of demand on the entire territory in the strict respect with the legal, regulatory, institutional and adapted framework*"[11].

1.1.2.1. The suppliers of microfinance services

The microfinance market structure is dominated by formal structures framed into two types of institutions: savings and credit unions, and the non-mutual institutions (public company). The formal structure of microfinance is composed of two types of institutions: As displayed by the table 1.1, the sector is dominated by one type of MFIs, i.e. the credit and savings unions which are characterized by the mutual funds and cooperatives. The statistics in 2008, demonstrates this 93 against six (6) structures with convention signed with the government. In total, there were 99 MFIs in 2008.

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[11](www.lamicrofinance .org)

Table 1.1: Types of MFIs and their evolution on period 2002-2008

Type of institutions	2002	2003	2004	2005	2006	2007	2008
Credit and saving union	41	49	68	73	93	98	93
Institutions with a convention	-	-	-	01			6
NGOs	-	-	-	-			
Others	-	-	-	-			
Total	41	49	68	74	93	98	99

Source: DGTCP/DIF/SDIME (2005) and MEF/DGTCP/DM

Although NGOs and village banks exist, they are not recognized by the regulators. Commercialization conducts them sometimes to transform into the regulated structure, and the main form chosen is the credit union. The transformation process leaves from donor capital dependent MFIs to a more structured and self-sustained financial institution with more efficient operating processes and capital raising techniques.

a) Credit Union Institutions

They are owned and controlled by members; and function according to democratic rules. The two organs of a cooperative are the general assembly and the management committee. The committee is assigned by the general assembly and has to promote and oversee that operations are run smoothly. Moreover, it implements internal regulations and policies established by the general assembly. Members are equally treated and leadership is voluntary and unpaid, although professionals can be hired for everyday administration and management tasks.

These credit unions and savings provide loans to individuals. Generally, most of them limit borrowing to income-generating activities. Out of all the credit unions, Only UNACOOPEC-CI provides consumer credit. Membership in the form of equity shares is usually required to use credit unions and saving services. Most of them also require members to participate in a regular savings plan before obtaining loan. Maximum loan amounts are typically calculated in line with the individual's established savings. The major comparative advantages of credit unions lie in their ability to service large numbers of depositors in urban as well as higher-potential rural centers and use these savings to provide a diversified range of loans to individual members.

b) The structure with convention

The length of this convention is five (5) years and credit unions' activities are essentially focused on loan lending. At the end, the government can decide whether or not the experience should be renewed. Such structures are not interested in the long term sustainability.

1.1.2.2. Network organization

Literature suggests that several organizational forms are based on the integration basis adopted by credit unions and their members. In fact, the higher level of integration assumes that all members care for the institutional and financial sustainability of the organization. The categorization proposed by Desrochers and Fischer (2005) rests on the level of integration of different structures in the same network. In their studies, they established three categories known as: "Atomized Network", "Consensual Network" and "Strategical Network". In the "Atomized Network", links between the first level of credit unions and the central structure are very weak and few or no resources are pooled. The central structure largely plays a representative role. Second stage is The "Consensual Network" which is more integrated than the first one (Atomized Network). It works in a consensual way and exploits the market scale. The central structure manages the pooled resources and works to establish a unique image of the network. Unfortunately, first levels of credit unions are not required to use network services and keep strategic decision control and management in hands. Finally, the "Strategical Network" is the most integrated type of network. The first level of credit unions and the central structure are financially linked. They are required to follow collective decisions and to use network services. Strategic decision control and management are transferred to the central structure.

Another network structure encountered in the text is a Federative structure. The goal is to empower members and train them to become users, managers and owners of the organization. As a result, this structure is designed and put in for providing a venue for individual members to voice their opinions and participate in the decisions regarding the policies. It is a decentralized administrative structure including federation, branches, clusters and centers. Members elect their own leaders and representatives at each of these

levels. No matter what network structure is chosen, few MFIs in Côte d'Ivoire are integrated. The statistics of BCEAO (2005) provided three (3) MFIs. Out of the three, only RCMEC has the federative structure (BCEAO, 2005).

In order to improve the performance of the MFIs at all levels, it is important to monitor them. Therefore, the regulation should be made necessary.

1.1.3. Legal, Regulatory and Institutional Frameworks for Microfinance

The regulation of microfinance refers to the set of laws that favor the rational management of MFI institutions by public authorities. It meets the concerns of the sustainability activities of MFIs and their credibility as a development tool. In the following subsections, a presentation of the legal frame and the structures responsible of the supervision is made.

1.1.3.1. Regulatory framework

In Côte d'Ivoire like the other countries in the WAEMU zone, there are three conditions that one has to fulfill before running microfinance activities. These are recognition, agreement and convention. The convention framework is defined by the (La Convention – cadre) adopted on 3rd of July 1996 by the board of ministers of WAEMU. The non-members' structures are submitted to this regulation. The framework concerning the agreement is defined by the law of PARMEC[12]. The mutual savings and credits institutions are submitted to this regulation.

The PARMEC law was mandated in the first phase (1992-1996) to design the specific legal framework for decentralized finance in WAEMU member states and disseminate its contents. In its second phase (1997-2002), it was intended to focus on the effective implementation of specific regulations and strengthening institutionalization.

The PARMEC law was instituted in 1994 in order to provide a legal framework for mutual organizations, savings and credit cooperatives, unions and federations. The

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[12] PARMEC means in french 'Projet d'Appui à la Réglementation des Mutuelles d'Epargne et de Crédit'

PARMEC law is not applied to "tontines" or other informal savings groups, but these groups are free to apply for recognition under the law. This law was adopted on the 3rd of July 1996 by UEMOA member countries. Other microfinance organizations that are not of mutual type or cooperative type are not subject to the law. These types of organizations will be regulated under each country's separate banking laws.

Under the PARMEC law, mutual organizations have their name protected and benefit from tax exemptions. The organizations, however, are also subject to a more restrictive usury law. This law establishes interest rate ceilings on credit at about 27%. This regulation framework also includes law acts and height directives. These directives concern the regulation of savings and credit cooperative or mutual societies by defining a law to coordinate their activities. These directives incorporate a master agreement for the institutions which are not incorporated in a cooperative or mutual form. After that, the institutions of the Central Bank define the framework by which the institutions should collect and communicate financial information to the Monetary Authorities in charge of the supervision of the sector. These instructions particularly specify the past due credit provisioning rules, the account and date as well as the short, medium and long term ratings. MFIs in Côte d'Ivoire are required to conform to the legal status framework.

Then, in this framework, the MFIs must send their financial statement to the different authorities each year. But, it has been revealed few MFIs conform to this requirement. Less than 50% of MFIs authorized by the National commission of microfinance give their financial statement.

Table 1.2: Number of Institutions transmitting their financial statement to BCEAO

Year	2002	2003	2004	2005	2006	2007
Number of MFIs transmitting their financial statement	16	21	19	32	35	42
Number of MFIs reported by the CNM	41	49	68	74	93	98
Percentage (%)	39	42.85	27.94	43.24	38.71	42.85

Source: BCEAO (2005, 2006, 2007) and CNM (2005)

One thing that should be noticed about this law is that it favorites credit unions to the detriment of other forms of MFIs. Each form has its priorities in matter of sustainability and social performance. Then, it would be better to permit other forms of microfinance

institutions such as village's banks, Grameen bank replications, the "caisses villageoises", etc. to operate. These village banks could be implemented in the remote villages. In addition, the credit unions are privileged under this law comparatively to the structure with convention on the long term sustainability. The period of this convention is five (5) years. At the end, the government can decide whether or not this experience should be renewed. This situation could create a situation of corruption since the continuity depends on the civil servants.

This statutory frame, fast elaborated, revealed early its incapacities and therefore, weakened structures in charge of the regulation of the sector but harmed the efficiency of some MFIs. The central bank to limit the risks associated with the activities of MFIs, will establish a Regional Support Program for Decentralized Finance (PRAFIDE) for the period 2005-2009. This program should help to modernize their operations, their performance in terms of impact and strengthen their financial viability. In addition, by 2007, some innovations are brought to the PARMEC's law in order to regulate all MFIs under the same law and improve the sector stability. Hence, in the WAEMU zone, the implementation of the PARMEC dates approximately 1996 until 2007. However, the new law was adopted only in 2010 by some WAEMU countries except to Côte d'Ivoire, Togo and Benin.

1.1.3.2. Regulatory structures

For a better development and promotion of this sector through control and monitoring three (3) structures had been set up. These organizations are: the National Commission for Microfinance, The Direction of Microfinance, and The work group for Microfinance, AISFD-CI and BCEAO.

a) The National Commission for Microfinance

Founded on the 8th august 2002, the National Commission for the Microfinance has as a mission, the monitoring to ensure the viability and the sustainability of the sector. Besides, the commission must protect the population against bad micro lenders. It is formed of seventeen members from various establishments: government, BCEAO and AISFD-CI. In addition to the above missions, the National Commission examines the reports related to

the management of MFIs; audits the staff of microfinance institution in all cases of financial situation; examines the submission file of exercise in order to advice the ministry of Finance; monitor the effectiveness of the implementation of the government's policy in the microfinance development; and finally, proposes instructions related to the performances of MFIs to the ministry of finance.

b) The Direction for Microfinance

The policy of microfinance in Cote d'Ivoire is to promote national MFIs. Hence, the assignments of this direction is to the promotion the Ivoirian's MFIs; the issue permits to exercise as MFIs, examine accredited papers, an exam of the permits of funding the activities not related to savings mobilization or loan distribution, control and guarantee good governance (better management of MFIs).

c) Work Group for Microfinance

Created in 2005, its mission is to develop the framework for the elaboration of national strategies for microfinance for the period 2008-2015. These are:

- Reinforcement of the current legal, regulatory and institutional framework
- Consolidations and developments of the previous results of MFIs evolving in this sector.
- Improvement of financing of the sector by resources mobilization and creation of the facilities for access to refinancing.

d) Trade association "AISFD-CI"

AISFD-CI is the major trade union of microfinance body in Côte d'Ivoire. Created in August 1998, its mission is to Coordinate all the strategies of microfinance institutions; and ensure good reputation of MFIs in collaboration with authorities in the finance sector. Amongst other missions, AISFD-CI has the right to define a professional code of ethics and try as much as possible to preserve that code; to ensure that there is a fundraising and trainings plan for microfinance industry and to create a framework for experience sharing. Although the presence of trade association is necessary, there is the need for effective participation of all MFIs. On July 2007, the ministry of finance took a decision in the sense that all microfinance should adhere to the trade union. As at now, the union is

composed of 72 microfinance institutions. However, the proximity with some MFIs may create some suspicions that could undermine the well performance of the trade union.

1.2. Accessibility analysis

This section provides some insights on the accessibility to the financial services provided by the MFIs.

1.2.1. The number of institutions and the their geographical distribution

The number of MFIs had grown from 3 institutions in 1996 to 99 institutions in 2008. Again, the number of offices had increased from193 offices in 2005 to 223 offices in 2007. That denotes the dynamism of this sector of activity and shows that there is a great need of financial services for the population. However, this growth will be attractive if the penetration rate on the field (throughout the country) is higher.

Following Beck et al. (2007), one indicator of geographic penetration is defined on the number of MFIs branches per 1,000km^2 (square meter). It can also be interpreted as an average distance for a potential customer to the nearest physical bank outlet. Higher geographic penetration implies smaller distance and easier geographic access. A computerized data (data of 2007) for microfinance industry gives 0.69 branches per 1000 km^2. This lower performance demonstrates that the microfinance is geographically not accessible. Evidently, some limitation could be made on this indicator. As said by these authors, in particular area- and population-based ratios of the number of branches assume a uniform distribution of bank outlets throughout a country and across its population, while in most countries microfinance institutions branches are concentrated in urban centers of the country and are accessible only by some individuals. It means that the ratio will be higher in urban areas than rural zones. That confirms the repartition of MFIs in the territory.

An examination of the geographical repartition troughout the country shows a higher density in the «Lagunes » area. In fact, the "Lagune region" with Abidjan as the capital

[25]

town, totalizes 87 offices in 2007. That means 39% of the overall number nationwide. Some regions such as the "Worodougou", the "N'zi-Comoe", the "Sud-Comoe", the "Denguele" and the "Bas-Sassandra" have between one (1) and seven (7) offices with a percentage dangling between 0.5% and 2%. Others have a percentage between 3% and 10%.[13]

Figure 1.1: Geographical distribution of offices in 2007
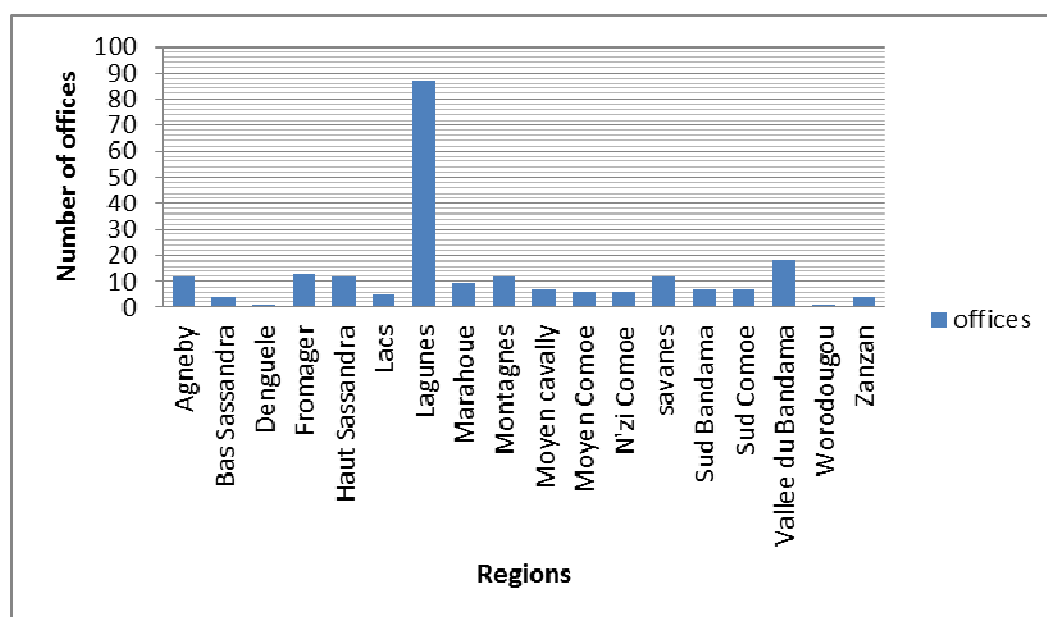
Source : DGTCP/DM (2007)

The remark is that most of MFIs are implemented in forest regions, with flourishing economic activity like coffee and cocoa farming. This imbalanced distribution is accentuated between rural and urban areas (CNM, 2007). According to studies, 60% of MFIs outlets are located in urban areas. A close observation disclosed that there is lack of understanding of the nature and characteristics of poverty. For instance, poverty is present in the rural area and amongst the young and the female gender. In another study, it has been brought out that there is no defined policy for the remote areas (CNM, 2005). Nevertheless, some results of the ivorian MFIs must not be neglected.

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[13] The region nomenclature follows the one before the change operated by the administrative authorities in 2011.

1.2.2. The accessibility of the microfinance services

Until now, the obtained results must be recognized. Presentation of the outreach of the Ivorian microfinance industry is more interested in breadth and depth. The Ivorian microfinance industry has grown significantly in size, client coverage, savings mobilization and loans offered. This section gives the main results. These results show the dynamism of the Ivorian MFIs. But, some effort must be made for a good coverage and satisfaction of clients.

1.2.2.1. Growth and composition of Beneficiaries

As explained in figure 1.2, the total number of clients rose up to more than 900000. It is also important to note that the number of beneficiary has grown at a rate of 39.16% over the period 2002-2005. That denotes the great interest of the population in the microfinance products. However, according to the Central Bank (BCEAO), the 2004 report shows that only 25% of households have access to microfinance services in Côte d'Ivoire. The rate is higher than the one of banking sector, which was evaluated to 5.18 % in 2003 (BCEAO, 2005).

Figure 1.2: The growth of beneficiaries
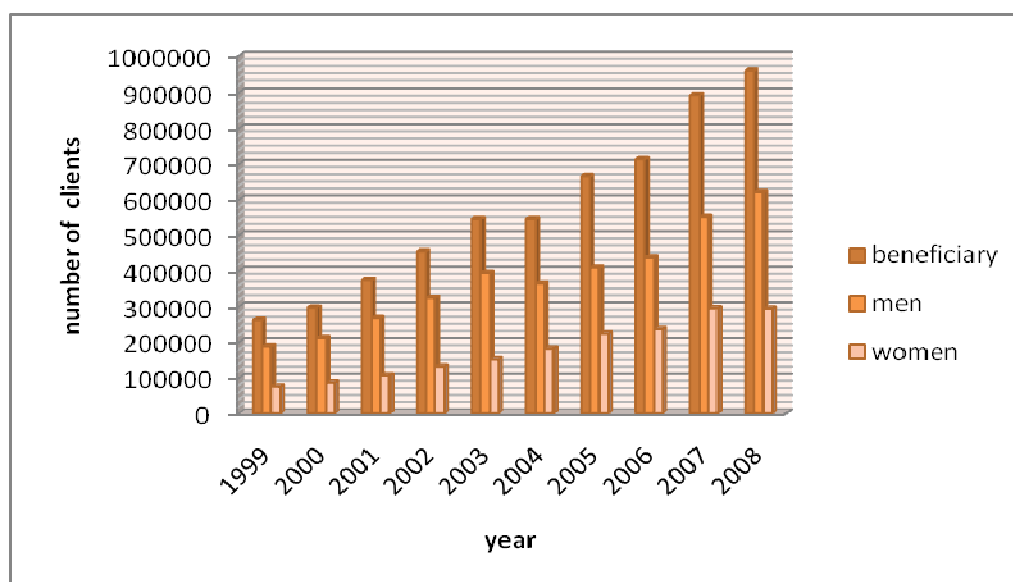
Source : Realized by the author from several monographies of BCEAO and Direction of microfinance

Nevertheless, the number of branches gives about 1.3 branches per 100 000 people. Per capita measures of branches (number of MFIs branches per 100 000 people) is used to

capture the demographic penetration of microfinance institutions. In other words, it permits to measure the alternative for the average number of people served by each physical bank outlet. Higher demographic penetration would indicate fewer potential clients per branch then, easier access (Beck et al., 2007). This ratio tells that the accessibility to microfinance services is not easy. As a matter of fact, more effort must be done for a larger access of the population. In Addition to that, the table 1.3 below tells that the gender empowerment did not change during that period. It remains 62% of male, 34% of women. A repartition according to the gender group shows that the percentage of women who have access to microfinance services had increased. However, it remains under 50%. At the same time, women and the youth are still under poverty.

Table 1.3: Gender distribution of beneficiaries on the period 1998-2005

	1999	2000	2001	2002	2003	2004	2005
Individual beneficiaries	261 889	296281	373822	454359	545126	544784	620995
% on the set of beneficiaries	89	89	93	93.2	94.8	94.9	91
% of women	28.5	28.9	28.4	28.8	27.8	33.2	36.1
% of men	71.5	71.1	71.6	71.2	72.2	66.8	63.9

Source: DSFD (BCEAO)

1.2.2.2. Savings and loan products

MFIs as financial intermediates seek funds from lenders (or savers) and pass on to borrowers. Savings and loans remain the main activities of MFIs. They need to be well designed and attractive for the population. In the Ivorian context, the usual products related to both are given in the table 1.4. The main products for the savings are ordinary or voluntary savings, mostly appreciated by customers. Then, the involuntary savings comes. This product provides facilities like loans.

Finally, there is another product known as "deposits at maturity term". There are numerous loan plans: there are ordinary loan products, long term loans, and loans for education, health and housing. Besides the two main products, others services exist: transfer of funds and insurance. The leading structures are UNACOOPEC-CI and RCMEC and represent 90% of MFIs activities in Côte d'Ivoire. The COOPEC network presents on all national territory and is mobilizing 163.9 million US$ of savings and 58.9

million US$ of outstanding net loan in the year 2009. During this same period, RCMEC is collecting 8.3 million US$ of savings and disbursing 2.2 million US$ of outstanding net loan.

Table 1.4: Summary of the savings and loans products offered by the Ivorian MFIs

Savings products	
Ordinary Savings products or voluntary savings	This is open access savings facility which allows members to deposit some amount each time and to access their savings any number of times without penalty. There is no ceiling on the amount of deposits or withdrawals. Annual interest rate is generally zero
Deposits at maturity or one-time fixed deposits	These are certificates of deposit for a large amount deposited at the beginning of the contract period for a fixed term up to 5 years. Annual interest rate is around 3%.
Others Deposits(guarantees or involuntary savings)	These deposits are the guarantees necessary to obtain the loan from the MFI.
Loan products	
Ordinary loan products	This product is available to all members the amount depends on the type of clients (traders, students, peasants, and, craftsmen...). The annual average interest rate is comprised between 15 to 20 percent. It includes the business or project loan products it is offered to members who can use larger loans to create jobs in the community.
Credit at long maturity	This is the credit allowed for investment and operating activities lead by the members with established business.
Housing and education credit	The loans help the members to build their livelihoods assets. This type of Credit is Few expanded in the MFIs.
All loans are charged an annual interest rate comprised between 15 percent and 20 percent depending on the methodology of loan used (group based loans or individual loans) and/or types of loans. All are not collateral free. The collaterals used mainly are obligatory deposits, tangible assets, having the large amount on the account and aval.	

Source: author

In addition, on the figure 1.3 below, a very close analysis of savings and loans shows a rapid growth of savings than credit in the MFIs. This growth has an implication on the credit policy. In fact, if the organizational structure of governance is net saver, MFIs could make restrictive policy of credit and become risk adverse. That induces to search for better clients at the expense of poor borrowers. Then, the excess of savings is used as an investments (term as a fixed deposits) to the investment Banks (which represent sometimes about 20% of the savings amount) or as intangible and tangible assets' investment.

Figure 1.3: Evolution of savings and loans on period 1999 to 2005
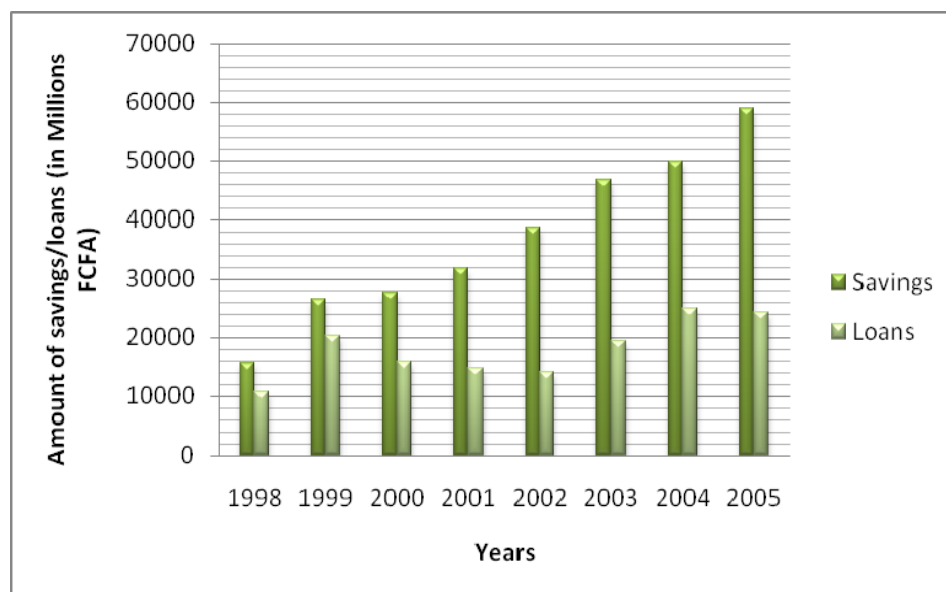
a) Savings mobilization policy

Credit Unions are savings mainly based on institutions. Savings provide relatively stable means to finance loan portfolios. In 2005, savings outreach got to about 52.862 Billion FCFA against 50.658 Billion FCFA in 2004. Even though there is a voluntary deposit policy, credit unions have some other means like forced savings in their deposit mobilization practices. Voluntary savings plays a major role in the MFIs resources. This growth could not be explained by the interest rate since this nominal interest paid on savings deposits is low. In general, the nominal interest rate is about 3.5%. Yaron et al. (1994) explained the attraction of savings to depositors. In their studies, they explained that with such deposit interest rates, the safety of deposits appears to be a significant factor inducing greater savings. This could explain the growth of savings observed in the MFIs.

b) Loans offered

In 2005 loans were estimated at 20.888.458.990 FCFA. Comparatively to the saving outreach, the amount is lower. The concentration ratio for the fourth leading institutions (CR4) was 93.8% in 2005. According to the Central bank (BCEAO, 2004); most MFIs apply for short term loan than medium and long term loan policy. The rates of short term loan rises from 32.1% to 100%. Leading MFIs like UNACOOPEC-CI, RCMEC,

MUCREFAB and MUCREFBO run more than 90% of all the activities in terms of savings mobilization and loan distribution. Mobilized loans are meant to finance some activities in the informal sector. The initial requirements to obtain loan from MFIs are as follows:

- A minimum deposit is required to apply for a loan;
- At least three or six months membership is required;
- A member has the rights to seek for a loan two times higher than his/her initial deposit
- A member is permitted to get any loan and he /she must have sufficient funds in his/her savings account to cover the entire amount of loan required.
- Sometimes, the need for a guarantor, not a member of the microfinance, is required.

Then, after satisfying all the above conditions, the MFIs conduct an investigation on the morality of the person.

1.2.2.3. Activities financed by the MFIs

A thorough remark indicates that most of the designed products have been made on the basis that households take a loan in order to finance production activity. From the economic point of view, production is the main source of value creation. Loan products in the Ivorian context are essentially meant for production purposes. The Ivorian MFIs are present in the entire economic sector, particularly in the informal sector. As a matter of fact Credit Unions in Côte d'Ivoire practice the lending system to support activities.

Statistics provided by the CNM (2005) show that a larger part of loan is allowed to finance business activities: respectively trade 30%, craft industry 13.5% and agriculture 10%. Unfortunately, it has been noted that in a country whereby the economy is based on agriculture, few funds are allocated to that sector. The consumer credit is credited at 1.4%. These results indicate that in 2005 the trade sector amongst others, received more funds than others. It is estimated at about 30%. At the same time, other sectors observed a significant reduction of their shares: Construction and housing (-99.45%); education and health (-93.33%), and Catering industry (-615%). However, sectors like the craft industry and transportation have seen their shared parts increased. The absence or quasi absence of

supply for the funding of some activities creates a lack of demand. Consequently, there is the need for an effective diversification of portfolios. Therefore, loans should be used for nonproductive purpose like medical services and school books (Kidder, 1999).

Richardson (2000) confirms that by suggesting the portfolio diversification to increase the efficiency of MFIs. His Analysis is based on the six basics concept of all societies: work; housing; health; education; transportation and security. Despite the fact that much more attention is paid to the transportation sector, the security services, other sectors such as emergency loans, liquid savings accounts, and insurance products should be considered as very important sections. Indeed, housing, health, education and transportation loans are also important investments since it contributes to the betterment of life of the people.

Table 1.5: Distribution of MFIs' funding by economic sectors

Sectors	2004 (%)	2005 (%)	Variation[b] (%)
Trade	39.08	30	-23.24
Craft industry	0.62	13.5	2077.42
Agriculture	9.32	10.1	8.37
Construction and housing	18.15	0.1	-99.45
Industry	0.03	0.0	-100
Transportation	0.10	5.7	5600
Catering industry	6.25	0.1	-615
Education and health	21.00	1.4	-93.33
Other sectors	5.45	39.2	86.1

Source: Reports from CNM (2004, 2005)
Note: b is computed by the author from CNM (2004; 2005)

1.2.2.4. Source of Funds

Savings and shares per capital are considered by the Ivorian MFIs as their main sources of funds. The table 1.6 presents the evolution with a decrease on the grant side some few years ago. From the period of 1998-1999 to that of 2004-2005, subsidies decreased from 2.18% to 0.28%. The reason is that donors have put a stop to the financial support in 2000. Leading MFIs receive larger grants than smaller ones. To some extent, minor MFIs receive no grants. Those MFIs work essentially with impartiality. The observation is that subsidy for investment increases at the expense of the operating ones. Although subsidies

exist, Ivorian MFIs lend loans out of their savings. The higher rate observed on long periods confirms that fact.

Some microfinance institutions receive their credit line from banks. Share capitals constitute owned funds for MFIS. In 2003, most MFIs, particularly UNACOOPEC-CI, reported negative sign as far as equity funds were concerned. That had an impact on the part of equity as resources. That part reduced from 6.05% to -6.35%. It means that members' investment had decreased.

The following table 1.6 shows that savings constitute the force of credit unions and demonstrate as well that they are able to capture savings from the informal sector. The growth of savings is also due to the fact that savings represent the security required to obtain loan. Although the importance of savings is illustrated by the growth theory, an activity whereby investors are members, governance policies can be influenced by those savers. That could create some conflicts about the credit plan.

Table 1.6: Combined income sources of all MFIs

	1998-1999		2000-2001		2002-2003		2004-2005	
	FCFA (millions)	%	FCFA (millions)	%	FCFA (millions)	%	FCFA (millions)	%
Subsidies	1051	2.18	401.192	0.63	197.292	0.23	299.143	0.28
Equity	2907	6.05	1562.4	2.47	521.865	0.59	-6768.16	-6.35
Savings	41639	86.63	59145.86	93.72	85439.63	98.04	108820.5	102.05
Line of credit	2469	5.14	1998.41	3.17	984.09	1.13	4276.71	4.01
Total	48066	100	63107.81	100	87142.88	100	106628.2	100

Source: realized by the author from several monographs BCEAO

1.2.2.5. Lending technologies

Lending technologies refer to actions, tools and procedures used by microfinance organizations to reduce expected losses from default and to accomplish this at a reasonable cost (Gonzalez-Vega, 1998b cited in Ouattara et al. 1999). These tasks involve screening applicants, designing contracts and choosing terms and conditions for the different classes of clients, monitoring borrowers, signaling the seriousness of the organization and enforcing contracts. Three forms of lending contract are designed: individual loan contract; group loan contract and cosigned loan contract.

An individual lending contract relies on lender to borrower scheme. While the group lending contract generally known as a symmetric group, is a situation whereby loan is consented to a group of borrowers. They are all liable if one fails to repay. For Bond and Rai (2008), symmetric group loans are just one way of lending to individuals who have insufficient collateral of their own. Group lending is mostly recommended by microfinance practitioners as the best mechanism for the higher rate of repayment (Besley and Coate, 1995). However, for Wenner (1995), the observed rate of non-repayment is due to the fact that most of the MFIs are located in urban areas where group lending works hardly. In the cosigned loan, a borrower provides for a cosigner who does not receive the loan, but is punished if the borrower does not repay.

However, in the microfinance literature, the group lending system is preferred than the individual lending one. In addition, Bond and Rai (2008) define the condition under which symmetric group lending and cosigned loan are preferred. They establish that symmetric group loans are preferred to cosigned loans whenever sanctioning abilities are similar; that is, when the power relation between borrowers is relatively equal. On the other hand cosigned loans are preferred when the power relation is asymmetrical.

The Ivorian credit unions use a lending technology mostly based on individual loans system. This represents at most 80% of the loan portfolio (BCEAO, 2005). Thus, granting loans to individuals means that those microfinance institutions have to rely on physical assets and other forms of collateral for contract enforcement. This preference could be explain by the higher rate of delinquencies observed. In most of the Ivorian microfinance institutions, access to a loan is attached to the individual's savings. The maturity term depends on the loan products offered. Short-term loans have an average of six months, while equipment loans carry longer terms on an average of two years.

1.3. Financial performance analysis

A Microfinance institution (MFI) is an enterprise facing a double challenge. Firstly, it must provide financial services to the poor which is their social mission. Secondly, it must cover their cost which is their financial performance. In the previous section, the emphasis

was made on the Ivorian MFIs' social performance. In the following sections, we will present the second Challenge with more light on their performance.

The overall performance of the Ivorian microfinance industry is quick low. Most MFIs are dealing with the higher rate of default of repayment. The portfolio quality remains bad with a higher rate of 13.65 percent in 2006. This reveals their inability to manage the risk related to their activities of intermediation. That could have an impact on the sustainability.

Figure 1.4: Evolution of portfolio at risk period 2004-2007
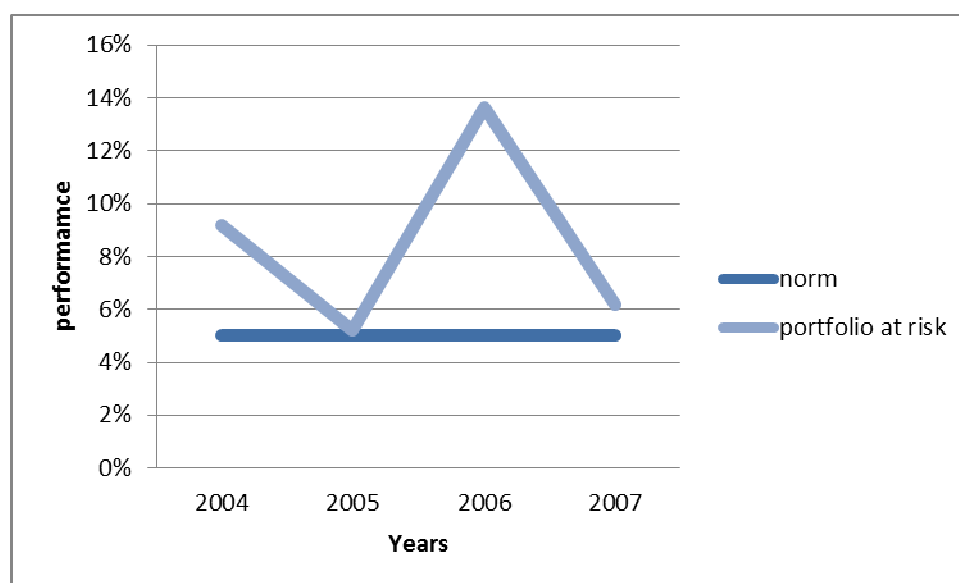
Source: realized by the author from CNM's reports 2005 and 2007

In overall, at the WAEMU level, the quality of the portfolio deteriorated in 2005 from 5.6% in 2004 to 6.2%, stabilizing beyond the norm of 5% required by MFIs. This number is an average which hides a great disparity between the countries. In fact, the gross rate is 7.2% in Benin, 4.9% in Burkina Faso, 16.2% in Côte d'Ivoire, 6.5% in Mali, 10.6% Niger, 2.3% in Senegal and 4.1% in Togo. The MFIs of Burkina and Senegal recorded an improvement in the quality of their portfolio. Thus it is necessary to underline that some countries as Côte d'Ivoire and Niger are characterized by very high rates of deterioration of their portfolio during the 2001 to 2005 period.

Table 1.7: Evolution by countries of the gross deterioration rate of MFIs portfolio (%)

	2001	2002	2003	2004	2005
Benin	2.9	2.7	5.7	6.2	7.2
Burkina Faso	6.8	4	5.7	5.8	4.9
Côte d'Ivoire	11.9	30.4	5.3	9.4	16.2
Mali	4.1	4.6	7	6	6.5
Niger	14.8	15.2	11.3	9.5	10.6
Senegal	3.7	3.3	3.7	3.6	2.3
Togo	13	8.9	10.3	3.9	4.1
WAEMU (without Bissau Guinea)	**6.4**	**6.7**	**5.8**	**5.6**	**6.2**

Source: BCEAO(2008)

One implication is that, bad portfolio quality influences the financial revenue of MFIs. In fact, the long term sustainability of these credit unions depends on their ability to keep their losses from default at minimum levels and not only to cover operational costs with revenues generated from their financial activities (operational self-sufficiency). They should rather cover both operational and financial expenses with their own revenues (financial self-sufficiency) (Ouattara et al., 1999).

The figure 1.5 shows that the MFIs in Côte d'Ivoire are not in average the operationally self-sufficient (i.e., the ability of the organization to cover its operational costs with its own revenues).

Figure 1.5*: Evolution of operational self-sufficiency on the period 2004-2007
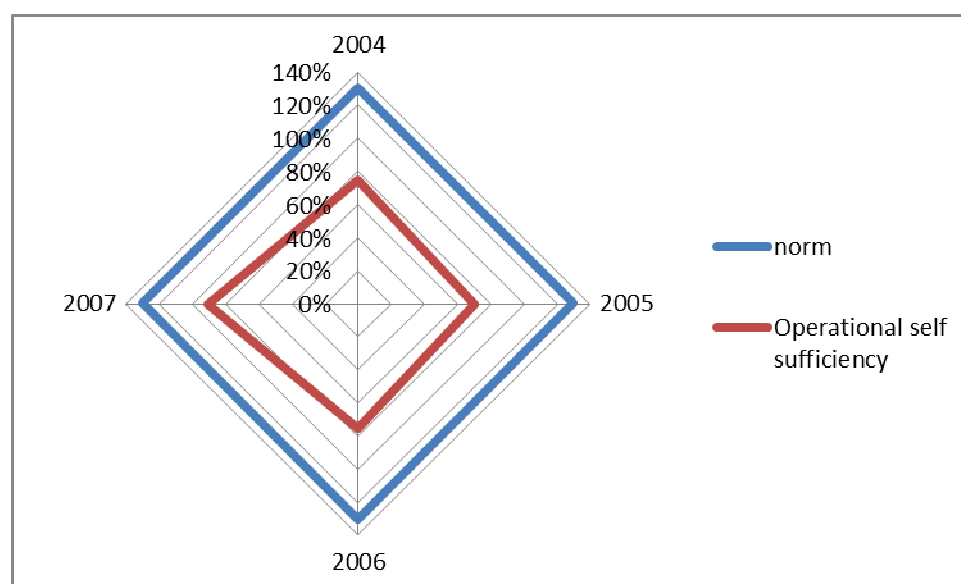
Source: realized by the author from CNM's reports 2005 and 2007

The average rate is under 130 percent, norm defined by the Central Bank. Even if Woolcock (1999) definition of sustainability is used, the rate of coverage of operating costs by the Ivorian MFIs in average remains less than 99%. Only six (6) MFIs ensure the coverage of the operating cost by the operating income. Only the credit union called MUCREFAB has been accomplishing this performance for few years (BCEAO, 2004).

In broad way, the table 1.8 shows that the financial performance of the Ivorian microfinance is critical. The performance ratios do not mostly complain with standards imposed by the central bank. These indicators confirm that there is a need to improve the financial performance of ivorian MFIs.

Table 1.8: Performance indicators

Nature of ratios	Ratio	Norm (%)	2004 (%)	2005 (%)	2006	2007
Portfolio quality	Portfolio-at-risk	**<5**	9.2	5.2	13.65	6.19
	Risk coverage ratio	**>40**	33.9	47.12	21.45	40.15
Efficiency and productivity	Portfolio at risk	**<5**	9.2	5.2	13.65	6.19
	Risk coverage ratio	**>40**	33.9	47.12	21.45	40.15
	Coverage of operating cost by operating income(OSS)	**≥130**	75	69.92	75.38	90.49
	Coverage of administrative expense by financial income	**100**	62	50		
	Staff cost rate	**<10**	8.2	12.63	11.05	11.05
Return	Return on Equity(ROE)	**>15**	-	-	-	-
	Return of Asset(ROA)	**>3**	-2.5	-6.14	-4.88	-1.87
	Yield of Asset	**>15**	6.4	6.6	6.08	6.49
	Portfolio yields		15.5	16.51	15.14	16.21

Source: DGTCP/DIF/SDIMEC (2005) and CNM (2007)

The indicators about return are lower and negative for the ROA. The rates were -2.5 in 2004 and -1.87 in 2007. The staff cost is higher than the norm indicator in 2005 and denotes the lower performance of MFIs. An absence of return on equity is observed. The reason is that most of the MFIs have no equity. The signs are negatives. That would threat the stability of the industry of microfinance.

The magnitude of this problem of capitalization is great since it is compared to the other countries in WAEMU. In effect, capitalization increased in Benin, Mali and decreased in Burkina, Togo, Niger, and Senegal. In Côte d'Ivoire for instance, capitalization dropped seriously almost leading to the non-existence of equity. In 2003 this indicator stood in

Côte d'Ivoire and Togo, below the norm of 10% restrained at the international level in the domain of microfinance.

Table 1.9: Evolution by countries of the Equity on assets ratio of MFIs (%)

	2001	2002	2003	2004
Benin	14.1	18.7	18.3	20.0
Burkina Faso	19.3	20.1	18.5	15.2
Côte d'Ivoire	1.8	1.7	2.6	-2.7
Mali	20.8	19.5	20.2	21.3
Niger	21.5	23.9	23.8	23.6
Senegal	28.6	28.6	27.8	26.9
Togo	8.6	10.0	6.1	6.6
WAEMU (without Bissau Guinea)	**16.3**	**18.2**	**17.9**	**17.3**

Source: BCEAO(2008)

1.4. Summary of the chapter

This chapter focused on the presentation of the microfinance industry in Côte d'Ivoire with the main results obtained from the MFIs several years ago. In overall, the microfinance industry in Côte d'Ivoire has a higher rate of savings mobilization. In addition, the creation of regulation' structure demonstrates the interest of the government for this sector. Although there is positive achievement resulting from savings mobilization, the microfinance industry faces some important problems.

Indeed, the analysis of this sector reveals that the attainment of high performance is the crucial problem faced by the microfinance business. It shows that there is a crisis of solvency and a low rate of penetration of financial services provided by the MFIs. These problems enumerated require a particular attention from the regulators of the sector. However, it is important to avoid the step by step solution, because a focus on financial self-sufficiency may divert MFIs' attention and resources from their core objective: poverty alleviation. It is therefore important to find a way to integrate both key objectives of Microfinance. Then, despite current crisis creating some disturbances in the Ivorian microfinance activities, it is an opportunity in the sense that there is a great need to grant loans to people who have lost everything. This represents a market opportunity for the MFIs since it can take advantage from it. Besides, it can assess its power with maximum care as far as the financial performance is concerned.

CHAPTER 2: SUSTAINABILITY AND ACCESSIBILITY: A REVIEW OF LITERATURE

Microfinance is often portrayed in the literature as a tool that allows individuals who are excluded from the formal financial system to gain access to sources of financing, i.e. as a weapon against exclusion and poverty (Morduch, 1999). Microfinance is the provision of relevant and affordable financial services to poor households. For example, the Consultative Group to Assist the Poorest (the apex association of international donors who supports microfinance) regards microfinance as ''a powerful tool to fight poverty'', help poor people to ''raise income, build their assets, and cushion themselves against external shocks'' (CGAP, 2004a, p. 1). Microfinance always proved that the poor in the world are creditworthy. They make productive use of loans to improve their personal lives and that of their families. The size and scope of the microfinance industry are expanding quickly, and it is expected to grow further as the demand for financial services by the poor remains largely unmet. This growth has generated increasing support among various types of donors, including bilateral and multilateral development organizations. Therefore, most performances have been realized through the support of subsidies.

However, some changes occur, leading to a transformation of this industry. ''Commercializing MFIs'' is the new slogan developed by the donors oriented to profitability. In such a context whereby there is an increasing integration of specialized microfinance and commercial banks, accentuating financial performance may jeopardize the social performance and poverty reduction objective (Copestake, 2007).

This chapter intends to provide the literature review and presents in which framework the problem of sustainability and households accessibility to credit posits. The chapter is divided into five sections: section 2.1 explains the concepts of sustainability, accessibility by linking these concepts to commercialization of microfinance. These concepts are important building blocks in the guidelines of this dissertation. Section 2.2 provides theoretical guidance on analysis of the linkages between sustainability and accessibility. Section 2.3 deals with the problems of measurement of these concepts; section 2.4 makes an empirical literature review. Finally section 2.5 provides a brief conclusion of the chapter.

2.1. Sustainability and accessibility: Two main goals of microfinance

Defined as the two goals of the microfinance, the debate on the importance of one compared to the other has been the purpose of several studies. The current section describes these concepts.

2.1.1. Sustainability, Commercialization and Scaling up

In microfinance literature, the terms ''scaling up'', ''commercialization, ''sustainability'' are interchangeably used for denominating the process of transformation which occurs in the sector. The pressure to scale up microfinance both in terms of number of institutions and the number of clients served is great. The reason is the scarcity of resources or reduction of subsidies. The term ''scaling up'' includes four keys dimensions which are: Scaling up coverage, activities, strategy and organizational sustainability (Hishigsuren, 2004). For these reasons, it appears that there is some overlap between the concept of scaling up, institutional transformation and financial self-sustainability. For its part, institutional transformation or commercialization is one of the mechanisms of scaling up. While financial self-sustainability is seen by some as a finish line, scaling up is seen as a mean to achieve financial self-sustainability through economies of scale.

2.1.1.1 Self-sufficiency or sustainability

Sustainability entails that appropriate systems and processes have been put in place; that will enable the Microfinance services to be available on a continuous basis and the clients continue to benefit from these services in a routine manner. Though sustainability is understood immediately in the financial terms or in the resource terms, actually it has broader dimensions, of which financial sustainability is the only major dimension. The different dimensions of sustainability are: Institutional sustainability, Mission sustainability, Program sustainability, Human Resource sustainability, financial sustainability, Market sustainability, Legal policy environment sustainability, Impact sustainability.

From banker's perspective, sustainability of microfinance institution includes both financial viability and institutional sustainability (self-sufficiency) of the lending institution (Sharma and Nepal (1997) cited in Acharya and Acharya, 2006). The frames of reference in banker's definitions are for that reason, more financial, administrative and institution focused. Our dissertation adopts the Banker's perspective to conduct our analysis. Therefore, sustainability is defined as "a program's capacity to remain financially viable in the absence of domestic subsidies or foreign support" (Woolcock, 1999). Financial self-sufficiency requires the ability to cover at least 99.5% of expenses exclusive of subsidies or grants (Micro banking, 2001). By definition, sustainability means generating sufficient profit to cover expenses by eliminating all subsidies, even those less obvious, such as loans made in hard currency with repayment in local currency.

2.1.1.2. Levels of sustainability

Two levels of sustainability are identified in assessing MFIs performance: Operational self-sustainability and financial self-sustainability (Meyer, 2002; Morduch, 1999c).

i) Operational self-sustainability: whereby the operating income is sufficient enough to cover operational costs like salaries, supplies, loan losses, and other administrative costs.

ii) And financial self-sustainability (referred to as high standard measure) a situation whereby MFIs can also cover the costs of funds and other forms of subsidies received at the market value. That means that if a microfinance institution is not financially sustainable, it cannot survive if it has to obtain all inputs (especially capital) at market rather than concessional rates.

Otero and Rhyne (1994) on their part, identified four levels of self-sufficiency (sustainability) in credit programs, summarized in Table 2.1. At the first level, it is obvious that MFIs are heavily subsidized. That corresponds to the traditional microfinance institutions such as NGOs and the starting up of most microfinance. With the commercialization system, all MFIs must try to attain the level four. Most programs seem to be at either level 1 or level 2. The best-known (by no means the only one) example of an institution achieving level 3 is the Grameen Bank in Bangladesh; level 4 is at present virtually confined to credit unions.

These different levels have some impacts on the objective of poverty alleviation. In fact, reaching level 4 could be made at the expense of the poor people's access to credit. However, one of the key roles microfinance has to play in the development effort is to facilitate the access of financial services by the poor, neglected by formal banking sectors. In other words, improving the access to credit by low income people is its social mission. Consequently, achieving both profitability and strong social performance is the ultimate goal of microfinance. That calls for a balancing of social and financial objectives which is sometimes difficult to attain. In order to understand why MFI fails to attain this balance, it is interesting to put forward the problem of accessibility to financial services.

Table 2.1: Level of self-sufficiency in credit program

	Amount of subsidy	Source and type of fund	State of revolving fund	Operating expenses paid by
Level 1 subsidized program Traditional highly	High	Grant or soft loans from donor agencies	Value erodes rapidly through delinquency and inflation	Continuing grants
Level 2 As level 1, but better managed	Some	Borrowed at concessional but near-market rates from donor agencies	Slow erosion of fund	Partly by interest income, partly by grants
Level 3 Approaching sustainability	Approaching zero	Borrowed at concessional but near-market rates from donor agencies	Fund stable in real terms	Interest income
Level 4 True sustainability	Zero	Raised at commercial rate from formal financial institutions and clients savings	Fund stable in real terms	Interest income

Source: Otero and Rhyne (1994)

2.1.2. The accessibility to financial services

The social performance needs to reach poor people, far in remote areas. This social performance include much more attention by increasing the number of poor and excluded people; improving the quality and appropriate financial services; ameliorating the economic and social conditions for clients and ensuring a social responsibility for clients, employees and the community they serve. In microfinance literature, allows the poor people access to financial services is called "outreach".

2.1.2.1. The outreach- the other face of microfinance

Three sets of indicators are widely used: the number of people using services in a given period (breadth of outreach); their social—including financial status at the beginning of the period (depth of outreach); and the net benefit for each, including indirect benefits for other household and even, non-household members during the period (quality of outreach or impact). However, the accessibility is analyzed generally through the concept of outreach. As a result, the greater emphasis on the financial sustainability and the trend toward the commercialization of the microfinance would raise concerns about the effects of this shift on outreach, or more specifically on the number (breadth) and socioeconomic level (depth) of the clients that are served by the microfinance institutions.

Outreach can be measured in terms of *breadth* — number of clients served and volume of services (i.e., total savings on deposit and total outstanding portfolio) or how many people the program gets to or *depth* (Lafourcarde et al., 2006; Olivares-Polanco, 2005, Conning, 1999).

2.1.2.2. In which angle the problem of accessibility posits?

Some precisions should be made about the real problem related to the improvement of the accessibility to financial services by poor people. In fact, for some practitioners, two situations occur when MFIs try to improve their financial performance. These situations depend on the way increasing outreach or improving accessibility is seen. The "increasing outreach" means how to reach more clients from similar demographic zone and at the same time improve accessibility and sustainability conditions. Increasing client outreach provides economies of scale that in turn makes MFIs more efficient and there after more sustainable, at least in the immediate financial terms. Yet, if improving the accessibility means targeting hard to reach clients such as people living in remote areas, then accessibility and sustainability are effectively competitive terms. Reaching clients in remote areas is relatively expensive. It makes MFIs less efficient, thus, less sustainable. This is the real accessibility challenge for MFIs and represents the second situation.

2.1.3. Drawbacks of commercialization

Drawbacks observed here concern the types of risks and the impact of the commercialization on the subsidies. These drawbacks have also impacts on the lender-borrowers relationship. At the initial stages of growth in the microfinance industry, most MFIs were only concerned about financial risks; mostly focused on credit risk. To overcome this credit risk, they apply for the group lending technologies or progressive lending, so on and so forth. When the demand for loans began to rise exponentially, MFIs also began to be concerned about a particular type of liquidity risk wherein MFIs would run out of enough cash to meet the demand for loans (Nimal, 2008).

The Commercialization of the industry carries some additional risks. In fact, the typology given by the GTZ in 2000 does not include the external risks such as regulation, competition, demographic risks, etc. GTZ's classification was more related to factors under MFIs control. However, given the new environment, these risks are appearing in the microfinance industry. At the same time, traditionally identified risks such as credit and liquidity risks, have increased in intensity (Nimal, 2008). All these risks undermine all efforts made by MFIs. As a result, leaders of those MFIs are reluctant to lend to the excluded people.

Table 2.2: Typology of risk in Microfinance

Source	Typology	Components and Definitions
GTZ (2000)	Financial risks	1-Credit Risk is the risk to earnings or capital due to borrowers' late and nonpayment of loan obligations. Credit risk includes both transaction risk and portfolio risk. – Transaction Risk refers to the risk in individual loans. – Portfolio Risk refers to the risk inherent in the composition of the overall loan portfolio. 2-Liquidity Risk is the risk that an MFI cannot meet its obligations on time. 3-Market Risk includes interest rate risk, foreign currency risk, and investment portfolio risk. – Interest Rate Risk is the risk of financial loss from changes in market interest rates. – Foreign Exchange Risk is the potential for loss of earnings or capital resulting from fluctuations in currency values. MFIs most often experience this risk when they borrow or mobilize savings in foreign currency and lend in local currency. – Investment Portfolio Risk refers to longer-term investment decisions rather than short-term liquidity or cash management decisions.
	Operational risks	1-Operational Transaction Risk (the document does not give a definition) – Human Resources Risk (the document does not give a definition) – Information and Technology Risk is the potential that inadequate technology and information systems will result in unexpected losses. 2-Fraud Risk is the risk of loss of earnings or capital as a result of intentional deception by an employee or client. 3-Regulatory and Legal Compliance Risk is the risk of loss resulting from noncompliance with the country's regulations and laws.
	Strategic risks	Governance Risk is the risk of having an inadequate structure or body to make effective decisions.
Churchill and Franklewicz (2006)	Institutional risks	1-Social mission 2-Commercial mission 3-Dependency 4-Strategic 5-Reputation
	Financial management risks	1-Asset and Liabilities 2-Inefficiency 3-System integrity
	External risks	1-Regulatory 2-Competition 3-Demographic 4-Macroeconomic 5-Environmental 6-Political
	Operational risks	1-Credit risk 2-Fraud 3-Security 4-Personnel

Source: Nimal (2008)

2.1.3.1. The implication for lender-borrower relationship

The introduction of microfinance constitutes an innovation in the world of credit markets by the creation of a competition. It contributes to reduce the negative impact of the moneylenders on their excluded people inducing the diminution of the interest rate. Providing the poor with access to savings and credit services, microfinance as a poverty alleviation strategy, has gained prominence in the past ten years with increasing success in terms of ability to reach the poor and sustaining the delivery of financial services.

At the beginning, most MFIs were located close to their borrowers and that situation allows some of the problems encountered in lender-borrower relationship overcoming. But, the expansion of these institutions in a matter of members and geographical localization, showed the way to undermine this progress. For De Young et al. (2006), the apparent decline in the importance of borrower-lender proximity and in-person relationships for small business lending, has potential implications for the supply and quality of small business credits as well as the strategies of banks that expand those loans.

Managing the risk, the lender can offer different loan contract with variable collateral requirement; the interest rate being a decreasing function of collateral. In this situation, people who lack guarantee would be excluded. Another possibility is to offer different loan variable sizes (Freixas and Laffont, 1999) with the interest rate being an increasing function of the loan size. Hence, MFIs facing heterogeneous distribution of potential borrowers may benefit from discrimination amongst them. Whatever the method of discrimination chosen in the case of MFIs, it would lead to exclusion of the low income people considered as more risky. Furthermore, commercialization could increase this situation by undermining the relation between borrowers and lenders.

2.1.3.2. Reduction of subsidies

In the accomplishment of their social mission (that is to provide the loans to the excluded and poor people from the formal banking system), MFIs received subsidies. Indeed, the majority of MFIs operated with subsidies some decades ago. Subsidies contribute to reduce the cost of giving loans to poor borrowers since the transaction costs are higher. As showed by Hudon and Traca (2008), for the vast majority of MFIs in their sample, the

received subsidies allow to reduce administrative cost per borrower than MFIs that are not subsidized. However, for efficiency purpose, the subsidies are being reduced by donors during the commercialization process. Then, the cross subsidies, practiced by the MFIs, disappear with the competitive environment that comes up (McIntosh and Wydick, 2005). Therefore, it is important to find in which frame these problems could fit in order to solve them since this transformation seems go to the reduction of subsidies.

2.2. The theories on sustainability and accessibility

This section presents the debate on sustainability and the outreach to the poor. It intends also to present the debate on the subsidy, sustainability and the poverty alleviation.

2.2.1. Controversies on sustainability and accessibility

There are two competing theories in the sustainability of microfinance literature: the poverty camp and the financial camp[14] (Bhatt and Tang, 2001; Woller and Woodworth, 2001, Conning, 1999). Morduch (2000) refers to these two positions as the *microfinance schism.* Each of these theories differs on how microfinance services should be delivered (NGO versus commercial banks), on the way technology should be use (financial services, or "minimalist" approach versus an "integrated" service approach), and on how their performance should be assessed. The poverty camp's advocates are not only concerned with the question of how poor the clients are, but whether or not they are less poor after they borrow the money (Cheston and Reed, 1999). The financial camp believes that performance should be assessed in terms of the institution's success in achieving self-sustainability and breadth of outreach.

Self-sustainability and outreach for both financial and poverty camps are perceived as contradictory objectives. They represent a trade-off for institutions. For the welfare-oriented practitioners, microfinance should on one hand, focus on reaching the poorest and help them alleviate both material and non-material poverty, even with subsidized operations.

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[14] Poverty camp and financial camp are sometimes termed as welfare approach and financial system approach or institutionalist approach respectively.

Table 2.3: Financial and social performance managements compared

	Financial performance management	Social performance management, including poverty reduction
Main goals	Profitability; reduced dependence on subsidies, reduced risk exposure	Achievement of stated social mission and /or commitments to corporate social responsibility over time: for example, reduction of financial exclusion, poverty reduction, empowerment of women, and compliance with ethical standards for consumer protection. Clear indicators and strategies supporting such goals are often lacking.
How assessed?	Systematic book-keeping and accounting, market research	Comply with process quality standards; monitor who clients are (as well as those affected by services offered indirectly) and how much they benefit. There has been little consensus about how to do this
What for?	To inform decisions about prices, products, services delivery systems and strategies	The same, but with a view to improving social performance as well: for example, through a better fit with provision of non-financial services; whether provided jointly or by other agencies. Mechanisms for linking assessment to action are often weak and unclear. Incentives to do so are also often weak.
Cost effective?	Part of the cost of doing business legal as well as a strategic requirement.	Fear that explicit social performance management is a drain on financial performance. Expenditure on social performance assessment should be proportionate to potential benefits arising from its use. Norms regarding what is appropriate are weak.
How validated?	Internal and external audits	Norms for internal quality assurance and external review of social performance assessment systems are lacking

Source: Copestake, 2007

On the other hand, the financial camp develops the financial expansion, whereby microfinance should focus on providing services to a larger number of poor people and reaching a financial sustainability through more efficient operations like market or higher than market interest rates, and economies of scale (Bhatt and Tang, 2001). The ''financial camp'' or "financial systems'' approach becomes the dominant thought, at least officially at the World Bank and amongst much of the donor community.

Comparing the two goals, Copestake (2007) thinks that social performance assessment and management have failed to achieve the same clarity, consistency, and level of acceptance like the financial performance assessment and management as summarized in Table 2.3. That seems the reason for which the financial performance management is widespread.

2.2.2. Sustainability, accessibility, and subsidies

Subsidies take several forms. They can be direct, e.g. making a grant to help paying for staff training, or indirect subsidies (Armendáriz and Morduch, 2005). The indirect subsidies are difficultly perceived by MFIs Staff, since subsidies come via "soft loans" from donors. A donor might prefer to support a micro lender by making a loan to be repaid in twenty years at an interest rate of 1 percent (1%) a year. The subsidy comes in when the interest on loans obtained through the market is higher. Many authors argue that subsidies are the only way for microfinance institutions to fulfil their role in poverty alleviation, in the short and long run. Reaching a large number of poor people, needs the provision of subsidies from MFIs specialized in serving them (Zeller and Meyer, 2002).

On the other hand, many are concerned with the excessive subsidization of MFIs and its potentially negative consequences on the MFIs' development mission (Armendáriz and Morduch, 2005). CGAP (2004) argues too, that excessive subsidization leads to market distortions; hurting the sector by creating hurdles for private actors such as commercial banks from emerging. For many, the well-known drawback of subsidies in the microfinance programs induce rent seeking which undermine operational and financial performances. This does not cancel the fact that most poverty alleviation programs are subsidized.

Morduch (2006) wrote that, since profitability of MFIs is also critical, subsidies can play an important role by reaching the poor. Subsidies have drawbacks, yet, they can drastically help microfinance institutions with lots of effort to achieve their mission. In in other words, the author said that with well oriented subsidy policies, it is possible to reach sustainability and improve poor outreach. Some authors think that providing small loans is

costly and there is an insufficient income to ensure profitable operations. Therefore, there is the need that a subsidy should be used to fund some social objective of microfinance institutions. Brau and Woller (2004), corroborate this by showing that unlike financial institutions in the formal sector, most MFIs are not financially sustainable. As a result, many MFIs could not function without the subsidies that they receive from governments and others funders. Most microfinance programs are therefore developed using public funds and most, if not all MFIs that reach large numbers of its clients below the poverty line, require state or donor transfers to subsidize their costs. McIntosh and Wydick (2005) discovered that the new environment reduces the possibility to make a cross subsidy, since most MFIs target the same population of borrowers.

For some practitioners as Otero (2006), microfinance institutions that adopt a rational good banking mechanism will automatically target poverty reduction or alleviation scheme. MFIs that are financially sustainable and shun, or those that avoid subsidies in the long run will have more outreach and will serve their course better because no limitations would be imposed on them by the donor. The key paradigm is that low income households need to have an approach to credit, necessarily not cheap credit. In this way, poverty can be reduced without costs to governments or donors. This may even be profitable to both. This approach looks like reaching poor households would be easy if self-sufficiency is attained. Unfortunately, that is not always the case. Indeed, these studies on sustainability often suggest that once this goal is attained, microfinance institutions will automatically pursue their social goal. But, they fail to say how it should be done. Good policy recommendations must be much more than mere lists of desirable outcomes (Schreiner, 2001).

2.2.3. Sustainability and accessibility as results of the strategical behavior of MFIs

Since MFIs are financial intermediates, they are confronted to two major problems, namely transactions costs and asymmetric information. In microfinancing, the microlenders delegate the MFIs to provide their funds to the borrowers in order to reduce the monitoring costs. Hence, MFIs are an intermediate between lenders and poor borrowers and/ or borrowers who have no collateral. Aliya Khawari (2004) considers that

"The demand or need for microfinance comes from the disadvantaged sections of the society - who are without access to services of formal sector financial intermediaries - and are typically excluded from the formal banking system for lack of survival collateral, in short the poor and the very poor".

Providing an economic foundation to sustainability and accessibility lays on the basis of theories developed on the firm's behavior. The firm theories lay their foundation in the critics made to the paradigm of the pure and perfect competition. This paradigm assumed that a firm is not decision-maker on the market. That does not hold in presence of transaction costs and asymmetric information. Hence, beyond the profit maximization, the firm is viewed as a set of multiple groups with different objectives. In this context, transaction costs and Agency theories have been retained to develop the theoretical frame for analyzing the sustainability and accessibility.

2.2.3.1. Transaction costs theory, sustainability and accessibility

The transaction cost approach to the theory of the firm was created by Ronald Coase (1937). Transaction cost refers to the cost of providing for some goods or services through the market rather than having it provided from within the firm. This theory attempts to explain why the firms exist, and particular structures of a firm. Williamson (1975) work goes beyond Coase's own; by assessing that the environmental factors (uncertainty and the number of firms) and the human factors (bounded rationality and opportunist behavior) explain the behavior of a firm.

Related to the microfinance market, transaction costs in credit delivery can be conceptualized as nonfinancial costs incurred by lenders and borrowers during pre-loan disbursement, loan disbursement and post-loan disbursement activities (Bhatt and Tang, 1998). MFIs have introduced and developed innovative financial intermediation to various facets of the society, especially to the poor and low income group, who would otherwise have, little or no access to financial services. Different methods such as group lending, dynamic incentives, regular repayment, are used for attaining the common goal of lending to low-income households and small enterprises.

The remaining question is whether the use of the innovations brought by the microfinance for the risks reduction can be sufficient to allow the sustainability and improve accessibility of credit. In other words, as it is said by Bhatt and Tang (1998), it is important to analyze the relative efficiency of the alternative forms of institutional arrangements to be able to economize the transaction costs for both lenders and borrowers.

An answer is that commercialization increases the opportunisms behavior of the borrowers, making it very difficult for the MFIs to monitor them. Consequently, the transaction costs have increased also. A possible solution for the MFIs is to implement the complex loan procedures which would allow them to ensure their sustainability. In this line, accessibility appears as a control variable in the production function of the MFIs. Thus, it is important to reduce the costs of increasing accessibility by rationing small borrowers and making fewer and bigger loans to creditworthy and wealthy individual. Finally, the transaction costs theory suggests that sustainability is an output and accessibility is an input to produce this output.

2.2.3.2. Incentive systems theory, sustainability and accessibility

The key achievement of incentive theory is that it provides a full characterization of the set of implementable allocations when resources within an organization must be allocated under asymmetric information problems. This theory is concerned with friction due to asymmetric information between owners of firms and their stakeholders or managers and employees; the friction between agent and principal. The quest of sustainability can be provided either by the stakeholders or the managers. The stakeholders can pursuit a profit objective. Thus, sustainability becomes a decision imposed to the manager. For the manager, rent seeking or remaining as manager can guide the quest of sustainability. Therefore, it can reduce the number of loans provided to the excluded people. Taking in this framework, sustainability becomes the ultimate goal of microfinance; not a means to attain the outreach as suggested by Otero and Rhyne (1998).

2.3. Sustainability and accessibility measurement

2.3.1. The sustainability Measurements

Sustainability, in a broad sense, is the ability to maintain a certain process or state. In the microfinance literature, concepts such as profitability, self-sufficiency, financial self-sufficiency, self-sustainability, financial viability are used interchangeably with the word sustainability. Profitability is defined as equality between profits net of taxes and subsidies and the opportunity cost of capital and risk taking. Viability means the ability to cover costs of operation from revenues. Chua and Llanto (1995) describe the term viability as follows:

$$Y > (OC + CK + CBL) \qquad\qquad [2.3]$$

Whereby Y is income (including interest income from loan and related fees and charges) OC is the operating cost which includes all the personnel cost and non personal expenses incurred in the provision of the services, and CK represents the cost of capital. It includes actual borrowing costs and the imputed cost of capital. CBL on the other side represents the cost of bad loan.

The result of the above equation is the following:

$$Y - (OC + CK + CBL) > 0 \qquad\qquad [2.4]$$

By definition, financial sustainability means generating sufficient profit to cover expenses at the same time, eliminating all subsidies, even those less obvious subsidies, such as loans made in hard currency with repayment in local currency. In other words, sustainability is a full cost recovery or profit making, and is associated with the aim of building microfinance institutions that can last into the future without continued reliance on government subsidies or donor funds (Conning,1999). For Aryeetey (2005), financial self-sustainability is achieved when the return on equity, net of any subsidy received, equals or exceeds the opportunity costs.

To achieve true financial sustainability, a credit program or MFI must be able to cover the following costs from the income it receives out of fees and interest:

- Its cost of funds: that is, the interest which the program has to pay to the provider of its funds (if these are interest-free, then a notional cost should be allocated);

- Its operating costs: including staff, offices, and equipment;

- Its loan write-offs: the losses incurred as a result of some borrowers failing to repay their loans;

- Inflation (which should be reflected in a true cost of funds). This is the standard against which financial sustainability should be measured (Havers, 1996).

All is summarized in the definition given by Woller and Schreiner(2006): Microfinance's financial self-sufficiency is defined when a microfinance institutions (MFIs) inflation adjusted operating revenues, less monetary and in-kind subsidies, exceed its inflation adjusted operating cost plus its actual and imputed (the rate the MFI would have paid in the market) funding costs. Unlike formal sector financial institutions, most of the MFIs are not sustainable in the sense where sustainability refers in the microfinance language self-sufficiency (Brau and Woller, 2004). The sustainability requires the efficiency from MFIs. Efficiency simply refers to the ability to maximize output per unit of input. Sustainability does not only refer to financial viability but includes the institutions' ability to ensure continuity of its services, to expand and adjust to changing circumstances (Chua and Llanto, 1995).

2.3.1.1. Measures of financial sustainability

It is important to define the elements to be included in the computations of the different ratios when measuring financial sustainability. A presentation of a financial statement is necessary.

a) Sustainability Index

The first way to measure financial sustainability is a financial sustainability index. This corresponds to the percentage of total cost covered by income.

$$sustainability\ index = \frac{total\ income\ earned\ from\ credit\ programme\ during\ the\ period}{total\ credit\ programme\ costs\ during\ the\ period} \times 100$$

This is also known as the loan-repayment rate. Unfortunately, it is quite inadequate as a worthwhile measure of sustainability. The reasons for this are twofold. Firstly, loan repayment is only a part, albeit an important part, of the sustainability picture. In assessing a financial sustainability, it needs to look not only at loan loss, but also at administration costs, cost of funds, and inflation; and on the other side of the coin, there is a need to look at interest and fee income. A simple look at loan-repayment rates does not give an adequate picture. The second problem with repayment-rate percentage is the one of definition. There are so many variables in constructing such a percentage that they are rendered almost meaningless. These are factors as arrears, default, and write-off. In fact, the Sustainability Index is nothing more than the percentage of total costs covered by income.

b) Subsidy index (an indirect measure of sustainability)

Self-sustainability is assessed by calculating the subsidy dependence index, that is, the percentage by which the agency's average on-lending interest rate would have to increase to make it self-sustainable (Yaron 1992). This is another way to calculate the self-sufficiency. Furthermore, the World Bank is advocating the use of 'Subsidy Dependence Index', or SDI. The SDI is equally a valid tool to measure financial sustainability. But the way in which it is structured means that it is more likely to be used by economic analysts than by the managers of NGO savings and credit programs seeking to improve their operational performance (Havers, 1996). The question is how much higher the interest rates charged to borrowers would need to be, in order for the MFIs to operate without subsidies. According to Armendáriz and Morduch (2005), the subsidy dependence index attempts to answer to this question. The model developed by Morduch (1999b) is presented as follow:

Let's start with a break-even (net) interest rate r^* that solves the equation

$$L\left(1+r^*\right)\left(1-d\right)+I = L+C+S \qquad\qquad [2.5]$$

Where

$L =$ The volumes of loans outstanding before adjustments are made for loan problems.

$\left(1-d\right) =$ The fraction of portfolio that is expected to be repaid

$I =$ Total income from other investments

C = Total costs including the cost of capital

S = total value of implicit subsidies (interest rate subsidy on concessional borrowed, opportunity cost of equity, reserve requirement exemptions, free equipment provided by government and donors, government's assumption of loan losses, free training for staff provided by government and donors, etc.)

The left side of equation [2.5] gives expected income and the right side gives the costs (in the absence of soft loans). Rearranging yields that the break-even interest rate is thus:

$$(1+r^*) = \frac{[L+C+S-I]}{(1-d)L}$$

[2.6]

$$r^* = \frac{[C+S-I+dL]}{[L(1-d)]}$$

And the percentage increase in the current interest rate required for the bank to break even is given by below formula:

$$(r^*-r)/r = [C+S-I+dL-r(1-d)L]/[rL(1-d)] = (S+K-P)/[rL(1-d)] \quad [2.7]$$

Where
P = reported net profits .they include gross revenues from lending grant and investments, less repayment of principal and all associated costs.

K = Direct grant and the value of discounts on expenses

SDI is the inverse of self- sustainability. It measures the degree at which the MFIs rely on the subsidies for their operations. If SDI =0 it implies that the MFIs have achieved the true financial self-sufficiency, i.e. MFIs obtain all its funds on a commercial basis including equity. If SDI<0 it implies that the MFIs are depending on the subsidies. However, there are also some major drawbacks. The SDI assumes that a rise in lending rates automatically leads to higher profits. Generally, that is not true. Higher lending rates could lead to lower profits of banks in case of adverse selection and moral hazard effects. The SDI do not indicate to what extend subsidies are justified (Hermes and Lensink, 2007).

c) Operational Self-Sufficiency (OSS)

The OSS is obtained from the division of the operating incomes by operating expenses (including financial expenses such as interest). When the ratio is lower than 100%, it

means that a MFI needs external funds to continue operations. The ratio should be over 100%. Revenue from operations must be higher than expenses linked to operations. A ratio above 160% is a desirable target to ensure sustainability.

d) Financial Self-Sufficiency (FSS)

This ratio is calculated by dividing income from operations by total expenses (operating and financial). More precisely, it is the adjusted operating income divided by the interest of adjustment loan loss and administrative expense (%). A financial self-sufficiency ratio higher than 100% means that the MFI is able to cover completely all its operations on its own. It generates sufficient revenue from its operations to cover all the financial and operating expenses. When a MFI has attained a financial self-sufficiency ratio higher than 100%, then, one can speak of profitability and sustainability. Also, FSS is achieved when the institution's profits net of taxes, revenue grants and discounts are equal to zero (or greater) after replacing subsidized loans with the market priced loans. At long last, one may conclude that a financially self-sufficient MFI is not necessarily profitable.

e) Other measures of sustainability

- *Return on Assets (ROA)*

ROA is obtained from the division of the amount of net income (loss) at the period by the average total asset average at the same period.

- *Return on Equity (ROE)*

The ROE is obtained by dividing the amount of net income (loss) for the period by the average total equity for the period.

ROA and ROE, for some practitioners should be adjusted to take into account the missing aspects of the internal and external factors that affect the institution. Adjustments have to be made about the following factors:

i) Inflation: all expenses must be understood in the sense of the preservation of capital with regard to the inflation

ii) The adjustment should consider a probable level of loss on loans by taking into account the situation of portfolio(overdue loans) and network performance over time

iii) An adjustment that takes into account the monetary value of technical assistance of any other, in a kind of assistance which has not been accounted by the institution in the financial statement.

iv) An expense attributable to the real cost of loans that are currently made to the network at advantageous rates below market rates.

- *Adjusted Return on Assets (AROA)*

AROA is obtained by dividing the amount of net profit (loss) adjusted for the period by the amount of assets averaged for the period. The net profit equates to total expense subtracting in total income. In this computation, only incomes directly linked to the microfinance activities are considered. An AROA above 0% is the target; in short, revenue must exceed expenses. A ratio above 5.0% is desirable in a microfinance context in order to ensure sustainability and a comfortable margin for maneuver.

- *Adjusted Return on Equity (AROE)*

AROE is obtained by dividing the amount of net profit (loss) adjusted for the period by the amount equity averaged for the period.

2.4.1.2. The adopted measure of sustainability

The Operational self-sustainability (OSS) will be retained as measure of sustainability in this dissertation. Several reasons justify this choice:

i) It is important to be careful about the use of the adjusted measures. We agree with Malanchini and Nègre (2005), who stipulates that the results provided by these analyses reflect the adjustment methodologies used. In fact, analysts may use different adjustment methodologies, depending on their objectives and the availability of data. That would have an impact on the results and their interpretations.

ii) True sustainability requires that one should avoid subsidies. By so doing, SDI could be a good measurement. But, SDI is difficult to compute because of lack of information on implicit subsidy. It is also an indirect measure.

2.3.1.3. Relationship between sustainability and profitability

Dividing the profit function equation [2.2] by $C(Q)$, we obtain;

$$\frac{\pi}{C(N \times v)} = \frac{P(N \times v)(N \times v)}{C(N \times v)} - 1 \qquad [2.8]$$

Since the self-financial sustainability is the ratio of total financial revenue from loan provision on the total cost, we get

$$\frac{\pi}{C(N \times v)} = OSS - 1 \Rightarrow OSS = \frac{\pi}{C(N \times v)} + 1 \qquad [2.9]$$

From this equation, we notice that the positive relationship between OSS and profit if all things equal elsewhere. If profit is zero, then OSS=1. If the profit is greater than zero then the operational self-sustainability is greater than 1. The profit is less than zero then operational self-sustainability is less than 1. The implication of this relationship is that sustainability which depends on the profit must be equal or more than zero.

2.3.2. The indicator of the extension to access to credit

There is currently no widely accepted measure for assessing the social performance (outreach). While outreach is traditionally conceived as consisting of two dimensions—breadth and depth—Schreiner (2002) proposes that outreach consists of six dimensions, each of which is also arguably a component of social value. He defines the six dimensions as follows:

- Worth of Outreach: The client's willingness to pay.

"Worth hinges on the terms of the financial contract and on the tastes, constraints, and opportunities of clients". With the cost to the user constant, more worth means more net gain. As says Schreiner (2003), this does not mean that users can or should pay. Rather, it supposes that a change in well-being due to microfinance can be expressed in dollar-equivalent terms.

- Cost of Outreach: "The sum of price costs and transaction costs". It is a cost of a loan to a borrower. Price costs are direct cash payments for interest and fees. Price costs are revenue for the microfinance organization. Transaction costs are non-price costs for both non-cash opportunity costs— such as the time to apply for a loan—and indirect cash

[59]

expenses for such things as transport, documents, food and taxes needed to use a financial contract. Transaction costs borne by clients are not revenue for the microfinance organization. The cost to clients is distinct from the cost of a loan to society or from the cost of a loan to a lender.

- Scope of Outreach: "The number of types of financial contracts (products and services) supplied". In practice, the MFIs with the best outreach produce both small loans and small deposits.

- Length of Outreach: "The time frame of the supply of microfinance" Length matters in a society which wants to care about the welfare of the poor both now and in the future. Without length of outreach, a microfinance organization may improve social welfare in the short-term but wreck its ability to do so in the long term.

- Depth of Outreach: "The value that society attaches to a net gain of a given Client". Net gain to clients is defined as worth minus cost, the increase in welfare due to microfinance. Since society places more weight on the poor than on the rich, poverty is a good proxy for depth.

- Breadth of Outreach: "The number of clients".

Outreach is commonly proxy by the gender or poverty of borrowers, the size or the terms of loan contracts, the price and transaction costs borne by users, the number of users, the financial and organizational strength of the lender, and the number of products offered, including deposits (Navajas et al., 2000). Aryeetey (2005) adds to that the number of branches and village sub branches, the percentage of the total rural population served as a real annual growth of the institution's assets over recent years. Rhyne (1994) suggests the inclusion of the quality of the service provided or quality of outreach. It means if an institution records high repayment rates and high growth rates in terms of clients, retains a large number of clients, which are willing to pay interest rates for institutional self-sustainability, then the services provided by the institution are considered of "good quality" because they are "appreciated and relevant to its clients" (Christen et al., 1995).

Nevertheless two widely measures of loan size are used: average outstanding loan (AOL), obtained by dividing the outstanding loan portfolio by the number of active clients at the end of the period of analysis; and the ratio of AOL to per capita GNP(AOL/PCGNP),

usually used in cross-comparative analyses. The loan size will be used to evaluate a larger of accessibility, essentially the depth of outreach. Generally, larger loan size means low number of people having access to credit. Loan size has been the predominant metric for comparison of outreach. But loan size is a rough and indirect measure (Hatch and Frederick, 1998).

Furthermore, Schreiner (2001) critiques the use of both AOL and AOL/PCGNP because they do not take into account other aspects of loan size, especially in term of maturity. Schreiner argues that AOL is imperfect; because it measures the resource held in the term of the loan but does not consider the length of the term to maturity. Since finance is the exchange of resources through time, then loan size should account for it. Additionally, in many countries, especially in poor countries, per capita GNP can be distorted by inequalities in income distribution. In countries with higher inequalities, per capita GNP exceeds both median GNP and the poverty-line income (Schreiner, 2001). Hence, AOL/PCGNP may not be a useful measure for cross-comparative analysis. Schreiner also criticizes the fact that the numerator and denominator pertain to different time frames. The numerator (AOL) is a flow disbursed in a specific moment, while the income (PCGNP) is generated in an entire year. Within a year, there can be more than one disbursement. Schreiner suggests an alternative measure to adjust for time: dollar-years of resources from loans over dollar-years of resources from annual income, if it were all saved (denoted as $-years loan/$-years income). This measure is:

$$\$ - year\ loan\ /\ \$ - year\ income = \frac{average\ outs \tan ding\ loan * \dfrac{12}{average\ term\ to\ maturity}}{per\ capita\ GDP\ /\ 2}$$

Paxton (2003) has developed an index to overcome the limits of loan size. She modifies the Foster, Greer and Thorbecke poverty index by incorporating both depth and outreach scale. This index is

$$PO\left(x; z, \alpha\right) = \frac{\log\left(q\right)}{q} \sum_{i=1}^{q}\left(1 - \frac{x_i}{z}\right)^{\alpha}, \alpha \geq 0$$

Where Log base 10 for allowing no upper bound

x_i = income of the ith household below the poverty line

q =number of households below the poverty line. An application to microfinance, q stands for number of clients below poverty line

z =poverty line which can be the absolute measure of poverty, may be $2 or relative poverty line

For an empirical work where scale is important, $0 \leq \alpha \leq 1$. The author finds that the PO index shows that larger and more heterogeneous institutions such as banks and credit unions actually serve a significant number of people below the poverty line.

For the purpose of this study, these indicators provide partial information on the poverty status. Indeed, the assumption made by loan size is not true all the time. In some context, the African context, in particular, the small loan is used for the start of activity independently the status of borrower. A bad rate of repayment and an asymmetric information (moral hazard and adverse selection) are the reasons this. After a good behavior, the loan size increases. And also, it does not necessarily reflect the level of poverty of the clients. It is evident that even larger businesses sometimes apply for small loans. In addition, Christen (2001) concludes that larger loans do not necessarily indicate mission drift, and they could simply be the function of different factors, such as choice of strategy, period of entry into the market, or natural evolution of the target group.

Finally, the way which has computed, is suggesting to some discussions (Schreiner, 2002). Furthermore, the use of the number of borrowers as measure of the outreach presents the inconvenience that it doesn't give the poor status of the borrowers. For these reasons, it could be interesting to create a synthetic index from principal component analysis to analyze the relationship between sustainability and accessibility. The variables to be included in the synthetic index are the following: number of borrowers, $-years loan/$-years income and gross loan portfolio. A computation thereafter of each MFI score of this obtained index will be used as variable.

2.4. Empirical Studies on sustainability and accessibility

2.4.1. The tradeoff between sustainability and outreach

Using a theoretical model of a contract, Conning (1999) designed solutions that assesses problems of tradeoff between outreach and sustainability. In his study, he shows that reaching the poor is more costly (monitoring and peer monitoring costs) than reaching other segments of the market even though there is no fixed lending cost. He also states that leverage may be much harder to achieve for MFIs that target the low-end of the market. But he finds that the sustainability is not a sufficient condition to improve the leverage. Basing on a sample of 72 MFIs, Conning confirms the theoretical models that sustainable MFIs that targeting poorer borrowers must charge higher interest rates and have higher staff costs. At the same time, they are less leveraged than those targeting less poor borrowers. In contrast, Hollis and Sweetman (1998) analyze mid-19th century Irish loan funds and find that MFIs were able to lend to the poor at competitive interest rates without subsidies.

On the whole, financial self-sufficiency and depth of outreach tend to be treated as dichotomous concepts. The idea is that self-sufficiency and outreach are dichotomous. Therefore, there is a wide literature on the tradeoffs between financial sustainability and the outreach aspects. Christen et al. (1995) examine whether a direct trade-off exists between sustainability and outreach in their study, "Maximizing Outreach", based on analysis of the performance of eleven (11) leading microfinance institutions. They find out that microfinance programs were sustainable at every level of the clientele. More important result revealed that for well-performing institutions, there was no correlation between the poverty level of clients (as measured imperfectly by loan size) and the financial viability of the institution.

Some authors argue that by increasing the number of outreach people will undermine and endanger the existence of MFIs themselves. The explanation is that, increasing the outreach of microcredit programs will attract the wrong kind of borrowers: bad credit risks for the MFIs. Secondly, with the rise in the number of clients and the amount of

loans, the operating costs for loans making will rise as well (von Pischke, 1996). Hulme and Mosley (1996) also, corroborate by telling that there is an inverse relationship between outreach and financial sustainability. The argument is that higher outreach means higher transaction cost in order to get information about the creditworth of clients, which therefore, make the MFIs financially unsustainable.

Finally, the models confirm an old belief in microfinance: there is a trade-off between depth, breadth, and sustainability. Copestake (2007) explains graphically how this tradeoff exists (see figure 2.1). On the figure, raising interest rates on loans is likely to improve financial performance (assuming inelastic demand), but at the expense of current social performance(due to reduced net benefit per client, as well as a possible short-term reduction in the breadth and depth of outreach). Copestake thinks the effect of this tradeoff is longer over time and they are able to touch future social and financial performances. Hence, future social performance will depend upon both current social performance (e.g., via its effect on users' future demand for services) and financial performance (as a critical determinant of future capacity to supply services). The author represents MFI's mission by a set of indifference curves (C1, C2, C3, etc.). Each Curve represents a set of combinations of social and financial performance that are equally attractive. From any given initial level of performance (pt), an MFI is constrained in how it can change its position within the next time period by a performance possibility locus PPt+1 of potentially attainable positions.

For the author, five Change possibilities over one period are offered to the MFIs.

i). The horizontal arrow represents a growth-first strategy, subject to the rule that current social performance should not get any worse.

ii) The yellow vertical arrow represents a current clients-first strategy, subject to the rule that financial performance should not get any worse.

iii) The red arrow pointing upward and to the right represents an intermediate strategy. Assuming the MFI is successful in reaching the PPt+1 line, then such strategy is optimal.

iv) The green arrow moving up and to the left represents a trade-off strategy of improved current period social performance at the expense of financial performance. To be sustained this would require an increased rate of subsidy. This could be justified by the improved social performance, but if so the indifference curves would have to be redrawn.

v) The downward sloping arrow also represents a trade-off strategy: this time to enhance financial performance by reducing current social performance. This might take the form, for example, of deliberately targeting richer and more profitable clients. It is this last strategy that the MFIs seem used.

Figure 2.1: Strategic options facing MFIs
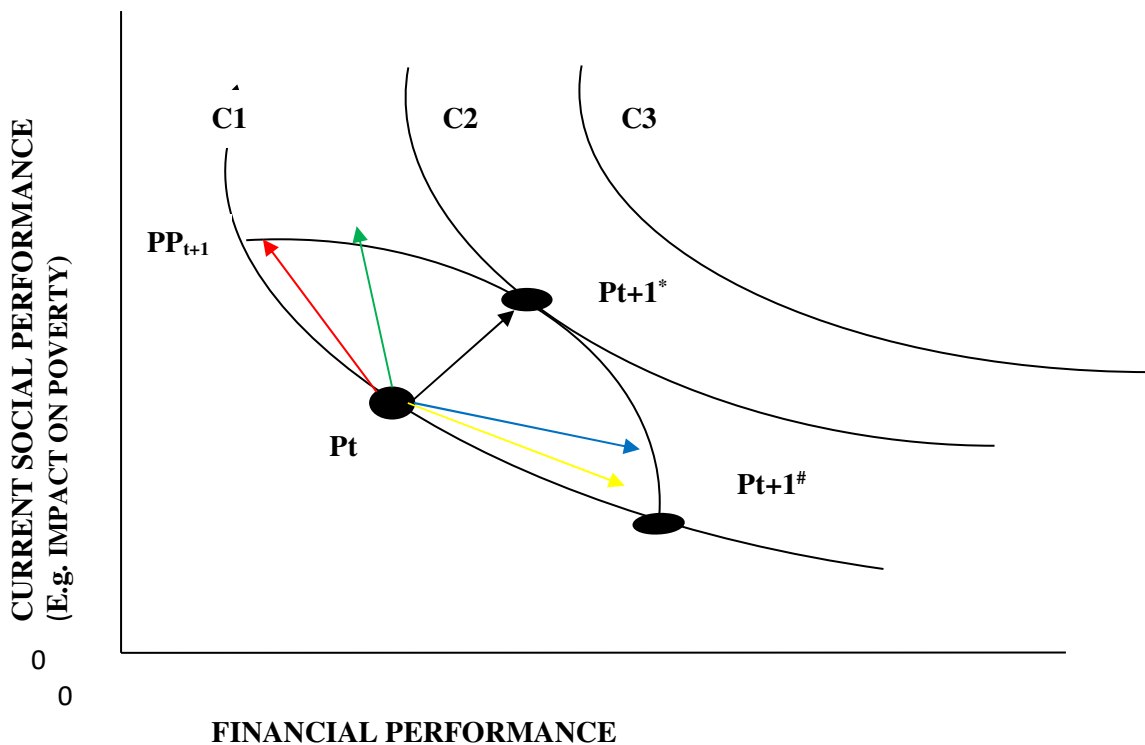
Source: Copestake (2007)

Paxton (2003) on his side had realized that this result depends on the type of measurement chosen. For her, whenever traditional measures alternate for depth of outreach are used, it is evident to have a positive correlation between depth of outreach and reliance on subsidies. However, by using the PO index, this relationship could be either zero (when setting for absolute poverty line) or negative (when setting for relative poverty line).

These findings suggest that independent MFIs with scale of economies may offer the most promise of reaching the largest number of poor. As a result, there is no longer transaction between outreach and institutional sustainability. Hence, the most important result is that Banks and credit unions are found to have greater poverty outreach than smaller and subsidized non−governmental organizations that target exclusively the poor.

Nonetheless, most of the research project had formulated a partial analysis in the sense that they study either the financial performance or the social performance. In fact, they failed to remember the complexity of the relationship between sustainability and outreach. According to some authors, outreach and financial sustainability are complementary because whenever the number of clients increases, MFIs enjoy economies of scale. Hence, it reduces the costs which help them to be financially sustainable (Meyer (2002), Rhyne (1998)). For Woller and Schreiner (2006) financial self-sufficiency and depth of outreach are not inherently dichotomous. Rather, they have a complex, multidimensional relationship that depends on several factors, both direct and indirect. Moreover, financial self-sufficiency is driven by factors that may or may not facilitate deep outreach. The exact relationship between financial self-sufficiency and depth of outreach in a given situation will depend on the way all these factors interact with each other. There is a statistically significant and positive relationship between financial self-sufficiency and depth of outreach. In fact, sustainability seems to play a greater role on the outreach. But on the other side, outreach could impact on the sustainability. Therefore, it is important to analyze them in a simultaneous framework.

All studies have stressed out the impact of subsidies on the sustainability or the tradeoff between sustainability and outreach. However, they did not take into account the socio environmental and cultural context in developing countries. As a result, Besley et al (2001) reported that 82% of lending occurred in the informal sector and 12 % in the formal sector in Nepal. Azam et al. (2001) in another study on the credit markets in Côte d'Ivoire found out that the Ivorian micro entrepreneurs as compared to high and foreign enterprises prefer borrowing from parents and relatives or neighbors. Based on evidence from rural India, Kochar (1992) suggested that the informal sector may also be the sector of choice. She argued that informal loans, in particular that from friends or relatives, may be cheaper than formal loans, therefore, preferred by borrowers. Hence, World Education

Australia (2006) suggested that microfinance services must fit the needs and preferences of clients. The delivery of appropriate financial services to low-income people requires a good understanding of their needs and desires. A good understanding of these factors requires a constant investment in client research and feedback mechanisms. That is important for the long term or institutional sustainability, because the financial self-sustainability is a short term objective. As a result, analyzing the borrowing sources could contribute to reaching this objective. This dissertation tries to fill up this gap.

2.4.2. Empirical studies on the sustainability of MFIs

The attainment of sustainability for most practitioners and researchers requires the covering of total cost and the obligation of the real interest rate by institutions. According to them, low and subsidized interest rates make it difficult to attract depositors (those who will naturally seek to place their savings where they can earn the highest return). They also harm other non-subsidized credit providers by driving them out of business, without ensuring the existence of a long-term replacement. In addition, this situation contributes to attract richer people and others who do not need money, but those who are very skillful at accessing subsidized services.

Several studies have analyzed the factors that can drive to the achievement of sustainability. According to Adongo and Stork (2005), in a study on "Namibian microfinance institutions", the "start-up" capital given by donors, influences significantly and negatively on the MFIs sustainability. On the other side, the group lending method also contributes positively on the sustainability. In their study, they also applied an ordinary least amount square regression to make an analysis of covariance (ANCOVA). The independent variables are regulation, organizational forms and time of loan repayment, start-up capital given by the donors, lending methodology, loans, and per capita income of the area where the MFI is located. Woller and Schreiner (2006) on their part had discovered that, interest rates, administrative efficiency, loan officer productivity and staff salaries are significant for self-sufficiency. Even though it's applied for an ordinary least square for the analysis of sustainability, the methodology used by these authors differs from the other studies because they use the Sala-I-Martin (1997) approach.

This approach consists in regressing several times the same equation. In this approach, two variables (administrative expense ratio and real portfolio yield) are fixed and the other variables are used interchangeably. Ayayi and Sene (2010), find that a high quality credit portfolio is the most determining component of financial sustainability of MFIs, followed by the application of adequate interest rates and effective management to control the personnel expenses.

Using panel data on Uganda microfinance industry, Okumu (2007) finds that the determinants of the sustainability are the ratio of gross loan portfolio to total assets, the average loan size relative to the national per capita income, the real effective lending rates, the age of the MFI, the unit cost of loan disbursed. All these studies do not integrate in their analysis, the complexity of the relationship between sustainability and accessibility.

In addition to variables regularly used in the studies on sustainability, Gringrich (2004) suggests an MFI's orientation and philosophy, for example in an important role. There is also a growing awareness that clients' ownership and participation greatly affect MFIs' performance and sustainability (Zaman, 2004, Morduch, 1999). Bennett et al. (1996) quoted evidence from five South Asian MFIs to illustrate how reliance on member savings improves loan repayment and compels management to control costs. Ashe and Parrott (2002) found out that women's groups in Nepal's Terai are sustainable because they are completely financed by members' savings. Matthews and Ali (2002) reported similar results for remote communities in Bangladesh using savings-led microfinance schemes. According to Baumann (2005), in assessing MFIs' performance toward sustainability, it is particularly important to take into account the level of income inequality in a given society.

2.4.3. Empirical studies on the choice of borrowing source

Several studies had attempted to provide an explanation to the households' choice in borrowing sources. For many policymakers, borrowers base their decisions on one particular loan component which is the interest rate. However, focusing on interest rates

alone is not sufficient to explain borrowers' choices for or against a particular financial intermediary (Nguyen, 2006). Indeed, a research on rural financial markets and household food security in Malawi has shown that the interest rates charged on loans seem not to be an important factor for households in deciding in which microfinance institution to participate. Non price attributes of credit institutions and their services play a larger role (Diagne and Zeller (2001), Diagne (1999)). Chung (1995) and Mushinski (1999) on their side pointed out that high transaction costs related to loan application in the formal sector may discourage households from taking formal loans. For Nguyen (2006), ranking lenders according to interest rates and transaction costs only, implies that in most cases borrowers will deal with lenders with the lowest rates and costs. But borrowers' decisions to accept to participate or not to take part are influenced by other factors as well (Zander, no date, cited in Nguyen, 2006). Schmidt and Kropp (1987) further argued that the type of financial institution and its policy will often determine the choice of source of loans.

For Beck and Demingurc-kunt (2007), in an analysis of data from Indonesia indicated that there seems to be at least much need for consumer credit than for productive credit, and microfinance customers do not seem to react to product offering in ways suggested by the theory. Many low-income households identified by MFI credit officers as creditworthy are reluctant to take on debt. In effect, some borrowers might be afraid of prohibition or the untrustworthiness of the lender, because they formerly have had an overdue debt. Others fear refusal due to lack of collateral. Loan duration also influences borrowing decisions - whether it is compatible with the life cycle or not.

A part from variables related to the MFIs credit policy, borrowers' characteristics too play an impact on the choice of source of credit. Zeller (1994) used an unvaried profit model to estimate factors that determine an individual's borrowing decisions, in terms of their participation in formal or informal credit markets in Madagascar. The results show that amongst informal lenders, some aspects like age, schooling, wage income, sick days and household headship are determinants applications for credit. On the other hand, gender and social events are not significant. In the formal sector, being male significantly increases the probability of applying for a loan. By using a micro-econometric analysis of household surveys, Duong and Izumida (2002), examined the rural household participation in the Vietnamese rural credit market and found out that, total farming area

and total value of livestock are decisively the determinants of borrowing by households from the formal financial institutions. In a study, Nguyen (2007) stated that the number of members in a household is found to have a large and significant effect on credit participation, especially from formal source. Farm work is also significant. Household is more likely to borrow if the head of the household is working in agriculture or self-business. The demand of labor during farm work could be the reasons why larger number of household members affects the possibility of getting loans. Without hiring other people, small family will not have motivation and capacity to expand the family business, conducing to a less participation. Guirkinger (2008) added to these mentioned factors, variables such as wealth, farm size, the existence of other sources of revenue for the households, the household size and the dependency ratio as well as the areas where the borrower lives.

2.5. Summary of the chapter

In this chapter, we intended to provide a literature review and present in a framework, the problem of sustainability and households' accessibility to credit. The literature review revealed both problems were considered as dichotomous. Whereas, achieving both profitability and strong social performance is the ultimate promise of microfinance institutions. Therefore, key research questions for this study are fashioned, based on these results in order to address the gap in the literature. The following chapters will address the problem by attempting to provide frameworks likely to combine both aspects.

CHAPTER 3: EMPIRICAL FRAMEWORK FOR AN ANALYSIS OF SUSTAINABILITY AND ACCESSIBILITY TO CREDIT

The purpose of this research is to investigate how to conciliate the objectives of sustainability and social mission of microfinance. This question is evaluated through several steps. The first step concerns the analysis of the determinants of the sustainability. The next step addresses the question of institutional sustainability through the analysis of the households' decision making a choice of a borrowing source. Finally, the last step develops a theoretical model on how to finance the credit extension.

3.1. Investigation on the factors leading to sustainability of Ivorian MFIs

3.1.1. Theoretical approaches to measurements of Microfinance Activities

Freixas and Rochet (1998) distinguish three approaches to measure the activities of a financial institution. Those are the "production approach", "the intermediate approach" and the modern approach". The first two approaches derived from the classical microeconomic theory of the firm to the banking sector. The third approach goes further and modifies the classical theory of the firm by incorporating some specificity of banks' activities such as risk management and information processing (agency problems).

Hughes and Mester (2008) summarized these three approaches in two broad approaches. For them, when there is a need to measure technology and explain the performance of banks, there exist the nonstructural and structural methods. Using a variety of financial ratios that capture various aspects of performance, the nonstructural approach compares the performance amongst banks and considers the relationship of performance to investment strategies and other factors such as characteristics of governance. It looks for evidence of agency problems in correlations of performance ratios and variables characterizing the quality of banks' governance. While informal and formal theories may motivate some of these investigations, no general theory of performance provides a unifying framework for these studies.

The structural approach is a choice-theoretic and, as such, relies on a theoretical model of the banking firm and a concept of optimization. The older literature applies the traditional microeconomic theory of production to banking firms. The newer literature views the bank as a financial intermediary that produces informationally intensive financial services and diversifies risks, and combines the theory of financial intermediation with the microeconomics of bank production. This helps to guide the choice of outputs and inputs in the bank's production structure.

3.1.1.1 The Structural approaches

The structural approach usually relies on the economics of cost minimization or profit maximization, where the performance equation denotes a cost function or a profit function. The structural performance equation, rarely, denotes a production function.

Under production approach, a MFI's activities are treated as a production of services and it is viewed as using physical inputs such as labour and capital to provide deposit and loan accounts. The intermediation approach is complementary to the production approach, and it differs in the way of specification of inputs –outputs. In effect, the intermediation approach views a financial institution as the intermediate of financial services and assumes that it collects deposits, using labor and capital, then intermediate those sources of funds into loans and other earning assets (Sealey and Lindley, 1977). Thus, the total amount of deposits is an input in the intermediation approach, whereas the number of depositors is an output in the production approach.

3.1.1.2 The modern approach or non-structural approach

The non-structural approach to measure the performance of the banking system, usually focuses on the achieved performance. Then, it is used to measure the dependent variable by a variety of financial ratios, e.g., return on asset, return on equity, or the ratio of fixed costs to the total costs. This approach to the size of bank's activities consists in incorporating the specificities of these activities such as risk management and information processing into the classical theory of the firm. Then, the non-structural approach explores the relationship of performance amongst various bank and the environmental characteristics. This exercise includes the investment strategy of banks, location,

governance structure, and the corporate control environment. For example, the non-structural approach might investigate into the technology system by asking how performance ratios are correlated with asset acquisitions, the product mix of the bank, and the type of society; i.e. if the bank is organized as a mutual or stock owned firm, and the ratio of outside to inside directors on its board (Hughes and Mester, 2008).

3.1.1.3. Theoretical approach adopted in this study

As stipulated in the previous section, there are two approaches used to analyze the performance of the banking system. In the case of microfinance institutions, the problem for the theoretical approach to be adopted is more complex. In fact, performance analysis of MFIs is quite different from banking performance since MFIs have a double mission known as banking and social purpose. But, the non-structural approach is retained here with the selection of variables based on two major aspects of the microfinance system: the social performance (the outreach) and the financial performance (sustainability or self-sufficiency).

3.1.2. Principal Component Analysis (PCA) for creating accessibility index

Principal component analysis (PCA) and Exploratory factor Analysis (EFA) are the two methods composing the factor analytic techniques. In exploratory factor analysis the aim is to explore the field, to discover the main constructs or dimensions. It was for this purpose that factor analysis was originally developed by Spearman (1904), in the area of human abilities (Kline, 1994). It attempts to reduce a set of, say ten variables, into two or three underlying "factors".

Principal component analysis (PCA) constitutes a tool for evaluating and presenting the redundancies between several variables and is often used to graphically represent and summarize the key features of a dataset**.** PCA is applied when the variables are continuous essentially. In general, when several continuous variables are measured, rarely is the data collected on each observation completely independent from one another. In other words, there is often a degree of overlap in the information provided by the data. In this

dissertation, the variables studied for the outreach measurement are essentially continuous, and then PCA will be applied.

Principal component analysis (PCA) is a mathematical procedure to create new uncorrelated variables called principal components from a set of correlated original variables (Everitt and Dunn, 2001). It is therefore a method that reduces data dimensionality by performing a covariance analysis between factors. It is a way of identifying patterns in data, and expressing the data in such a way so as to highlight their similarities and differences. In PCA, linear combinations of variables are formed. The first principal component is that which accounts for the largest amount of variance in the sample, the second principal component is that which accounts for the next largest amount of variance and is uncorrelated with the first and so on. Therefore, each extracted component can write as the following function:

$$C_1 = \hat{a}_{11} \, \mathrm{var}_1 + \hat{a}_{12} \, \mathrm{var}_2 + \hat{a}_{13} \, \mathrm{var}_3 + ... + \hat{a}_{1k} \, \mathrm{var}_k$$
$$C_2 = \hat{a}_{21} \, \mathrm{var}_1 + \hat{a}_{22} \, \mathrm{var}_2 + \hat{a}_{23} \, \mathrm{var}_3 + ... + \hat{a}_{2k} \, \mathrm{var}_k$$

.

.   [3.1]

.

$$C_i = \hat{a}_{i1} \, \mathrm{var}_1 + \hat{a}_{i2} \, \mathrm{var}_2 + \hat{a}_{i3} \, \mathrm{var}_3 + ... + \hat{a}_{ik} \, \mathrm{var}_k$$

The coefficients defining the principal components are obtained from the eigenvalues of either the covariance matrix of the original variables. The software package used in this analysis is SPSS 16.

In addition, the PCA's application required a minimum sample size. Several criteria are defined but there is no consensus about one of them. Thus researchers seeking guidance concerning sufficient sample size in explanatory factor analysis or PCA are left between two entrenched camps- those arguing for looking at total sample size and those looking at ratios such as subject per items(or variables), the number of items per factor and communalities and item loading magnitudes (Osborne and Costello, 2004).

For Osborne and Costello (2004), those that arguing the concept of subject to variable ratios has an important influence in the "goodness" of exploratory factor analysis or

principal components analysis, must remember that Explanatory factor analysis are large-sample techniques, not well-suited to the small sample sizes. Thus, the most valid conclusion regarding sample size is that more is always better. However, if subject to item ratios appeal intuitively to some researchers, and if it leads researchers to utilize samples of a more appropriate size, it is useful. Because in an empirical analysis of data originally published by Guadagnoli and Velicer (1988), Osborne and Costello (2004) found that sample size had less of an impact on factor analysis when there were fewer variables (items) and that both *N* and *N:p* had a larger effect on the 'goodness' of a factor analysis when item loadings were small.

MacCallum et al (1999) suggest that definitive recommendations regarding sample size in factor analysis are based on the misconception that the minimum sample or N: p ratio for meaningful factor analysis is invariant across studies. Thus, they suggest that the minimum sample size depends upon the nature of the data itself, most notably its 'strength'. A strong data is data in which item communalities[15] are consistently high (in the order of .80 or above), factors exhibit high loadings on a substantial number of items (at least three or four) and where the number of factors is small. For them, when a data is 'strong', it greatly reduces the impact of sample size. Therefore, the use of factor analysis in small samples must be carefully considered and explicitly defended in terms of the 'strength' of data. The justification of our sample is based on the strength of our data.

3.1.3.Analytical framework for the determinants of sustainability

Analytical framework for most of these studies is designed from the econometrical tools. They apply the ordinary least square (OLS) method. The main reason is that there is lack of data (Woller and Schreiner, 2006). Nevertheless, some studies have begun using the Panel data analysis (Okumu, 2007). But, when the sample size is small and not able to produce the estimated parameters which should be robust, there will be over-fitting of the estimated data. There is also a preconceived notion concerning the asymptotic properties that lead to the deduction of errors. Some studies suggest the use of discriminated analysis and logistic regression to identify the determinant of the financial performance of a firm.

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[15] Communality is the part of variance that each variable share with another variable.

Indeed, Beaver (1966) and Altman (1968) suggested several models of financial health that began with discriminate-analysis and progress to logit regression models. Many of these models use some form of logit model to estimate the financial state of an organization. More and more, some authors suggest the multinomial model as an alternative approach to analyze the financial state of an organization or firm. Pinder (1996), in his paper on the valuation of a mortgage portfolio, demonstrated multinomial models as an alternative to the traditional approaches. He further suggested that multinomial models should be used in a decision analysis framework in order to provide an approximation of expected monetary value rather than as estimators for the state of the organization's financial status. The reason given by this author is that, since the early works of Beaver (1966) and Altman (1968), several models of financial health based on this approach have been constructed and tested. Consequently, it is important to test other models like multinomial. Fontenla and Gonzalez (2007) also used a multinomial model to examine factors associated with the occurrence of both self-fulfilling and fundamental banking crises. In their study, they put up indexes that distinguish between the two types of crises. This allows the use of a multinomial logit model rather than a binomial logit, to examine the determinants of self-fulfilling and fundamental banking crises. In our case, such models can be limited by the sample size.

Furthermore, since MFIs are particular financial institutions, the analyzing method of their sustainability depends on the link between sustainability and accessibility (outreach). According to Rhyne (1998), outreach and financial sustainability are complementary, and that sustainability serves outreach. That means that a high degree of sustainability of microfinance institutions raises the access to the funding in order to serve their poverty level clients. At the same time, if the number of clients increases, MFIs will enjoy economies of scale. That contributes to reduce costs, and help them to become financially sustainable. For them, both are the two sides of a whole. Consequently, any analysis would be incomplete without considering these aspects. Hulme and Mosley (1996), for their part, the link is an inverse relationship between outreach and financial sustainability. The argument here is higher outreach equals to higher transaction cost in order to get information about creditworthiness of clients and hence make MFI financially unsustainable.

From these debates, the link between outreach and sustainability is summarized as follows:

- Higher sustainability may increases the breadth of outreach. At the same time, breadth of outreach may increase sustainability. Then, we observe two ways of relationship.

- Sustainability is assumed to decrease with the depth of outreach. Higher sustainability plays negatively on the MFIs' outreach. The situation present two ways of relationships.

We could assume either breadth or depth of the outreach has the impacts on sustainability. We could also suppose that sustainability also has the impacts on both. Consequently, a one-sided examination (not taking into account the simultaneity of variables), cannot (completely) capture the interaction between sustainability and outreach in general. Therefore, we assume an interdependence relationship between these two variables. Instead of estimating single equations, we will make use of the simultaneous equations model. Hudon and Traca (2006) use this framework in order to assess the performance in microfinance institutions. It will take into account the possible dependence between outreach and sustainability. This may help us to get the full information.

The works from Nagar (1959), Basmann (1960) are the pioneers' works to consider the simultaneity in some economic relations in econometric analysis.

Let us derive the two structural equations with two endogenous variables and K variables exogenous as follows:

$$Sustainability: sust_i = \beta_0 + \beta_1 outreach_i + \beta_2 x_1 + ... + \beta_k x_k + \varepsilon_1$$
$$accessibility: outreach_i = \alpha_0 + \alpha_1 sust_i + \alpha_2 x_1 + ... + \alpha_k x_k + \varepsilon_2$$

[3.2]

Where $i = 1,...,n$ stand for MFIs, y_{i1} and y_{i2} are endogenous variables, representing operational self-sufficiency and accessibility indicator respectively. $x_1......x_k$. The predetermined (exogenous) variables, and ε_{i1} ε_{i2} are error terms. The β's are coefficients of predetermined variables.

The structural form [3.2] in vector-matrix notation is the most convenient and the most easily manipulated form of expressing the structural equations. In vector-matrix notation, after some computation, the system [3.2] is written as:

$$y_t' \Gamma + x_t' B = \varepsilon_t'$$

[3.3]

The solution of the system of equations determining y_t in terms of x_t and ε_t is the reduced form of the model,

$$\begin{aligned} y_t' &= -x_t' B \Gamma^{-1} + \varepsilon_t' \Gamma^{-1} \\ &= x_t' \Pi + v_t' \end{aligned}$$

[3.4]

For this solution to exist, the model must satisfy the completeness condition for simultaneous equations systems: Γ must be nonsingular.

3.1.3.1.   *Problem of Identification*

Considering equation model [3.2], we wish to express the structural coefficients as explicit functions of the reduced-form coefficients, but it is sometimes difficult or even impossible. Determination of whether there is a one-to-one correspondence between the structural coefficients and the reduced-form coefficients is called the identification problem. The identification problem is not the one of sampling properties or the size of the sample. The identification is prior to choosing the examination method of estimation. If the identification conditions are satisfied, the econometrician may then proceed to estimate the parameters in the model under consideration. Therefore a simultaneous linear equations model is identified if all the equations are identified. Two conditions of identification are usually used by the econometricians that are: Order condition and rank condition.

The order condition for identification is necessary but not sufficient, but the rank condition for identification is necessary and sufficient. If the rank condition for identification is satisfied, the order condition for identification has also been satisfied, but not vice versa.

Let us define the following terms:

M: is the number of endogenous variables in the system of equations. In this case, M =2

[78]

K: the number of exogenous variables in the system of equations, K= 8

k: the number of exogenous variable included in the equation j (Where J =1, 2)

The order condition requires that the number of exogenous variables excluded from equation *j* must be at least as large as the number of endogenous variables included in this equation, i.e. $(K-k) \geq (M-1)$.

The rank condition for identification states that an equation is identified if and only if there exists at least one non-zero determinant of order M-1 in the array of coefficients where those variables excluded from the equation in question appear in the other equations.

3.1.3.2. Method of estimation

The econometricians distinguish three approaches to estimate the simultaneous linear equation model: the naive approach, the limited-information approach, and the full information approach. The simple approach consists in estimating a single equation using the technique of the ordinary least squares method (OLS). This approach ignores the information that the predetermined variables in question are endogenous and exogenous; the estimators are biased and inconsistent because of the inclusion of the endogenous variables into the set of the predetermined variables.

The *limited-information approach* considers one equation at a time, estimating the structural form as does the OLS. It uses the information as to which variables, both endogenous and exogenous are included in the *other* equations of the model but excluded from the equation being estimated. In this group there are, for example, the following methods: the indirect least squares method (ILS), the two-stage least squares method (2-SLS) and *k*-class estimators as the generalization of the 2-SLS.

The full-information approach estimates the entire model of the simultaneous linear equations simultaneously using all information's available on each of the equations of the system. This approach includes two methods: the three-stage least squares method (3-SLS) and full-information maximum likelihood method (FIML). All of these methods are extensions of the two basic techniques of single-equation methods, the ordinary least squares and maximum likelihood.

Three stages least square consists in using as the instruments for Y_j the predicted values in a regression of Y_j on all the x_s in the system. The procedure is as follows:

1. Compute Π by ordinary least square and compute the predicted values of the operational self-sustainability and outreach index respectively.

2. Compute $\hat{\delta}_{2sls}$ for each equation. That means this following steps:

$$\hat{\delta}_{j,2SLS} = \begin{bmatrix} \hat{Y}'_j Y_j & \hat{Y}'_j X_j \\ X'_j Y_j & X'_j X_j \end{bmatrix}^{-1} \begin{bmatrix} \hat{Y}'_j y_j \\ X'_j y_j \end{bmatrix}$$ [3.6]

3. Compute the Generalized least squares estimator and get

$$\hat{\hat{\delta}}_{3SLS} = [\hat{Z}'(\Sigma^{-1} \otimes I)\hat{Z}]^{-1}\hat{Z}'(\Sigma^{-1} \otimes I)y$$ [3.7]

The choice between the two approaches depends on the resolution of identification problem. In fact, when the model is just identified, 2SLS and 3SLS give the same results.

3.1.3.2. *Definitions and Hypotheses on the explanatory variables*

Basing on the literature on the sustainability of MFIs, the independent variables used in this study are given with their expected effects on the operational self-sustainability and outreach index in the table 3.1.

Administrative expense ratio (admexp): This is the most widely used indicator of institutional efficiency. An increase in the administrative expense ratio is assumed to be associated with a decrease in operational self-sufficiency.

Portfolio at risk >30 (par30): according to Berger and Mester (1997), whether it is appropriate to include nonperforming loans or loan losses in the cost or profit function depends on the extent to which these variables are exogenous. They would be exogenous if caused by economic shocks (bad luck), but could be endogenous to the extent that management will be inefficient or will make a conscious decision to cut short-run expenses by cutting back on loan origination and monitoring resources. Berger and Mester (1997) solve this problem by using a ratio of nonperforming loans to total loans in the bank's state as a control variable. This state average would nearly be entirely exogenous to any bank, but could control for negative shocks that will affect the bank output quality. The variable, nonperforming loans, can also play a role of a quasi-fixed "input" whose

[80]

quantity rather than price is included in the performance equation. Under these conditions, the expected effect is that the portfolio-at-risk will have a negative influence on MFI sustainability.

Table 3.1: Description of used variables in financial sustainability and accessibility analysis

variables	Description	Expected Effects on OSS	Expected effects on Outindex
Admexp	Total administrative cost, Continuous variable expressed in percentage of total cost	-	
Par30	Portfolio at risk >30, Continuous variable	-	
Portfolioyield	Portfolio yield, Continuous variable used as a proxy of the nominal real interest	+	
Subsidy	Continuous variable	-	+
Equity	Dummy variable which takes the value 1 if the MFI has an equity fund. It is used as the economic cost	+	+/-
Operational self sustainability (*OSS*)	Continuous variable		+/-
savings	The amount of savings mobilized by the MFI, continuous variable		+
Outreach index (*outindex*)	Synthetic index provided from the ACP analysis	+/-	
Number of year of regulation(*yearregul*)	Number of years the MFI is under regulation control, continuous variable		
Percent of women in clients portfolio (*percwomen*)	Number of women clients in the total clients portfolio	+	+

Portfolio yield: It is equal to total interest income and fee incomes from portfolio divided by average loan portfolio. Portfolio yield is used as a proxy for the effective interest rate. Most practitioner use the increase of interest rate for attaining the sustainability. The expected effect is that interest rate should have a positive effect on the financial sustainability.

Equity: For Hughes and Mester (2008), most studies use the accounting concept of cost, and neglect the economic cost which includes the cost of equity. To solve this problem, they suggest the inclusion of the level of equity capital as a quasi-fixed input in the cost function. Consequently, the increase of this input leads to the improvement of the sustainability. Therefore, there would be a positive effect of the equity on the operational

self-sustainability and accessibility. Equity takes a value 1 if the MFI has an equity fund and 0 otherwise.

Savings: Savings are viewed as an integral part of the future of microfinance. It is not only as an important service for the poor but a means to fund MFIs. It represents the capital used by the MFIs to fund loan provision. We assume that savings facilitates the accessibility to credit.

Outreach index: It is represented by the scores provided from the ACP analysis.
Subsidy: According to "poverty camp", subsidy is the way to extend credit to poor people. In this analysis, the amount of subsidy received by the MFIs is retained as a variable.

The following equations will be estimated:

$$oss_i = \beta_0 + \beta_1 Outindex_i + \beta_2 portfoliyield_i + \beta_3 yearreg_i$$
$$+ \beta_4 percwomen_i + \beta_5 adm\exp_i + \beta_6 equity_i + \beta_7 par30_i + \varepsilon_{i1}$$
$$outindex_i = \alpha_0 + \alpha_1 oss_i + \alpha_2 yearregul_i + \alpha_3 percwomen_i + \alpha_4 subsidy_i$$
$$+ \alpha_5 equity_i + \alpha_6 savings_i + \varepsilon_{i2}$$

[3.8]

3.2. Analysis of the choice of microfinance lending program by the households

Financial sustainability is seen as the ultimate goal of MFIs by the researchers and the practitioners. But the financial self-sustainability is a short term objective. The long term sustainability or institutional sustainability requires that the microfinance institution is well integrated in the environment where it evolves. The knowledge of the motivations underlining the choice of microfinance credit program is very important. For instance, understanding the characteristics of the demand for financial services is even more important, particularly the demand for credit. Most of the advocates in favor of self-sustainability say that reaching this objective could impact positively on the outreach in terms of population growth, and neglect the socio and cultural environment. As said Matin et al. (2002), there is the need to perfectly know the financial service preferences and behaviors of the poor and poorest. The expansion of the scope of microfinance initiatives depends on that. The poor have diverse financial needs including credit for the purchase of small capital assets, working capital and consumption.

To achieve sustainability and improve households' access to credit in Côte d'Ivoire, there is the need to know what explains the participation to a credit program in Côte d'Ivoire. For instance how to enable the understanding by increasing low-income households' access to microfinance credit program. In other words, what are the factors that drive households to borrow from MFIs or others sources? Is it the interest rate? Does the Production purpose conduct the choice? Or is it because there is a lack of information about their services? Or are MFIs too far away from the areas where poor people live? In short, what are the factors influencing households' decision relating to the choice of microfinance credit program?

The second step of the analysis attempts to identify the real motivation of households in their preference as far as microfinance lending programs are concerned. Therefore, the analysis will be essentially on the demand side, i.e. how households make their decisions concerning credit program. Understanding households' decision making on the credit markets has received some attention and has been modeled mainly through discrete choice approach (Nguyen, 2007; Duong and Izumida, 2002; Zeller, 1994). Zeller (1994) used a univariate probit model to estimate the factors that determine an individual's borrowing decisions, in terms of their participation in formal or informal credit markets in Madagascar. The market segments are treated separately in order to identify similarities and differences between the sectors in credit applications and rationing. Nguyen (2007) also separates the source of loan by expecting that the determinants of credit participation will be different as the eligible requirements for borrowing are different between sources. This dissertation adopts the approach of Zeller (1994) that the markets must be segmented in order to capture the feature of each source and modeling the source of credit as substitutes. The framework in which we should analyze the households' behavior is that of the choice theories frame. The underlying concept of the choice theories is known as the decision making process.

3.2.1. The decision making process

The decision making act is the process of making choices amongst competing courses of action. In this case, Choice Theory gives an explanation of why and how all living

creatures behave. Its basis is the idea that we are all driven by five genetic needs -survival, love, power, fun and freedom- which dictate how we must attempt to live our lives. An understanding of these needs as well as the other major components of Choice Theory (the Basic Needs, the Quality World, the Perceived World, the Comparing Place, and the Total Behavior System), can help us build and maintain better relationships with the important people in our lives, having happier and more satisfying lives.

Several theories have been developed from the choice theory to explain the choice made by an economic agent. An economic agent is described as a unit who respond to a scenario called a choice problem. Most of the theories emphasize on the decision making as a rational process, and those who makes this decision.

The decision making of the households which is to choose a source of credit amongst other alternatives can be analyzed in two ways: the access to credit or participation. Despite the fact that the two concepts are used interchangeably, some authors think that a distinction between the two should be made (Zeller, 1994). Accordingly, credit access is essentially the supply side phenomenon of credit markets, because lenders decide whether or not, borrowers may have access to credit; while Participation to a credit program is something that households choose to do freely. Diagne and Zeller (2001) think that this distinction is crucial in carrying out studies on the choice of credit program. In effect, a household may borrow credit from a particular source. On the contrary, borrowing is looked at as a participation of households. Hence, a household may choose not to borrow, i.e., may not participate in the credit market. In this study, the choice problem will be developed in the sense of participation. The decision to apply for a financial institution amongst others depends on a demand for credit, expressed by a member of a household.

3.2.2. Modeling concepts for Household behavior

A proposed framework for the choice process is that in the first stage where an individual determines the available alternatives; next, evaluates the attributes of each alternative relevant to the choice under consideration; and then, uses a decision rule to select an alternative from the available alternatives (Ben-Akiva and Lerman, 1985).

3.2.2.1. The Decision maker

The decision maker in each choice situation is an individual, a household, a group or an institution which has the responsibility to make the decision at hand. The decision maker will depend on the specific choice situation. A common characteristic in the study of choice is that different decision makers face different choice situations and can have different tastes. These differences amongst decision makers should be explicitly considered in choice modeling; consequently, it is important to develop choice models at the level of the decision maker and to include variables which represent differences amongst the decision makers. The decision maker in this analysis is the household[16].

However, some issues arise when the household is the decision maker. He does not know how decisions are taken because of the preferences of household members are neither identical nor independent. The neoclassical school solves these problems by assuming that the household head is not only interested in maximizing own utility but he is also interested in the welfare of the family members. Households are seen as acting as a single unit, making choices as if household members were in full consensus (Armendáriz and Morduch, 2005).

3.2.2.2. The choice set

The discrete choice set offered to the consumer needs to exhibit three characteristics:
- The alternatives must be exclusive. This requirement implies that the person chooses only one alternative from the set.
- The choice set must be exhaustive, meaning that the set includes all possible alternatives. This requirement implies that the person can necessarily choose an alternative from the set.
- The number of alternatives must be finite, meaning that there are a countable number of alternatives in the set. This third requirement distinguishes discrete choice analysis from regression analysis in which the dependent variable can (theoretically) take an infinite number of values.

---

[16] A household is a set of two or more individuals who live together and involved in joint (pairwise or group)decision taking in respect of their allocations of time and money(Apps and Rees, 2007).

Under this choice set, the household makes its choice based on preferences. Assuming that the preferences are complete, reflexive and transitive; then, there is a random utility function $U(.)$ which preserves the ordering preference.

3.2.2.3. The Choice probabilities for choice set

The households' decision for the choice of the credit source can be rationalised by a household utility maximization model in which the contractual relationships between the household and its lenders (as source of loan) are explicitly recognized. Random utility models are widely used to analyze choice behavior and predict choices amongst discrete alternatives in a given set. These models are based on the assumption that an individual's preference for the available alternatives can be described with a utility function and that the individual selects the alternative with the highest utility.

Following the work of McFadden (1978), under the discrete choice approach, this utility is a function of two sets of factors: individual and product characteristics. Let Household specific characteristics be denoted by Z, and overall product characteristics by C, where $C = (x, \varepsilon, p)$ with x representing observed product characteristics; ε unobserved product characteristics, and p prices. It is assumed that households observe all relevant characteristics, unlike the researcher, who may observe some characteristics, but not all. Thus, one may write utility for household i for product j as $U(z_i, x_j, \varepsilon_j, p_j)$.

Let us say households are interested in borrowing a loan from a financial institution. Assume that $j = 1, 2, 3, ...m$ borrowing sources are observed, each with $i = 1, 2, ..., n$ households, the utility derived from the jth choice specified to be given by:

$$U_{ij} = U_{ij}(z_i, x_j, \varepsilon_j, p_j) = U_{ij}\left(z_i, x_j, p_i\right) + \varepsilon_{ij}, \forall\, j = 1, 2, ..., m \qquad [3.9]$$

Where $U_{ij}(.)$ is a deterministic and continue function of utility, and ε_{ij} [17]denotes the random component of the utility. Each household chooses the financial institutions that maximizes its utility, so that household i chooses a financial institution j whenever $U_{ij}(z_i, x_j, p_j, \varepsilon_j) \geq U_{il}(z_i, x_l, p_l, \varepsilon_l), \forall j \neq l$.

---

[17] The error term takes into account the misperception of the choice set by the Household or the difficulty to capture with certainty the different utility levels chosen by the household (Quandt, 1956)

Random utility theory assumes that individuals maximize utility but that modelers only observe noisy estimates of that utility. The chosen alternative for each individual I is that with the highest utility, so that

$$
\begin{aligned}
\Pr[y = j] &= \Pr\left[U_{ij} \geq U_{il}, \forall j \neq l\right] \\
&= \Pr\left[U_{il} - U_{ij} \leq 0, \forall j \neq l\right] \\
&= \Pr\left[\varepsilon_{il} - \varepsilon_{ij} \leq U_{ij} - U_{il}, \forall j \neq l\right] \\
&= \Pr\left[\tilde{\varepsilon}_{lj} \leq -\tilde{U}_{lj}, \forall \ j \neq l\right]
\end{aligned} \qquad [3.10]
$$

The econometrics literature has placed great emphasis in restricting attention from discrete choice models that are consistent with maximization of a random utility function. The conditions, stipulated by McFadden (1981) cited in Cameron and Trivedi (2005), ensure that: (1) well-behaved probabilities and translation invariance, (2) integrability of p_j similar to the Slutsky conditions, and (3) that the distribution function of the errors in the corresponding Additive Random Utility Models (ARUM) have a proper (nonnegative) density function. These are:

Let us say $U = (U_1, \ldots, U_m)$. From Borsch-Supan (1987) cited in Cameron and Trivedi (2005), a set of probabilities $p_j(V)$, $j = 1, \ldots, m$, is compatible with maximization of an ARUM if

$$
\begin{aligned}
&1. \, p_j(U) \geq 0, \ \sum_{j=1}^{m} p_j(U) = 1, and \ p_j(U) = p_j(U + \alpha) \forall \alpha \in R; \\
&2. \, \partial p_j(U)/\partial U_l = \partial p_l(U)/\partial U_l; and \\
&3. \, \partial^{(m-1)} p_j(U)/\partial U_1 \ldots [\partial U_i] \ldots \partial U_m \geq 0
\end{aligned} \qquad [3.11]
$$

3.2.2.4. Models derived from the choice probabilities

Several discrete choice models can be generated by different assumption about the joint distribution of the error terms i.e. $\varepsilon_1, \ldots, \varepsilon_m$.

Using the density $f(\varepsilon_n)$, this cumulative probability can be rewritten as

$$
\begin{aligned}
P_{ij} &= \Pr ob(\varepsilon_{ij} - \varepsilon_{il} < V_{ij} - V_{il} \, \forall j \neq l) \\
P_{ij} &= \int_{\varepsilon} I(\varepsilon_{ij} - \varepsilon_{il} < V_{ij} - V_{il} \, \forall j \neq l) f(\varepsilon_i) d\varepsilon_i,
\end{aligned} \qquad [3.12]
$$

[87]

Where $I(.)$ is the indicator function, equaling 1 when the expression in parentheses is true and 0 otherwise. This is multidimensional integral over the density of the unobserved portion of utility, $f(\varepsilon_i)$. Different discrete choice models are obtained from specifications of this density, that is, from different assumptions about the distribution of the unobserved portion of utility. The integral takes a closed form only for certain specification of $f(.)$. The issues therefore are what distribution is assumed for each model, and what the assumptions underlying these models.

Concerning the errors terms distribution, two broad ways of models specification are defined. An obvious choice for error distribution is that they are normal. The Probit models are based on this assumption that the unobserved factors are distributed jointly normal: $\varepsilon_i = \left(\varepsilon_{1i},...,\varepsilon_{ji}\right) \sim N(0,\Omega)$. When applied to sequences of choices over time, the unobserved factors are assumed to be jointly normal over time as well as over alternatives, with any temporal correlation pattern. The main advantage of the probit models is that they allow the relaxation of the homoscedasticity hypothesis. Its only functional limitation arises from its reliance on the normal distribution. In some situations, unobserved factors may not be normally distributed. In addition, the probit multinomial model can be applied to a small set of alternatives (at least three or four) because the computations involve evaluating multiples integrals.

The second group of models is derived from the assumption that ε_{ij} is iid extreme value for all i. These are the Logit models and are widely used because of their easy computation. But they rest on an important assumption which is the Independence of irrelevant alternatives (IIA). The IIA property states that for any individual, the ratio of the probabilities of choosing two alternatives is independent of the presence or attributes of any other alternative. In effect, the ratios of probabilities for each pair of alternatives depend only on the attributes of those alternatives and not on the attributes of the third alternative; and these ratios of probabilities would remain the same regardless of whether that third alternative is available or not. In fact, the independence of irrelevant alternatives property allows the addition or subtraction of an alternative from the choice set without

affecting the structure or parameters of the model. This assumption, while restrictive, provides a very convenient form for the choice probability.

However, the assumption of independence of irrelevant alternatives can be inappropriate in some situations. The assumption of independence also enters when a Logit model is applied to sequences of choices over time. The Logit model assumes that each choice is independent of the others. In many cases, one would expect that unobserved factors that affect the choice in one period would persist, at least somewhat, into the next period, inducing dependence amongst the choices over time.

The development of other models has arisen largely to enough avoid the independence assumption within a Logit. Generalized extreme-value models (GEV) are based, as the name implies, on a generalization of the extreme-value distribution. The generalization can take many forms, but the common element is that it allows correlation in unobserved factors over alternatives and collapses to the Logit model when this correlation is zero. Depending on the type of GEV model, the correlations can be more or less flexible. Mixed Logit allows the unobserved factors to follow any distribution. The defining characteristic of a mixed Logit is that the unobserved factors can be decomposed into a part that contains all the correlation and heteroskedasticity, and another part that is iid extreme value.

3.2.3. Households'model of sectoral choice of borrowing

A discrete choice model is a mathematical function which predicts an individual's choice based on the utility or relative attractiveness of competing alternatives. The model generally includes characteristics of the individual (e.g., age, gender, and income) and relative attributes of competing choices. It also might include environmental factors, personal attitudes, or other factors which are thought to influence the choice in question. The model is developed from a data set containing individual trip decisions, characteristics of alternative choices for the trip, geographical characteristics, and characteristics of the individual. This chapter studies the household's decision making in matter of source of borrowing. As stated early, when the household decide to borrow from

one source amongst others, he chooses the alternative which gives him higher utility. The offered choice set can be in order and in disorder; but this latter is the more convenient choice set for household decision making.

Assume a household, denoted i, faces a choice amongst J alternatives with $J = \{1, 2, 3, 4, 5, 6, 7, 8\}$ where

1: *Bank and financial institutions*
2: *Companies of framing*
3: *Credit unions*
4: *Social funds*
5: *ROSCAs*
6: *Moneylenders*
7: *Cooperatives*
8: *others*

The chosen alternative by the household procure more utility than the other alternatives. This utility is denoted U_{ij} with $U_{ij} > U_{ik}, j \neq k$ meaning Alternative j is chosen. The utility is derived from each choice specified to be given by the above equation [3.11].

Formal providers are defined as those that are subject not only to general laws but also to specific banking regulation and supervision (development banks, savings and postal banks, commercial banks, and non-bank financial institutions, credit unions). However, formal or semi-formal providers may also be registered entities subject to general and commercial laws but not under bank regulation and supervision (companies of framing and social funds). Informal providers are non-registered non-regulated groups, such as rotating savings and credit associations (ROSCAs) and cooperatives, moneylenders and other (friends, family).

The supervision or regulation of certain institutions aims at protecting customers and allowing access through limiting the price for credit, which is lower than those practiced by non- regulated institutions. It also aims at securing financial operations by requesting to respect managerial norms like prudency and demanding for operational autonomy. The effects of this regulation are felt at the level of access or demand for credits and financial products because conditions for borrowing from these institutions may become difficult to fulfill by households. Indeed, this is displayed in the form of prescribed minimum loan amounts, complicated application procedures and restrictions on credit for specific purposes (Schmidt and Kropp, 1987). On the contrary, the service from informal sources

is based on flexible arrangements to adjust to changing economic circumstances, and on reducing the transaction costs to borrowers, who respond by maintaining discipline in order to sustain their access to credit (Atieno, 2001). Unlike formal sources, informal lenders often attach more importance to loan screening than to monitoring the use of credit. Screening practices often include group observation of individual habits, personal knowledge by individual moneylenders, recommendations by others and creditworthiness. Therefore, low income households have to choose between borrowing from formal sources, where credit is cheaper, but where their loan application are usually rejected, or resorting to informal sources where funding is much more expensive.

In order to take into account the major differences between these alternatives, they are grouped as (1) formal institutions for those who are regulated, including banks and financial institutions, companies of framing, credit unions, and social funds; and (2) informal institutions, including moneylenders, ROSCAs, cooperatives and others. When there is a demand for credit, a household will choose to apply to either a formal institution or an informal credit institution, depending on their perceived relative probabilities of obtaining credit from each institution.

Assuming that the household is rational in sense where he makes choices that maximizes its perceived utility subject to constraint on expenditure; it is possible to derive an indirect utility function (Maddala, 1983). Then, the indirect utility level associated to the perceived utility V_{ij}^* denotes the underlying latent variable. The direct utility variables U_{ij} are defined as:

$$U_{ij} = 1 \ \ if \ V_{ij}^* = Max(V_{i1}^*, V_{i2}^*)$$
$$U_{ij} = 0 \ \ \ otherwise$$

[3.13]

However, there are many errors in this maximization because of imperfect perception and optimization, as well as the inability to measure exactly all relevant variables. Some econometricians as McFadden (1974) suggested using a random function where the random term comes with additive manner. Consequently, this indirect utility function V_{ij}^* will be written as follows:

$$V^*_{ij} = V_{ij}\left(z_i, x_j, p_i\right) + \varepsilon_{ij}, \; \forall \; j = 1, 2 \qquad \text{[3.14]}$$

$V_{ij}\left(z_i, x_j, p_j\right)$ represents a deterministic component of utility in which x_j is a vector of observable MFI characteristics, z_i a vector of observable attributes specific to the household ε_j is the random component of utility that represents the unobserved household i's idiosyncratic taste for choosing a MFI j. It is assumed independently and identically distributed.

The probability that household i select formal institutions j as a source of borrowing is also written as follows:

$$\begin{aligned} P(y = 1 \mid x) &= P(x'\beta + \varepsilon \geq \alpha\,) \\ &= P(-\varepsilon \leq x'\beta - \alpha) \\ &= F(x'\beta - \alpha) \end{aligned} \qquad \text{[3.15]}$$

Where F is the cumulative density function of ε. The probability mass function is:

$$f(y_i \mid x_i) = p^{y_i}(1-p)^{1-y_i}, \quad y_i = 0,1 \qquad \text{[3.16]}$$

The equation (3.4) implies the following log density:

$$\ln f(y_i) = y_i \ln p_i + (1 - y_i)\ln(1 - p_i) \qquad \text{[3.17]}$$

The Log likelihood function is

$$l(\beta) = \sum_{i=1}^{1392} \left\{ y_i \ln F(x'\beta - \alpha) + (1 - y_i)\ln(1 - F(x'\beta - \alpha) \right\} \qquad \text{[3.18]}$$

The regression parameters β and the threshold parameters α are obtained by maximizing the log likelihood equation [3.18].

$$\frac{\partial l}{\partial \beta} = 0 \qquad \text{[3.19]}$$

The sign of the regression parameters β can be immediately interpreted as determining whether or not the latent variable y^* increases with the explanatory variables. The maximum likelihood is used to estimate this model.

The marginal effect of the jth explanatory variable on the probability of choosing formal source is given by the following equation:

$$\frac{\partial P(y_i = 1 | x_i)}{\partial x_{ij}} = F'\left(x_i'\beta - \alpha\right)\beta_j \tag{3.20}$$

Let's assume that the error terms are identically and normally distributed. Thus, the probit regression will be implemented.

Meanwhile, choice of borrowing source is a two-step process which requires that households demand a loan in the first stage and choose the source where they want to borrow in the second stage. Since this latter is a sub-sample of the first stage, it is likely that the second stage sub-sample is nonrandom and from those who did not demand a loan creating sample selection bias. Indeed, Nagarajan and al. (1995) think that estimates of loan demand or choice of credit source are often biased because they use models that do not adequately fit for selectivity bias. Therefore, it is important to correct this sample bias in order to obtain consistent estimates. Thus, the next section deals with the methods to correct this bias.

3.2.3.1. Sample selection bias problems

In some situations, a binary outcome is observed only for a specific part of a sample. The idea that factors affecting selection into the sample may simultaneously affect the binary outcome of interest, has been the motivation for the introduction of the probit sample selection model (van De Ven and van Praag, 1981). In our case, it is believed that the decisions of choosing a source of borrowing and that of expressing a demand of loan are correlated (both decisions are binary).

The discrete model for choice response is fitted simultaneously with a dichotomous model for the loan demand. In effect, the data set specifies a binary variable that identifies the observations for which the dependent is observed/selected or not observed. In our case, households that demand a loan are observed. The dichotomous model for sample selection assumes that there exists an underlying relationship. The underlying structural framework is a household production model with utility maximizing households, who demand credit (demand = 1) if a loan is expected to increase utility, and they do not demand credit (demand = 0) in the opposite case.

The dichotomous demand selection equation is given by:

$$d = \begin{cases} 1 & if \ d^* > 0 \\ 0 & otherwise \end{cases}$$
[3.21

The latent equation is given as follows:

$$d^* = \delta x + \varepsilon_2$$
[3.22]

The outcome dependent variable y is observed only if $y^* > 0 \ and \ d = 1$. In other words, the dependent equation can be written as follows:

$$y = \begin{cases} 1 & if \ y^* > 0 \ and \ d = 1 \\ 0 & y^* \leq 0 \end{cases}$$
[3.23]

Where the latent equation for outcome equation is $y^* = \beta x_1 + \varepsilon_1$ [3.24]

Assuming the latent errors are bivariate normal and independent of the explanatory variables. The probit model with sample selection can be expressed as follows.

$$y_i^* = \beta x_1 + \varepsilon_1$$

$$y_i = \begin{cases} 1 & if \ y_i^* > 0 \ and \ d = 1 \\ y_i^* \leq 0 \end{cases}$$
[3.25]

$$d_i^* = \delta x_2 + \varepsilon_2$$

$$d_i = 1 \ if \ d_i^* > 0 \ \ and \ 0 \ otherwise$$

Heckman (1990) has shown that selection bias can be overcome by including the inverse Mills ratio from the sample selection equation in the equation of interest. .In this approach, the selection into the sample of those who demand credit is first modeled. Then, the inverse Mills ratio (lambda) from this regression is incorporated into the equation of interest. Heckman (1979)'s two-step procedure can be applied: first, estimate δ by probit of d on x. Then, we get the mills inverse ratio. Second, we run y on the mills inverse ratio λ and x_1 to get β.

3.2.3.2. Endogeneity problem

The endogeneity problem is an explanatory variable in a multiple regression model that is correlated with the error term, either because of an omitted variable, measurement error, or simultaneity. In our case, we are unable to capture the impact of interest rates on the

participation in credit as this variable is not consistently captured in the survey. Therefore, no price variable was included in the empirical model because these variables don't exist in the data. Since Price and Income are the key variables explaining the demand, it creates a correlation between Income and error term. That means there is an endogeneity bias, and, then this estimator is also inconsistent (Yatchew and Griliches, 1984).

Then, their inclusion under the assumption of the information known as the interest rate charged by each source makes the adjusted R-squared equal to one. According to Greene (2003), it indicates a flaw in the model, not a good fit. Rivers and Vuong (1988) cited in Wooldridge (2001) provide a simple test to verify this endogeneity in the case of binary model. They suggest two-stage estimators for probit in order to deal with continuous endogenous explanatory variable. The strategy is to model a continuous endogenous regressor as a linear function of the exogenous regressors and some instruments. Predicted values from this regression are then used in the second stage probit. Therefore, in order to find an instrumental variable for the income, Rivers and Vuong's approach is used (Appendix 2).

Finally, following Pitt and Khandker (1998) and Morduch (1998), we specify the choice of credit as a linear function of household characteristics including the gender of household head, age of the household head, number of household members, education level of the household head, agricultural work, and other variables such as the variables related to the credit contract, house holding and land holding, etc.

The empirical model to be estimated is presented as follows:

$$
\begin{aligned}
dloan_i = \alpha_0 &+ \alpha_1 income^*_i + \alpha_2 mastat_i + \alpha_3 Endown_i + \alpha_4 socioecogrp_i \\
&+ \alpha_5 male_i + \alpha_6 hhsize_i + \alpha_7 area_i + \alpha_8 noproject_i \\
&+ \alpha_9 education_i + \alpha_{10} religion_i + \alpha_{11} age_i + \varepsilon_{1i}
\end{aligned}
\qquad [3.26]
$$

dloan denotes the loan demand equation. *Income* denotes total household income. *Age* denotes the age of household head, *mastat* denotes the marital status of the household head, *endown* denotes whether the household head has a house or not, and land or not, *Socioecogrp* denotes the categorical socio-economic group to which the household head belongs; *male* denotes the head household is male; *hhsize* denotes the number of persons in the household. *Area* denotes the area where lives the household, *noproject* denotes the

household doesn't plan to extend his activity; education *Religion* denotes the religion of the household head, *Age* denotes the age of household head, and ε_{i1} denotes the error term assumed to be normally distributed.

we specify also the choice of credit as a linear function of household characteristics including gender of household head, age of household head, number of household members, religion, education level of the household head, ethnic group, geographical location, and variables related to the credit contract, including time of repayment, loan size, type of activity funded etc.

$$
\begin{aligned}
formal_i = {} & \beta_0 + \beta_1 income_i + \beta_2 assetindex_i + \beta_3 male_i + \beta_4 age_i + \beta_5 age^2_i + \beta_6 hhsize_i \\
& + \beta_7 religion_i + \beta_8 schooling_i + \beta_9 ethnic_i + \beta_{10} area_i \\
& + \beta_{11} timrepaym_i + \beta_{12} loansize_i + \beta_{13} useloan_i + \beta_{14} \lambda + \varepsilon_{2i}
\end{aligned}
\qquad [3.27]
$$

Formal denotes the choice for the choice of formal sources. *Income* denotes total household income, *Assetindex* represents a measure of wealth; *male* denotes the head household is male*; Age* denotes the age of household head, *hhsize* denotes the number of persons in the household, *Religion* denotes the religion of the household head, *schooling* denotes whether the household head is illiterate or not, *Ethnic* denotes the household head ethnic, *Area* denotes the area where lives the household, *timrepaym* denotes the time of repayment of the loan, *loansize* denotes the amount of loan demanded by the household head, use of loan denotes the purpose for which the loan has been taken, and ε_{i2} denotes the error term assumed to be normally distributed.

3.2.3.3. Definitions of Explanatory Variables and expectation signs

While socioeconomic characteristics such as income, wealth, and education play the largest roles in explaining access, there is clear evidence of the effect of other sets of barriers. Thus, the independent variables are:

Gender of household head: Since there is a positive discrimination in favor of women, we think gender a priori influences the demand of credit to formal sources. This discrimination is due to the fact the higher rate of repayment is observed amongst women who are generally poorer than men. Here the variable is *male*.

Education: Higher education level for the head of household assumes better comprehension of the role and the importance of credit and its advantages for consumption smooth, investments. Therefore, higher educational level is hypothesized to be associated with higher probabilities of demanding a loan. Furthermore, the formal sources require more papers to fill. We assume that the probability for a person, who is not educated to take a loan from a formal source, is lower. They avoid them. We make the following hypothesis: households with a good educational level are more likely than the less educated one, to choose more formal financing practices.

Age: We are dividing age into four categories: (1) household head aged less or equal to 24 years, (2) household head aged between 25years and 39 years old, (3) household aged between 40 years and 59 years and (4) household aged from 60 years upward (age60p). Younger (age 24) and older head households are expected to be less likely to demand a loan. Indeed, according to the life cycle hypothesis, these ranges of individuals generally have no revenue flow. The others are hypothesized to be more likely to demand a loan. The effect of age on the source of borrowing is ambiguous.

Time of repayment: represents the variable measuring the loan maturity. The argument is that lenders lend small amount and have maturity periods that minimize costs; often in a way that make their loans less attractive to businesses. Longer is the loan maturity more the household borrows from formal sources.

Size of loan: the expected amount demanded has an effect on the choice of source.

Households' size: The larger the household the greater is its expenditure. In effect, larger family size exerts consumption stress on the household, which is mostly reflected through an increased probability of demanding a loan. However, the sign on the choice of formal source seems ambiguous.

Marital status: head of households who are married are more likely to be stable and financial institutions are likely to view them as more reliable to demand for financial services compared to the unmarried. Therefore, we expect that married head of household has a positive effect on the demand of credit and formal source choice.

Use of loan: Loans are intended to be reproductive, in the sense that the item financed should generate a cash flow from which repayments could be made, and to serve a poverty relief function (Hollis and Sweetman, 2001). The households often examine whether there is need to fund their activity on a loan when involving in income generating activities.

Income: At the household level, the level of income is an important factor that would determine the demand for financial services. Income is the key variable observed by the lenders. Depending on the flow of revenue, households can get credit or not. Then, the choice of formal source is positively correlated to income.

Endowment: The household's wealth includes the endowment such as land, housing and livestock. These variables can be used as a proxy in order to capture this aspect are *house owner,* and *land owner.* These variables can be served as a proxy for collateral. Therefore, the probability of demanding a loan is positively linked to wealth.

Socio economic status: this category includes the public servant, private formal workers, own service and agricultural worker.

Religion: it is a dummy variable that captures the fact that some religion forbids lending for an interest. Those of such religious groups have a higher likelihood to borrow from parents and relatives.

Ethnicity networks: The analysis of the ethnic network to get access to credit is scarce. A number of researches have mostly examined the intersection between ethnicity, credit and entrepreneurship in Africa, but they have not explored ethnic heterogeneity within the indigenous African population (Biggs et al 2002; Fafchamps 2000, 2003; Fisman 2003). Even Azam et al. (2001) do not take into account this heterogeneity of indigenous ethnicity. This research tries to fill this gap.

Area: It is a dummy variable with the following components: Abidjan, other urban areas (*ouarea*), east rural forest (*erf*), west rural forest (*wrf*) and savannah rural (*rsav*). Considering the unequal distribution of credit structures on the entire territory, we could assume this aspect impacts on the households' choice of credit sources.

Table 3.2: **Description of variables, measurement units and expected effects**

Variables	Description and codes	Measurement unit	Expectation sign for borrowing sources	Expectation sign for demand of loan
Income	Total income of household head (FCFA/month)	Number (FCFA/month)	+	+
Household size	Number of household members	Number	-	
Age	Age of household head	Number	(+/-)	
Age24	Age less than or equal to 24 years	dummy		-
Age2539	Age comprised between 25 years and 39	dummy		+
Age4059	Age comprised between 40 years and 59 years	dummy		+
Age60p	Age is equal to 60 years and over	dummy		-
Education		Dummy	NA	
No education	head of household has no education		-	
Low education	head of household has some primary school.	dummy	-	
Medium education	head of household finished primary schooling or continued to secondary school	dummy	+	
High education	Head of household completed secondary or higher.	dummy	+	
Schooling	Head of household has some literacy level	Dummy	+	
Endowment	Household has an endowment			
house	Household has a house	Dummy	+	
land	Household has a land	Dummy	+	
Time of repayment	Is term of loan maturity	number	+	
Use of loans		dummy		
Agricultural activities	Activity generated is in agricultural sector	dummy	+	
Trade activities	The trade activities	dummy	+	
Size of loan	The amount of the loan expected demanded	continuous	+	
gender	Whether the head of household is female, coded 1=female and 0=otherwise	dummy	+	
Socio economic status				
Public service	head of household is employed in Agriculture	dummy		
Private service	head of household is employed in Agriculture	dummy		
Own service	head of household is doing its own business	dummy		
Agriculture	head of household is employed in Agriculture	dummy		
Religion				
Christians	Head of household is christians	dummy	+/-	+/-
Muslim	Head of household is muslims	dummy	+/-	+/-
Ethnic group	The ethnic spoke by the head of household	dummy		
Marital Status				
married	Head of household has a spouse	dummy	+	+
unmarried	Head of household has no spouse	dummy	-	-

3.3. Data Source and Sample

Two different data are used for the analysis. The first data concerns the microfinance institutions performance analysis which is a secondary data. These data have been collected in the income statement and balance sheet of MFIs. They consist in financial and portfolio information over the seven-year period 1999-2005 of the credit unions institutions. These data are delivered by BCEAO and CNM. The data set includes main financial indexes on the financial and physical assets and liabilities (loans, deposits, physical capital, and so forth) which characterize the MFIs performance in Côte d'Ivoire. However, even if 74 MFIs exist, the vast majority of MFIs do not submit their financial statements; creating selection bias. Any conclusions from the proceeding analysis will therefore be somewhat limited. That has been the nature of MFI analysis—limited data followed by limited conclusions. Construction of the sample, however, was limited by many factors.

1- Few credit unions submitted their financial and portfolio data to the regulatory.
2- Still, few amongst credits unions have submitted data regularly over period of analysis.

Therefore, the period 2005 is retained because it is the year where many MFIs have submitted their financial statement. On A preliminary sample where 32 MFIs were chosen, finally 30 MFIs were included, based on the availability of operational and financial information.

The second data used originates from secondary source. The data used in this research is the households Living Standard Survey conducted in 2002 by the National Statistics Institute. The research unit is the household and the people who live in it. The 2002 households Living Standards Survey is a nationwide, multi-topic household survey with modules covering numerous aspects of living standards. The survey contains detailed information on households from all regions of the country. The household survey has 12 sections, gathering data on education, health and employment status of household members, household economic activities, income and expenditure, household size and housing, borrowing and lending activities. It covers 10800 households living in Côte d'Ivoire. Out of 10800 households surveyed, 1392 households have demanded a loan.

They represent 12.88% of the overall sample. This sample is composed of those who have applied for and who have received the total amount, those who have received a part of amount of loan, and those whose application has been refused. Among those who have demanded a loan, about 85.06% expressed a demand to informal sources.

The problem of missing data in survey data is one of long standing, arising from non response or partial response to survey question (Cameron and Trivedi, 2005). Sometimes, this situation occurs because the respondents are not willing to give the answer, or have a difficulty to recall the past events before the survey. Most of the time, they don't know the answer. The questions are related to the way of dealing with it. It is possible to handle missing data without models or use the model based approach. The simplest way is to delete the missing data and analyzing only the reduced sample of complete observation. This is called "listwise deletion". The inconvenience is that the standard errors will be inflated due to the fact less information is used. The second approach is the pairwise deletion. It consists in using all possible pairs of observation to estimate joint sample moments. This approach has two important drawbacks: estimated standard errors and test statistics are biased; the resulting regressors' covariance matrix (X'X) may not be a positive definite. Facing with the inconvenience of the deletion methods, the mean imputation or mean substitution is widely used. It is mean preserving but will have an impact on the marginal distribution of the data. For the purpose of this dissertation, we are using the mean imputation to replace the missing observations.

3.4. How can we integrate low income households in the loan portfolio in order to extend credit access?

The remaining question is about the inclusion of the poor borrower in the loan portfolio. How can we integrate or avoid the exclusion of these borrowers? This question is a critical issue in the new environment of microfinance. Indeed, the new requirements concerning the market oriented approaches imply a competitive environment. This new situation could influence some previous results obtained by the MFIs. As said Armendáriz and Morduch (2005), strong competition can undermine all dynamic incentives. However, most studies don't take into account the competitive environment which occurs actually

(McIntosh and Wydick, 2005). Even if they consider this situation, the researches attempt to demonstrate how this environment leads the borrowers to contract multiples loans, sometimes hidden to the lenders. That would assume an increase of credit risks in the MFIs.

Furthermore, for McIntosh and Wydick (2005), the nonprofit lenders make generally the cross subsidy within their pool of borrowers and that competition eliminates rents on profitable borrowers; it is likely to yield a new equilibrium in which poor borrowers are worse off. As competition exacerbates asymmetric information problems over borrower indebtedness, the most impatient borrowers begin to obtain multiple loans, creating a negative externality that leads to less favorable equilibrium loan contracts for all borrowers. Therefore, two important issues are raised here: how can we deal with the credit risk namely the risk of default? And then, how can we finance this extension? Both issues must be analyzed in the competition context. Thus, it is interesting to know what the industrial organization of the Ivorian microfinance industry is. This section describes the market structure and the model of the interaction between MFIs which will be retained. Then, the type of asymmetry information they face is evaluated.

3.4.1. The structure of microfinance market and competition

The determination of market structure refers to the characteristics of the industry in terms of number of firms, the kind of product produced (homogeneous or differentiated) and easy entry to or exit in the industry. Based on these characteristics, the economists have defined four types of markets: pure competition, monopolistic competition, monopoly and oligopoly.

a) The number of firms

The number of MFIs operating in Côte d'Ivoire was 97 in 2007 (CNM, 2007). The microfinance market is characterized by few firms composed to the large structures and the small structures. The large structures have a significant share of the market so that none of them ignore the behavior of the others. So they are not price takers. The number

of firms: pure competition, monopolistic competition and monopoly competition cannot characterize this market. It would be like the oligopolistic market.

b) The kind of products produced

The loans products are similar but not identical, although they are alike enough to be regarded by the public as very close substitutes in use. The firms in the market don't have the same managerial capacities but use approximately the same technologies of lending (individual lending and group lending). Product differentiation allows these MFIs to set their own price within a limit defined by the usury law. Product differentiation creates the need for advertising in order to call for prices. Concerning the kind of goods, two types of markets may correspond: monopolistic markets or oligopolistic markets.

c) Entry or exit in the microfinance market

Entry into the Ivorian microfinance market is relatively easy because of the small amount of capital required. Also, exit from the monopolistically competitive market is also easy. The following market structures can be applied: pure competition, monopolistic competition and oligopolistic competition.

To summarize, the Ivorian microfinance industry has neither pure competition structure nor monopolistic. The Ivorian MFIs market has an oligopolistic structure. However, one is attempted to ask the following question: what are the features of that market? Are all the firms sizeable? Indeed, the studies on competition in microfinance take the MFIs as the identical firms. That representation does not always reflect the true structure of microfinance industry in the world.

The key element to understand the oligopolistic market is the concept of Mutual Interdependence. This term simply implies that actions of one firm affect the outcome of all the firms. For example, if one firm decides to raise its price, it affects its own demand but at the same time, that price increase policy affects the demand for the other firms in the market as well. In turn, this affects the profits of that firm and all the other firms. This means that all firms have to take into account, not only their own actions, but the actions of all the other firms in the market. Finally, it means that firm's behavior is a form of Strategic Interaction.

The Game theory is the appropriate tool for analysis. The Game theory is referred to as the behavioural study of people in a strategic situation. Strategic decisions are those in which each person who decides what actions to take, must consider how others might respond to that action. An interactive decision involves two or more individuals making a decision in a situation whereby the payoff to each individual depends (at least in principle) on what every individual decides. Since there are some interactions between MFIs, these interactions may concern price setting or quantity offered. These interactions can be simultaneously, sequentially or repeatedly. If it is simultaneously, there is a static game, otherwise the game is dynamic.

3.4.2. Static analysis versus dynamic analysis of competition

A static game is one in which a single decision is made by each player, and each player has no knowledge of the decision made by the other players before making their own decision. Sometimes such games are referred to as simultaneous decision games because any actual order in which the decisions are made is irrelevant.

Static games in industrial economics are two models of competition: Cournot model (competition by the quantities) and Bertrand model (price competition) .Although the models have similar assumptions, they have very different implications. Neither model is necessarily better. The accuracy of the predictions of each model will vary from industry to industry, depending on the closeness of each model to the industry situation.

Some limits could be found to the static approach. Firstly, the Cournot model assumes the MFIs produce the same quantities of loans. In general, the studies on the competition in microfinance take the MFIs as identical firms. That representation does not always reflect the true structure of microfinance industry in the world. The MFIs don't have the same capacities of the production of loan since loan production depends heavily on the savings mobilized. In fact, this industry is characterized by the large structures which mobilize around 80 percent of savings in the overall industry. Therefore, MFIs have a different loan portfolio even though the central bank suggests a loan portfolio around 20% of the savings mobilized. Secondly, a static analysis assumes that the information concerning the choice

of loan portfolio is not known by the MFIs when they make their decisions. In the Ivorian microfinance, it is possible to approximate the loan portfolio allowed by each MFI by regarding the last year performance. Therefore, we assume that the MFIs have information on the loan portfolio in particular small structures have information on the large structures. In conclusion, static analysis cannot be used in this case. Stackelberg model will be developed to assess the dynamic of the competition.

3.4.3. Asymmetry problems

Concerning the asymmetric information, all the studies on the asymmetric information have showed how information asymmetries undermine credit markets in places where potential customers have few assets to offer as collateral (Besley, 1995). For McIntosh and Wydick (2007), the asymmetric information occurs when the lender don't know the existing debt before this current debt. The form of moral hazard that characterizes their model is multiple loans contracting, in which borrowers may obtain more advantageous credit terms through hidden loans from different lenders, with each lender possessing informations only over his own contract with a borrower. Lewis and Sappington (2001) examine the optimal design of contracts when an agent is privately informed about his wealth, his ability[18], and his effort supply. They find that the agent's wealth and ability act as perfect complements in determining the power of the incentive scheme under which he operates. Only if his ability and his wealth both increase, an agent is assured of operating under a more powerful scheme. Their analysis is based on the principal agent problems. The borrowers are not considered.

Gehrig and Stenbacka (2007) focusing on the type of borrowers (talented / untalented or able / unable),discovered that information sharing introduces a welfare tradeoff by promoting equilibrium profits at the expense of talented entrepreneurs whenever market power persists in credit market. As a result, regardless of the reduction of asymmetric information that information sharing allows, it may induce exclusion of creditworthy borrowers from credit markets. As the other models, we take into account the asymmetric

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[18] In some studies, the ability of the borrowers is analyzed in terms of talents. see Gehrig and Stenbacka (2007)

information. In our case, we assume that the asymmetric information is based on the ability of each borrower, as stipulated by Gehrig and Stenbacka (2007). Yet, this aspect will be analyzed in the chapter four.

3.5. Summary of the chapter

This chapter focused on the methodological framework employed. It also described the source of data and the analytical framework employed. It intended to give the different step of the analysis in the conduct of this dissertation.

CHAPTER 4: DETERMINANTS OF SUSTAINABILITY AND HOUSEHOLDS ACCESSIBILITY TO CREDIT

Financial sustainability is seen as the final goal of MFIs by the researchers and the practitioners. This question of sustainability is largely debated by the two schools of thought. Despite their divergence on new orientation of microfinance, they recognize the necessity to target the poor people.

Chapter one discussed of the microfinance industry in Côte d'Ivoire with an emphasis on their low social and financial performance. One feature of Ivorian microfinance is the problem of viability or sustainability and the high rate of default of repayment. Although the requirement of sustainability is crucial, most of the MFIs ignore the main determinants of this sustainability. They only know that they must attain some indicators below some limits as required by the regulators. The chapter two reviewed a literature on the sustainability and accessibility by defining the framework of our analysis. Chapter three described the analytical framework. The current chapter presents descriptive and estimation results of the analysis based on the empirical models developed in chapter 3.

This current chapter is organized as follows: section 4.1 analyzes the factors driving the sustainability. This section presents also the synthetic index computation, and discusses the main findings. Section 4.2 presents the determinants of choice of credit program. Then, section 4.3 discuss o how integrate the low income households in the MFIs loan portfolio when the subsidy is allowed. Finally, section 4.4 makes a summary of this chapter.

4.1 Investigation on the factors leading to sustainability of Ivorian MFIs

4.1.1 Synthetic index computation

As stated in chapter two, a synthetic index for accessibility has been created with the indicators number of borrowers, $-years loan/$-years income, and Gross loan portfolio.

Concerning $-years loan/$-years income, it is interesting to provide some information on how it has been computed. The computation of this indicator included the average term of loan maturity and the GDP per capita. The average term of loan maturity is around 6 months and the GDP per capita reported by the World Bank in 2005 was $850.

Before processing with the PCA analysis, it is important to know if the sample size satisfies the minimum sample size required. As stated by MacCallum et al (1999) when data have the higher communalities, it greatly reduced the impact of small sample size. The table 4.1 presents the correlation between the variables. The correlation matrix shows that the communalities between some variables are greater than .80. That means the sample size is not a problem and that the PCA analysis should be possible.

Table 4.1: Correlation matrix between the three accessibility measures

	Borrowers	$-years loan/$-years income	Gross loan portfolio
Borrowers	1		
$-years loan/$-years Income	.296	1	
Gross loan portfolio	.959	.339	1

Determinant=.71
Source: Computed from the sample by the author with SPSS software

The validity of factor models is tested via Bartlett test and Kaiser–Meyer–Olkin (KMO) test. Bartlett's test of sphericity gives the information if the correlation matrix is the unit matrix or not. The table 4.2 gives the statistics of the test. The sphericity test gives a value of 71.912 with a p-value of 0.000. Bartlett's Test of Sphericity was significant. That means the matrix is not unitary. In addition, the KMO index for the matrix is .538. In conclusion, it is possible to implement the PCA.

Table 4.2 : KMO and Bartlett's Test

Tests		Value calculated
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.538
Bartlett's Test of Sphericity	Approx.x. Chi-Square	71.912
	df	3
	Sig.	.000

Source: Computed from the sample by the author with SPSS software

4.1.1.1 Determination of number of factors

Several methods exist to determine the number of factors. But the most spread method is the Kaiser criterion. This criterion stipulates that only the factors with the Eigen values greater than one must be retained. Based on this criterion, the factor C_1 should be retained. But, it gives 71.2% of our information set. Our goal is to obtain a set of factor which gives us 80% of information. Considering this aspect, factor C_2 with 27.4% of variance is added. Finally, the principal component factors derived are C_1 and C_2, and their cumulative variance is 98.657%.

Table 4.3: Factor loadings and Eigen values

		Total Variance Explained							
	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cum %	Total	% of Variance	Cum %	Total	% of Variance	Cum %
1	2.136	71.216	71.216	2.136	71.216	71.216	1.933	64.430	64.430
2	.823	27.441	98.657	.823	27.441	98.657	1.027	34.227	98.657
3	.040	1.343	100						

Source : computed from the sample by the author with SPSS software

4.1.1.2 Factors interpretation

The rule of thumb is to retain the variables highly correlated with factors for its interpretation if the correlation coefficient is greater than 0.5. The table 4.4 displays the correlation between the two principal component and these indicators. Thus table 4.4 reveals that *borrowers* (.956) and *Gross loan portfolio (.967)* load positively and highly on the first component, indicating a higher value of these variables that leads to higher score on component one. Since these variables represent the breadth of outreach, the first component can be termed "the breadth of outreach". Concerning the second component, the variable $-years loan/$-years income *(.843)* are positively correlated with it. This variable represents the depth of outreach.

Table 4.4: Correlation between variables
and Factors

	Component Matrix[a]	
	1	2
Borrowers	.956	-.259
$-years loan/$-years income	.538	.843
Gross loan portfolio	.967	-.213

Extraction Method: Principal Component Analysis.

a. 2 components extracted.

In summary, the synthetic index can be represented as follows:

$$outindex = 2.136\,C_1 + 0.823\,C_2 \qquad\qquad [4.1]$$

4.1.2. Determinants of sustainability and Accessibility results

4.1.2.1. Order and rank conditions of identifiability

In order to solve identification problem, let us write the system under structural form as presented in the table 4.5.

Table 4.5: Coefficients of structural equations

Equation No	OSS	1	Outindex	portfolioyield	yearregul	Percwomen	Admex	subsidy	equity	Par30	savings
1		1	β_0	β_1	β_2	β_3	β_4	β_5	0	β_6	β_7	0
2	α_1	α_0	1	0	α_2	α_3	0	α_4	α_5	0	α_6

Source: author

Let us begin by the order condition. Applying order condition, each equation is over identified as displayed in the table 4.6. This condition stipulates that the rank of the exogenous coefficients must be equal to the number of endogenous variables less one. Gujarati (2004) stipulates that " *In a model containing M equations with M endogenous variables, an equation is identified if and only if at least one nonzero determinant of order (M-1)(M-1) can be constructed from the coefficients of the variables(both endogenous and predetermined) excluded from that particular equation but included in other equations of the model.*"

[110]

Table 4.6: The order condition application

Equations No	Number of variables excluded (K-k)	Number of endogenous variables included less one (m-1)	Nature of Identification
1	2	1	Over identification
2	3	1	Over identification

Source: author

This condition stipulates that the rank of the exogenous coefficients must be equal to the number of endogenous variables less one. Gujarati (2004) stipulates that " *In a model containing M equations with M endogenous variables, an equation is identified if and only if at least one nonzero determinant of order (M-1)(M-1) can be constructed from the coefficients of the variables(both endogenous and predetermined) excluded from that particular equation but included in other equations of the model.*"

In our case, from equation one in table 4.5, we get a matrix called A which is as follows:

$$A = \begin{pmatrix} 0 & 0 \\ \alpha_4 & \alpha_6 \end{pmatrix}$$

We could get at least two determinant of order (1, 1) from this matrix. Those determinants are $|\alpha_4|$ *et* $|\alpha_6|$. Therefore, equation one is identified.

From equation two also, we derive also a matrix B with the following components;

$$B = \begin{pmatrix} \beta_2 & \beta_5 & \beta_7 \\ 0 & 0 & 0 \end{pmatrix}$$

We could get also three nonzero determinant of order (1, 1) which is $|\beta_2| |\beta_5|$ *et* $|\beta_7|$.

Equation two is also identified.

Since each equation is over identified, for the purpose of this study, the three stage least squares methods will be retained.

4.1.2.2. Estimation results

Before starting with the simultaneous equations estimation, some problems must be resolved. These problems concern the multicollinearity problem and the identification problem. Concerning the multicollinearity problem, the Variance Inflation Factor (VIF)'s test of all independent variables is implemented. A rule of thumb defined by Chatterjee

and al. (2000) shows that there is presence of multicollinearity if the largest VIF is greater than 10 or mean VIF is larger than 1. The VIF diagnostic does not reveals the presence of multicollinearity.

Estimates of the simultaneous equation model are presented in Table 4.7. It is important to note that the variables *portfolioyield, admexp, yearregul, percwomen, subsidy, par30 and savings* are taken under the logarithm form. The software used is STATA 10. The model is globally significant since the chi2 test rejects the null hypothesis that all coefficients are zero for both equations. The table 4.5 reveals that the following variables are significant and have effects on sustainability and accessibility to credit. These variables are:

➤ *Equity*

The sign of equity is as expected. The equity has a positive effect on the sustainability. When a MFI has an equity funds, it increases its operational self-sustainability about 20.1 %. The reason is that Equity is the owned resource of the microfinance institution; the managers put in place the good practices of management and restrictive rules of loans delivering in order to reduce the losses. However, equity does not contribute to increase the number of borrowers.

➤ *administrative expense*

The administrative expense has negative effect on sustainability and the sign is as expected. That means that the MFIs do not run efficiently at the administrative level. Administrative costs include administrative costs of making payments, keeping open offices, cost of loan monitoring, transaction costs etc but the largest component is salaries due to the very labor intensive nature of microlending. First, the cause of this situation could be also related to the technology of lending used by the microfinance in Côte d'Ivoire, here individual lending. The individual lending has high transaction costs which becomes more important face to asymmetric information problems. In addition, for many Ivorian MFIs, lack of independent transportation to reach their clients contributes to increase their administrative costs. In fact, they rely on an inadequate public transportation system, taxis, and their feet to reach their clients. That has an great effect on loan monitoring.

Table 4.7: Results of Three Stage Least Square (3SLS) estimation

Dependent variables: OSS and outindex	OSS equation Coefficient	Outindex equation Coefficient
OSS		1.175
		(1.136)
Outindex	.054	
	(.063)	
Portfolioyield	.0198	
	(.042)	
Years regulation	-.0563	.231
	(.0832)	(.468)
Percwomen	.114**	-.258
	(.0552)	(.318)
Administrative expense	-.237***	
	(.0525)	
subsidy		.061*
		(.035)
equity	.201*	-1.288*
	(.115)	(.656)
Par30	.045	
	(.080)	
savings		.483***
		(.149)
Constant term	-.129	-8.42***
	(.236)	(2. 966)
Number of observation	30	30
R2	65.32	52.71
Chi2	54.44	33.59
p-value	.0000	.0000

Note: the number in parentheses represents the standard deviations.
***, **, and * denote the level of significance 1%, 5% and 10%

➢ *Subsidy*

Subsidy has a positive and significant effect on the outreach. That confirms the fact that subsidy is necessary for allowing the access to credit to poor.

➢ *Savings*

Savings plays a positive role on the outreach. The explanation is that savings constitute the main source of funding of the ivorian MFIs.

> *The constant term*

The constant term is also negatively and significantly correlated to the accessibility to credit. It assumes without the inclusion of the variables related to MFIs, some external factors such as the government's attitudes towards microfinance institutions, the overall financial system. In fact, sometimes the loan contracts are not easily enforceable, rendering the MFIs not be willing to lend. The problem observed is that there is a lack of well-defined judiciary and effective laws to protect the MFIs in case of non payment of loan. Then, market structure, the socio-cultural environment in which the MFIs evolve, and the political instability etc., would influence the accessibility. That could indirectly impacts on the long lasting of the microfinance. From this result, it is important to analyze the impact of these external factors, in particularly the impact of socio-cultural environment. For that, a study of the behavior of potential borrowers is made.

A credit contract is defined simultaneously by the amount, purpose, cost of borrowing, nature of collateral and the repayment schedule. These are determined by negotiation between borrowers and lenders in the financial market. So, factors influencing access to credit of households will be those that affect both decisions making of households and behavior of lenders in their respond to the demand of the borrower. Thus, in order to increase access to credit, one has to identify the factors that influence the borrower's choice. The existence of other sources of credit such as informal source (friends, parents, relatives, moneylenders, etc.) and formal source (Banks) which are beginning to offer the microlending and micro-savings products, leads to the competitive environment such as the revenue from the increase of interest which could diminish. Then, the borrower is able to compare each source and substitute the microfinance product of credit with the cheaper source. Furthermore, the structural reform also imposes the understanding of the households' behavior in order to adapt the credit policy. What explain the households' preference in matter of credit choice source?

4.2. Analysis of the choice of microfinance lending program by the households

4.2.1. Descriptive characteristics of the sample households

Out of 10800 households surveyed, 1392 households have demanded a loan. They represent 12.88% of the overall sample. Amongst those who have demanded a loan, about 85.06% expressed a demand to informal sources. The following sections give some description of this sub- sample.

4.2.1.1. Household composition and demographic characteristics

The demographic profile of the 1392 respondent household indicates that the average age of a household head is 42.59 years and about 84.63% of them fall in the economically active population (ages 18-59). The majority of household heads (53.59%) have no formal education. Approximately 19.40% and 22.49% of them have low and medium education respectively. Christians and adherents to non-traditional religion and those without religion constitute about 36.78% and 24.14% respectively, against 38.15% of Muslims. 30.68% of households live in other urban areas (Table 4.8). A large proportion of household heads is active as showing the belonging to a socio economic group. The socio economic categories gather the workers of agriculture sector such as peasants, the public sector workers such as civil servants, the workers of private sector, and managers of small and medium enterprises. The statistics reveal that the majority of households belong to the category of private sector workers for the choice of for formal institutions. The majority of the household head are married, which is a sign of household stability. Male-headed households constitute 82.33%.

The average household size in the entire sample is 5.66 persons per household. Concerning the income, the average value of income for formal sources is inferior to those of the informal sources suggesting low income households prefer demanding loans from the formal sources. The asset variable is a combination of the asset data which are all dummy variables, indicating whether households own those assets or not. Principle component analysis has been used to create the asset index, to proxy wealth and captures ownership of tangible assets. The assets considered are consumer durables goods. Owning

some assets are determining for the choice of formal source since those assets could be used as collateral. Then, the formal institutions favour house owning households as is evident from the higher share of formal borrowing in the category of households owning a house. On contrary, a land owning household is predominant for informal sources.

Then, from the table 4.8 below, we notice that the religious Christian and muslim households are the ones who applied more for loans. Nevertheless, the Christian households are the ones who choose more informal sources for their loans applications, whereas the moslem households go more towards formal institutions.

4.2.1.2. Community network variables and source of borrowing

The potential borrowers share some cultural similarities and us. They include ethnic groups and religion groups. Some Ethnic groups facilitate the access to credit of their members (Azam et al., 2001). Hence, a majority of credit transactions amongst these groups occur in the informal sector. From the figure 4.1 below, we notice that the transactions with the informal sources represent more than 80 percent of the overall transactions.

At the ethnic group level, we notice that some ethnic groups like more the informal sources. It is mainly the case of Akan group, south mande and other African ethnic groups. On the contrary, the Kru group and North mande prefer formal sources whereas for the remaining groups the preference is not so clear.

Figure 4.1: Ethnic groups and choice of credit sources
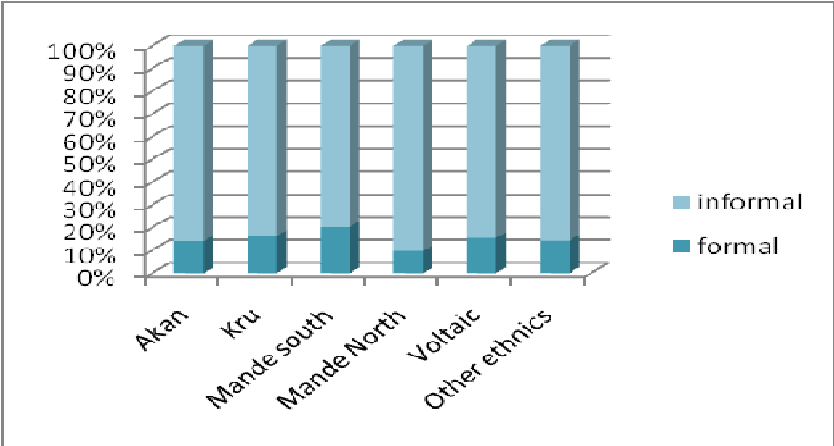
Source : realised by the author from INS survey 2002

4.2.1.3. The features of loan contract

➢ Time of repayment

Considering the factors related to loan contracts, the time of loan repayment ranges from 1 to 75 months with mean about 2.74 months in the survey. The mean of formal credit time of loan repayment is 3.48 months, while the mean of informal credit is 2.61 months. The time of repayment varies from 1 to 36 months in the formal institutions. In the informal institutions, the time of repayment ranges from 1 to 75 months. The modal value of time of loan repayment for all types of sources is one month.

➢ Use of the loan

The first objective of loan is to create revenue from an activity in order to improve living conditions of households. Most designs of loans product in MFIs concern production purposes. Indeed, about 91.82% of total borrowing from the formal sources was for production purposes (agriculture and trade). Loans from informal sources were also mainly used for production. The statistics give about 90.87%. However, it has been noticed that agricultural activities remain the first activities for which each source is chosen. Loan demands for agricultural activities have, about a proportion of 58.17% and 60.81% respectively for formal and informal sources. That is due to the fact that the majority of households lives in rural areas.

Table 4.8: Summary statistics of variables used in the credit choice

Variables	Full sample of loan demanding households	Demanding formal loan	Demanding informal loan
Characteristics of the household head			
Age composition (%)			
Age of the household head	42.59 (14.46)	41.1 (13.68)	42.85 (14.58)
Age (Less than 18 years)	0.79	0.48	0.33
Age (from 18-59 years)	84.63	86.53	84.29
Age (+ 60 years)	15.01	12.98	15.37
Gender (%)			
Male	82.33	80.76	82.60
Female	17.67	19.24	17.40
Marital Status (%)			
Married	70.50	66.83	71.19
Unmarried	16.6	19.71	16.13
Other (divorced, separated, widow, widower)	12.8	13.46	12.66
Education (%)			
No education	53.5	56.25	53.12
Low education	19.4	19.71	19.34
Medium education	22.5	20.19	22.88
High education	4.5	3.84	4.64
Area (%)			
Abidjan	17.2	18.75	16.89
Other urban areas	30.7	35.09	29.89
Eastern rural forest	17.2	17.78	17.06
Western rural forest	18.4	12.98	19.42
Rural savannah	16.5	15.38	16.72
Socio-economic group (%)			
Agricultural worker	22.9	18.75	23.65
Public services	5.4	4.32	5.57
Private formal services	20.2	22.59	19.76
Own business	16.7	15.86	16.89
Other occupation	17.0	17.78	16.89
Characteristics of the household			
Household size	5.66 (4.01)	4.88 (3.46)	5.35 (3.87)
Income (in 1000 FCFA)	60.4049 (141.891)	37.8188 (53.579)	64.3727 (151.873)
Assets (between 0 and 1)	.0442	.2299	.0115
Owning house (%)	49.14	50	48.98
Owning land (%)	54.38	45.67	55.91

Table 4.8: Continued

Community network variables			
Religion (%)			
Christian	39.22	35.57	39.86
Muslim	36.64	41.82	35.72
Other religion (traditional, other religions, no religion)	24.14	22.59	24.41
Ethnicity (%)			
Akan	29.74	27.88	30.06
Kru	14.15	15.38	13.96
Mande south	8.91	5.76	9.45
Mande north	12.43	16.82	11.65
voltaic	13.58	13.94	13.51
Other African ethnic	21.19	20.19	21.36
Characteristics of the loan			
Time of repayment (in months)	2.74 (4.12)	3.48 (5.13)	2.61 (3.87)
Loan size (in FCFA, in log.)	11.507 (1.857)	12.74 (1.805)	11.29 (1.781)
Purpose of loan (%)			
Trade activities	30.6	33.65	30.06
Agricultural activities	60.42	58.17	60.81
Transport activities	0.43	0.48	0.42
Other activities	8.55	7.69	8.69

Source: own computation from 2002 INS Survey Data
Note: (.) represents the standard deviations for continuous variables

4.2.1.4. Poverty status of the household

Poverty is recognized as a complex and a multidimensional phenomenon. The contested issue is whether poverty is mainly attached to material needs or whether it is about a much broader set of needs that permit well-being (or at least a reduction in ill-being). The question raised in many debate is who constitutes 'the poor'? Several approaches are attempting to answer to this question. The first definition which is mostly used by the international organizations is the monetary approach. According to the World Bank, it is the state of living on a less than $1 a day. It is the situation where poverty is defined in absolute terms. It refers to levels of income which do not guarantee a cover of basic physical needs. According to this conception, all people who live on less than a certain amount of money are considered poor.

The recent survey on households made by the National Statistic Institute of Côte d'Ivoire in 2005 reveals that 86% of individuals give this definition of poverty. But, Poverty is more than just lack of funds. It also relates to vulnerability, defenselessness, and dependency (Bhatt and Tang, 2001). Vulnerability refers to the economic instability of

poor or very poor families. Unexpected sicknesses and other difficulties can be all it takes to drive a family deep into poverty. Finally, Poverty could be defined as the lack of access to goods and services such as education, health, jobs, clean water, electricity, roads, so on. If no action is driven, that could lead to chronic poverty. Chronic poverty occurs when an individual experiences significant capability deprivations for prolonged periods, which some researchers think should be about five years or more (Chambers, 1997).

This study makes a poverty status of the household base on the monetary approach. Indeed, the XOF poverty annual line per capita in Côte d'Ivoire is taken to define the low income households. This poverty line is about 183450 FCFA[19]. That leads to 15287.5 FCFA per month. In our sample, 55.96% of households fall under this line. This proportion of households will be called "the poor" or low income households. In addition, the households can have the similar income but the other characteristics are different. Those specificities could impact on the household credit program choice. The 55.96% of households falling under the poverty line are composed essentially of economically active households (77.32%). The ranges of 25-39 and 40-59 have 32.79% and 35.56% respectively. This poverty status influences on the choice of the source of credit by the households.

Table 4.9: Households' distribution by income and age

Age Group	Income level	
(in years)	Low income	Higher income
<=24	8.97	6.55
25-39	32.79	46.34
40-59	35.56	38.13
60+	22.68	8.98
Total	100	100

Source: own computation from 2002 INS Survey Data

The tables below give the distribution of the income according to age and education levels. The distribution of range of age according to income supports the life cycle hypothesis. Most of the young household and the old household heads are poor. Their percentages are 78.31% and 80.69% respectively.

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[19] This line of poverty is defined by the INS in the DSRP document 2009.

Table 4.10: Percentage of households heads age by income

	Age_25	Age 2539	Age4059	Age 60+
Low income	51.88	35.76	42.33	66.51
Higher income	48.12	64.24	57.67	33.49
Total	100	100	100	100

Source: own computation from 2002 INS Survey Data

The studies on income state that the income level depends on the education attainment. 60.03% of households with low income are not educated.

Table 4.11: Repartition of households according to income and education level of household heads.

	Low income	High income
No education	60.03	48.52
Low education	22.51	16.94
Medium education	15.17	28.24
High education	2.28	6.29
Total	100	100

Source: own computation from INS 2002 survey data

4.2.2. Empirical results of borrowing sources

As stated earlier, Heckman's two steps approach is used to estimate the determinants of choosing a credit program. Before proceeding to the regression analysis, we take into account some potential problems with the following econometrics methodology. In order to avoid multicollinearity, we compute Variance Inflation Factor (VIF). The rule of thumb defined by Chatterjee and al. (2000) applies that there is presence of multicollinearity if the largest VIF is greater than 10 or mean VIF is larger than 1. The results reveal that there is no multicollinearity problem (Appendix B). The software used is STATA 10.

4.2.2.1. Demand of loan estimation

Before starting with the demand equation results, let's analyze the stated endogenous problem. As stated in chapter Three, Rivers and Vuong's approach permits a simple test on the residuals from income regression. This test reveals that income is correlated with

the error term in the demand equation. That means that there is endogeneity. In order to deal with this problem, an instrumental variable is used. This is the predicted value of income from income regression (Appendix C).

Concerning the demand of loan equation, the convectional Wald test statistic is significant at 1%. It rejects the null hypothesis, that all coefficients are zero. Knowing the sign of the parameter is enough to determine whether the variable has a positive or negative effect on demand equation. Therefore the following variables are relevant to explain the demand of loan: income, owned land, Own business, household size, no development project, other urban areas and Eastern rural forest.

(a) Individual and household variables

➢ *Income*

The effect of income is positive and significant for demanding a loan. That demonstrates that a household demands a loan when its income is higher.

➢ *Endowment*

Owning a land increases the probability of demanding a loan. In effect, the probit estimation displays a positive sign for owned land. The explanation is that the land could be used as collateral by the household.

➢ *Socio economic group*

Regarding the socio-economic groups to which the household head belongs, it can be seen that the head of household who is doing its own business is least likely to demand a loan. This negative effect is explained by the fact take the loans from these sources require the provision of business registration, procedure enterprises, or complex tax procedure and the collection of public revenue, documents they do not have sometimes and necessitate money for their establishments.

➢ *Household size*

The household size has a significantly positive effect on the probability of borrowing. A greater number of household members imply higher expenses. Most of the time, the budget cannot cover the expenses of the all members of the household. Therefore, in order to smooth their consumption, households have to borrow.

Table 4.12: Probit estimation of the demand of loan

Dependent variable: demand of loan

Explanatory Variable	coefficients	Standard error	Marginal effects	Standard error
Predicted Income	1.11e-07**	4.73e-08	1.39e-08	.000
Matrimonial status				
Married	-.041	.0622	-.0052	.008
unmarried	.0077	.0724	.0009	.0091
Endowment				
House	.0561	.0391	.0071	.005
land	.2012***	0392	.0255	.0057
Socioeconomic group				
Agricultural worker	-.060	.0466	-.0073	.0056
Public services	.0517	.0879	.0067	.0118
Private formal services	-.0185	.0517	-.0023	.0064
Own business	-.1401***	.0511	-.0163	.0057
male	.0112	.0531	.0014	.0066
Household size	.0186***	.0052	.0023	.0007
Area				
Other urban areas	.1569***	.0498	.0207	.0073
Eastern rural forest	.1008*	.0605	.0132	.0084
Western rural forest	.0638	.0613	.0082	.0082
Rural savannah	.1003	.0643	.0132	.0089
No project	-2.464***	.3017	-.164	.004
Education				
low education	.0091	.0462	.0011	.0058
medium education	-.0114	.0484	-.0014	.006
Higher education	-.0805	.0901	.0095	.0101
Religion				
Christian	.0365	.0447	.0046	.0057
Muslim	-.0323	.0451	-.004	.0056
Age				
Age less or equal 24 years	.0338	.0834	.0043	.011
Age between 25 and 39	-.0267	.0569	-.0033	.0071
Age between 40 and 59	-.029	.0530	-.0036	.0065
constant	-1.204***	.0848		
Number of obs	= 10800	Prob > Chi2	=.000	
Wald chi2(25)	= 160.22	Pseudo R-squared	=.1013	
Pseudo log likelihood	= -3729.5996			

*Note: z denotes z-statistics; *** significant at 1%, ** significant at 5%, *significant at 10%*

> ➢ *no project*

The fact that the head of household have no development project for his/her activities has negative effect on the probability of demanding a loan.

> *Areas*

Comparatively to the household head that lives in Abidjan, the household's head who lives in other urban areas and eastern rural forest demand a loan.

In the second step of this analysis, we try to determine the factors influencing the choice of formal versus informal sources.

4.2.2.2 Choosing formal source estimation results

Again, the convectional Wald test statistic is significant at 1%. It rejects the null hypothesis that all coefficients are zero. The predicted probability of choosing formal source is 11.56%. That confirms the fact that there is preference for informal sources in Côte d'Ivoire (Azam and al., 2001). It demonstrates the higher role of social capital as source of borrowing in the Ivorian context. The following variables have been found relevant to explain the choice of formal source.

(a)Individual and household variables

> *Income and wealth*

Income has a negative effect on the likelihood that a formal source is chosen. This result is opposite to what is expected. In the table 4.13, we noticed the average income of households who use formal sources was low. This suggests that a household, who applies for loans, do so in order to smooth consumption. So when his income increases, the household will not apply for formal loans because he meet himself his needs.The importance of personal wealth is confirmed here by the positive effect of the variable asset index, proxy of wealth, on the choice of the formal sources. In addition, the age of the household head raises the probability of borrowing from formal sources.

> *age*

Age raises the probability of borrowing from formal sources. However, when the household head becomes old, that decreases the probability of borrowing from formal sources.

> *Area*

The effect when the household head lives in western rural forest and rural savannah comparatively to Abidjan is negative on the probability of borrowing from formal source. In fact, households living in such regions have difficulties to access facilities, higher

transaction costs and as such they do not choose formal institutions. This result is in line with the unequal distribution of MFIs on the whole territory, as stated by the national commission of microfinance (CNM, 2005). The magnitude of these effects when the household head lives in western rural forest and rural savannah are a decrease of 6.7% and 6.3% respectively. This result corroborate Guirkinger (2008)'s finding and Swain (2002)'s finding that areas where the borrower lives has an impact on the choice of source of borrowing.

(b) Community network variables

> *Ethnicity*

Compared to other ethnic groups, the Kru are most likely to choose formal sources for borrowing. Indeed, the probit results display a positive and significant sign, as compared to the reference group of other ethnic group. The marginal effect is an increase of 8.4%. The ethnic network plays an important role in relations between the households in Côte d'Ivoire through the imposition of social sanctions for misconduct of a member of the network. But it also imposes the respect of strong kinship ties requiring acute sense of forgiveness for the person that went wrong has. Therefore, depending on whether the household comes from an ethnic group where social sanctions are higher, the use of formal loans will be chosen for fear of losing his reputation. That explains why the households from the ethnic groups as Kru and Akan, North mande or voltaic prefer the formal sources.

(c) The variables related to credit contract

> *Loan size*

The size of the loan is positively and significantly related to the probability of choosing the formal credit program. Indeed, the probit results display a positive and significant effect of the loan size for the choice of formal source. That supports the presumption in the literature that informal institutions are far more effective at financing small borrowers than the formal institutions. Therefore, when the loan size is larger the household will choose formal sources. The higher transaction costs that are typically related to borrowing from formal sources may in the case of larger loan sizes become relatively smaller. A

100% increase of the loan size is associated with an increase in the probability of choosing the formal sources of 4.37%.

Table 4.13.: Probit Estimation of borrowing from formal sources

Dependent variable: formal source choice

Explanatory Variable	coefficients	Standard error	Marginal effects	Standard error
Income	-2.68e-06 ***	6.69e-07	-5.22e-07	.0000
Assetindex	.229***	.075	.0447	.0149
Male	.012	.122	.0022	.0236
Age	.032*	.0187	.006	.0036
Age squared	-.0003*	.0002	-.000	.00004
Household size	-.001	.0148	-.0002	.0029
Schooling	-.048	.107	-.009	.0208
Religion				
christian	-.079	.121	-.015	.023
Muslim	.184	.158	.037	.033
Area				
Other urban areas	-.188	.141	-.035	.025
Eastern rural forest	-.256	.162	-.045	.025
Western rural forest	-.402**	.174	-.067	.024
Rural savannah	-.381**	.170	-.063	.023
Ethnic				
Akan	.208	.156	.042	.033
kru	.371**	.183	.084	.047
Mande north	.241	.163	.052	.038
Mande south	-.030	.213	-.005	.040
voltaic	.112	.163	.022	.035
Time of repayment	.011	.0108	.002	.002
Loan size	.224***	.026	.043	.005
Use of loan				
Trade activities	.099	.165	.019	.033
Agricultural activities	.273*	.153	.051	.028
Inverse Mills ratio	.905	1.458	.176	.283
cons	-4.591	.659		
Number of observations	= 1392	Prob > Chi2	=.000	
Wald chi2(22)	= 126.84	pseudoR-squared	=.1279	
Pseudo log likelihood	= -511.94384			

*Note: *** significant at 1%, ** significant at 5%, *significant at 10%*

(d) Production purpose

➤ *Use of loans*

The purpose of the loan, such as to finance trade activities or agricultural activities, shows that a positive effect is observed for the choice of formal sources when it concerns agricultural loans, as compared to other activities. Loans for agricultural activities are

5.16% more likely to be taken from formal sources, corroborating the results by Nguyen (2007).

Understanding the socioeconomic factors influencing the households' choice of borrowing sources is useful for future policy designs and for the institutional sustainability of microfinance. The variables such as income, household size, the socio economic groups, no project, land owner, age, loan size, ethnicity and areas have been found important. From their effects, some lessons can be drawn for improving the microfinance practices. This study has permitted to appreciate the effect of the loan size, use of loan, income, on the choice of the source.

The loan size is one of the criteria to choose the formal credit programs. In the new environment, loan size is a discriminating factor for the MFIs, because if the loan is large, then the risk is higher. Consequently, the borrowers with some level of wealth will be retained. The remaining question is about the inclusion of the poor borrower in the loan portfolio. How can we integrate or avoid the exclusion of these borrowers?

4.3. Integration of low income households in the loan portfolio

4.3.1. Model

Our model is more related to the McIntosh and Wydick (2005)'s work in the sense that the competition is taken into account. However, this study differs from theirs in matters of the type of competition. In fact, McIntosh and Wydick (2005) model a Bertrand competition instead of the Stackelberg quantity competition even if prices competition seem more appropriate strategic variables to describe the firms as financial intermediation institutions like banks, MFIs, etc. The reason is that there is a usury law which requires to the MFIs not to charge an interest rate greater than 27%. Furthermore, like McIntosh and Wydick, we do not integrate the double competition, i.e simultaneous competition on outputs (loans) and inputs (savings). Yet, we assume that the MFIs fund their loans on the mobilized savings.

The assumption is also made that the MFIs can discriminate according to wealth: like to provide loans to rich borrowers. Therefore, we analyze the optimal design of contracts in a setting where the borrower is privately informed about his ability. The Lenders can observe the initial wealth. The model also assumes that the loan size is the same for all lenders and this size is large. Therefore, the way for MFIs to increase your financial revenue is to charge a high interest rate, and thus reduce the number of borrowers in their portfolio. Furthermore, we show that the discrimination according to the wealth makes poor borrower worse off as them. Consequently, we add the ability of the borrowers as an important variable that the MFIs must consider. Finally, our model does not include the possibility to contract multiple loans and the asymmetric problem related to the loan repayment. We also reduce the observed oligopolistic market to the duopoly since we assume that the follower MFIs are small and have the same behavior.

Let us consider the case of a duopolistic industry of lenders with two lenders $j = 1, 2$, engaging in the Stackelberg competition over a finite but large pool of borrowers indexed by $i \in \{1, 2, ..., n\}$. The MFI leader has a higher market share in terms of savings mobilization and loans provisions. Each borrower has to borrow the same amount v to finance a project that yields him verifiable benefits $\overline{\beta} \geq 1 + r$ if it is successful with probability 1-p, and $\underline{\beta} < 1$ otherwise with probability p. we assume that even when the contract leaves borrowers with no rent, they still prefer borrowing. Lenders offer loan contracts to borrowers at a fixed administrative cost. Lenders finance these projects from a proportion of deposits. If $\delta > \underline{\beta}$ is the interest rate paid on deposits, then it constitutes the unit cost of capital for the MFI j which have the possibility to receive some grants. A large firm or a leader has a marginal cost advantage because he can mobilize more savings than a small firm or a follower. Both of them face the inverse demand function which is $r(L) = a - bL$ where $L = l_1 + l_2$ and $l_j = n_j v$. L stands for the loan portfolio or the amount of loan disbursed. l_1 the amount of loan disbursed by the leader and l_2 the amount of loan disbursed by the follower. N is the number of borrowers and v is the loan size.

Assumption 1: $(i)\, r(L) > 0; \quad a > L; \quad (ii)\, r'(L) < 0 \;\; et \;\; r''(L) \leq 0; \quad (iii)\, a > c$

C is the marginal cost of lending.

Lenders have a screening technology that allows them to categorize borrowers on wealth basis, mainly for sustainability or viability constraint. Unfortunately, they do not have information on the ability of those borrowers. So, "rich" borrowers are composed of people whose revenue allows them to have access to other sources of credit such as banks. Note that as Lewis and Sappington (2001), wealth could be in other terms than cash like a land, physical assets or social capital. The rich borrowers represent a proportion θ of the total potential borrowers and $1-\theta$ for the poor borrowers.

Assumption 2: The probability of failure decreases with the wealth.

$(p_w < 0 \quad and \quad p_{ww} \geq 0)$

Then, we assume a borrower may be "able, and therefore reduces the chances of failure i.e. he makes some effort toward the success of the investment. The lender knows that the borrower is able with a probability α and unable with $1-\alpha$.

Assumption 3: The ability reduces the probability of failure i.e. $p_e \leq 0 \quad and \quad p_{ee} \geq 0$

The timing of this game is defined as follows: first, the Stackelberg game between firms to define the loan portfolio. Second, the game implies the problem of choice of the type of borrower, i.e. poor or rich

The payoffs of this game is defined as follows for a lender j,

$$\pi_j = (1-p)(1+R(L))l_j + p\underline{\beta}l_j - cl_j - F_j \qquad [4.5]$$

4.3.2. Increasing the number of borrowers and optimal funding mechanisms

4.3.2.1 Increasing the number of Borrowers

<u>*Case 1*</u>: <u>*Marginal cost normalized to zero*</u>

First stage: Stackelberg game resolution

In the Stackelberg game, the timing is as follows: (1) large MFI chooses a quantity $l_1 \geq 0$; (2) the small MFI observe l_1 and then chooses a quantity $l_2 \geq 0$

To solve this game, we proceed by backward induction which consists in computing first Small MFI's reaction to an arbitrary quantity chosen by Large MFI.

$$\max_{l_2 \geq 0} \pi_2 \left(l_1, l_2\right) = \max_{l_2 \geq 0}(1-p)(1+a-bl_1-bl_2)l_2 + p\underline{\beta}l_2 - F_2 \qquad \text{[P.2]}$$

First order condition gives:

$$\frac{\partial \pi_2}{\partial l_2} = (1-p)(1+a-bl_1-bl_2)-(1-p)bl_2 + p\underline{\beta} = 0$$

$$= (1-p)(1+a-bl_1)-2(1-p)bl_2 + p\underline{\beta} = 0$$

this yields

$$l_2(l_1) = \frac{1+a}{2b} + \frac{p\underline{\beta}}{2(1-p)b} - \frac{1}{2}l_1 \qquad \text{[4.6]}$$

The large MFI's problem in the first stage of the game is as follows:

$$\max_{l_1 \geq 0} \pi_1 \left(l_1, l_2(l_1)\right) = \max_{q_1 \geq 0}(1-p)\left[1+a-bl_1-b(\frac{(1-p)(1+a)-b(1-p)l_1+p\underline{\beta}}{2b(1-p)})\right]l_1$$
$$+ p\underline{\beta}l_1 - F_1 \qquad \text{[P.3]}$$

First order condition

$$\frac{\partial \pi_1}{\partial l_1} = \left[\frac{1}{2}(1-p)(1+a) - b(1-p)l_1 - \frac{1}{2}p\underline{\beta}\right]$$

$$+ p\underline{\beta}$$

$$= \frac{1}{2}(1-p)(1+a) - b(1-p)l_1 + \frac{1}{2}p\underline{\beta} = 0$$

This yields the following result

$$l_1^* = \frac{(1-p)(1+a) + p\underline{\beta}}{2b(1-p)} \qquad\qquad\qquad\qquad \text{[4.7]}$$

And

$$l_2^* = \frac{(1-p)(1+a) + p\underline{\beta}}{4b(1-p)}$$

$$and \quad L^* = \frac{3(1-p)(1+a) + 3p\underline{\beta}}{4b(1-p)} \qquad\qquad \text{[4.8]}$$

as the backward induction outcome of the Stackelberg duopoly game.

$$n^* = \frac{3(1-p)(1+a) + 3p\underline{\beta}}{4bv(1-p)} \qquad\qquad\qquad \text{[4.9]}$$

These equilibrium quantities depend on the probability of failure p.

Let's study the sign of n^*. Before deriving the sign of n^*, notice n exist if $4bv(1-p) \neq 0$.

That means if $p \neq 1$

We know $a > 1$ and $0 < p < 1$

$\forall p \in [0,1[$ We have $3(1-p)(1+a) + 3p\underline{\beta} > 0$

Secondly, $\forall p \in [0,1[$ we have $4bv(1-p) > 0$

And then, the product of $3(1-p)(1+a) + 3p\underline{\beta}$ and $\frac{1}{4bv(1-p)}$ is positive.

Let us try at which value of p, $n^*=0$.

$$3(1-p)(1+a)+3p\underline{\beta}=0$$

$$3(1+a-p-pa)+3p\underline{\beta}=0$$

$$\Rightarrow p=\frac{1+a}{1+a-\underline{\beta}}\notin[0,1[$$

In conclusion, $\forall\, p\in[0,1[$, $n^*=\dfrac{3(1-p)(1+a)+3p\underline{\beta}}{4bv(1-p)}>0$

The integer part of the n is: $\lfloor n^*\rfloor=\dfrac{3(1+a)}{4bv}$ [4.10]

Case2: Marginal cost exists and is equal δ

$$\max_{l_2\geq 0}\pi_2\left(l_1,l_2\right)=\max_{l_2\geq 0}(1-p)(1+a-bl_1-bl_2)l_2+p\underline{\beta}l_2-\delta l_2-F_2 \qquad [P2']$$

First order condition gives:

$$\frac{\partial\pi_2}{\partial l_2}=(1-p)(1+a-bl_1-bl_2)-(1-p)bl_2+p\underline{\beta}-\delta=0$$

$$=(1-p)(1+a-bl_1)-2(1-p)bl_2+p\underline{\beta}-\delta=0$$

This yield

$$l_2(l_1)=\frac{(1-p)(1+a)+p\underline{\beta}-\delta}{2b}-\frac{1}{2}l_1 \qquad [4.11]$$

The large MFI's problem in the first stage of the game is as follows:

$$\max_{l_1\geq 0}\pi_1\left(l_1,l_2(l_1)\right)=\max_{q_1\geq 0}(1-p)\left[1+a-bl_1-b(\frac{(1-p)(1+a)-b(1-p)l_1+p\underline{\beta}-\delta}{2b(1-p)})\right]l_1 \qquad [P.3']$$
$$+p\underline{\beta}l_1-\delta l_1-F_1$$

First order condition

$$\frac{\partial\pi_1}{\partial l_1}=\left[\frac{1}{2}(1-p)(1+a)-b(1-p)l_1-\frac{1}{2}p\underline{\beta}+\frac{1}{2}\delta\right]$$
$$+p\underline{\beta}-\delta$$
$$=\frac{1}{2}(1-p)(1+a)-b(1-p)l_1+\frac{1}{2}p\underline{\beta}-\frac{1}{2}\delta=0$$

This yields the following result

[132]

$$l_1^* = \frac{(1-p)(1+a)+p\underline{\beta}-\delta}{2b(1-p)}$$

[4.12]

And

$$l_2^* = \frac{(1-p)(1+a)+p\underline{\beta}-\delta}{4b(1-p)}$$

[4.13]

$$and \quad L^* = \frac{3(1-p)(1+a)+3p\underline{\beta}-3\delta}{4b(1-p)}$$

As the backward induction outcome of the Stackelberg duopoly game.

$$n^* = \frac{3(1-p)(1+a)+3p\underline{\beta}-3\delta}{4bv(1-p)}$$

[4.14]

Here, after computing the sign of n according to the values taken by p,

$$n^{**} = \begin{cases} \dfrac{3(1-p)(1+a)+3p\underline{\beta}-3\delta}{4bv(1-p)} & iff\ 0 \le p \le \dfrac{1+a-\delta}{1+a-\underline{\beta}} \\[4mm] 0 & iff\ \dfrac{1+a-\delta}{1+a-\underline{\beta}} < p < 1 \end{cases}$$, we also have the same integer part.,

i.e. $\lfloor n^* \rfloor = \dfrac{3(1+a)}{4bv}$ (see Appendix D)

The integer part of n_1 and n_2 are as follows: $\lfloor n_1^* \rfloor = \dfrac{(1+a)}{2bv}$ and $\lfloor n_2^* \rfloor = \dfrac{(1+a)}{4bv}$

We notice that the leader's number of borrowers is two times the one of the follower, i.e.

$$n_1^* = 2n_2^*$$

$$R(L) = a - bL$$

Then, the demand market is equal to

$$= a - b\frac{3(1+a)}{4bv}v$$

$$= \frac{a-3}{4}$$

[133]

Case 3: Provision of additional services, and Marginal cost exists and is equal δ

To increase the borrower's ability is very important. As stated by Pretes (2002), ability and capital are both necessary if micro enterprises want to be successful and ready to provide an income for an entrepreneur and his / her family.

We assume that MFIs can provide some additional services (trainings in education and basic accounting, search market opportunity, sign some contracts with providers of raw materials, insurance products etc.) to borrowers in order to improve their ability. In effect, a very close look at the causes of project's failure reveals that many borrowers have weak management capacity and lack of technical skills in production, marketing and financial control; of course, actions that lead to difficulties in servicing their loans.

Again, borrowers face severe marketing problems as far as their products are concerned. This situation is crucial in agriculture, particularly during peak production seasons. Perishable products, such as agricultural and fish products and the poor transportation systems put together, contribute to the low product-price policy with negative consequences on loan repayment performances. There are some technical reasons like breakdown of machines; wrong breeds of animals; poor quality seeds; and crop failures due to drought; floods or outbreak of pests and diseases; death of livestock or sinking of fishing boats or impact of climate change are basics that also contribute to the failure of loan repayment. Most credit schemes or programs have poor loan follow-up systems and have no regular monitoring visits to borrowers in order to provide advice on loan collection and repayments. Unfortunately, borrowers are left to decide whenever they have to visit project offices. In conclusion, loans are deviated from the original reason for which they have been granted. Integrating insurance for health as additional service can improve borrower's ability.

Assuming the lender charges **m** as the price of the additional service, and the cost is supported by the borrower, the profit for the borrower I is:

$$\pi_i^B = (1-p)(\bar{\beta} - (1+r+m)v \qquad [4.14]$$

m becomes the additional amount supported by the borrower for the additional services. For a lender j,

$$\pi_j = (1-p)(1+R(L)+m)l_j + p\underline{\beta}l_j - \delta l_j - F_j \qquad [4.15]$$

Each lender maximizes his profit

$$\max_{l_j} \pi_j = (1-p)(1+R(L)+m)l_j + p\underline{\beta}l_j - \delta l_j - F_j$$

$$[P.4]$$

The profit function for the lender 2 is:

$$\pi_2 = (1-p)(1+a-b(q_1+q_2))q_2 + p\underline{\beta}q_2 + mq_2 - (1+\delta_2)q_2 - F_2$$

$$\max_{l_2 \geq 0} \pi_2(l_1, l_2) = \max_{l_2 \geq 0}(1-p)(1+a-bl_1-bl_2+m)l_2 + p\underline{\beta}l_2 - \delta l_2 - F_2 \qquad [P2'']$$

First order condition gives:

$$\frac{\partial \pi_2}{\partial l_2} = (1-p)(1+a+m-bl_1-bl_2) - (1-p)bl_2 + p\underline{\beta} - \delta = 0$$

$$= (1-p)(1+a+m-bl_1) - 2(1-p)bl_2 + p\underline{\beta} - \delta = 0$$

That yields

$$l_2(l_1) = \frac{(1-p)(1+a+m)+p\underline{\beta}-\delta}{2b} - \frac{1}{2}l_1 \qquad [4.16]$$

The large MFI's problem in the first stage of the game is as follows:

$$\max_{l_1 \geq 0} \pi_1(l_1, l_2(l_1)) = \max_{q_1 \geq 0}(1-p)\left[1+a+m-bl_1-b(\frac{(1-p)(1+a+m)-b(1-p)l_1+p\underline{\beta}-\delta}{2b(1-p)})\right]l_1$$

$$+ p\underline{\beta}l_1 - \delta l_1 - F_1 \qquad [P.3'']$$

First order condition

$$\frac{\partial \pi_1}{\partial l_1} = \left[\frac{1}{2}(1-p)(1+a+m) - b(1-p)l_1 - \frac{1}{2}p\underline{\beta} + \frac{1}{2}\delta\right]$$

$$+ p\underline{\beta} - \delta$$

$$= \frac{1}{2}(1-p)(1+a+m) - b(1-p)l_1 + \frac{1}{2}p\underline{\beta} - \frac{1}{2}\delta = 0$$

This yields the following result

$$l_1^* = \frac{(1-p)(1+a+m)+p\underline{\beta}-\delta}{2b(1-p)}$$

[4.17]

And

$$l_2^* = \frac{(1-p)(1+a+m)+p\underline{\beta}-\delta}{4b(1-p)}$$

$$and \quad L^* = \frac{3(1-p)(1+a+m)+3p\underline{\beta}-3\delta}{4b(1-p)}$$

[4.18]

as the backward induction outcome of the Stackelberg duopoly game.

$$n^{***} = \frac{3(1-p)(1+a+m)+3p\underline{\beta}-3\delta}{4bv(1-p)}$$

[4.19]

Again here, $n^{***} = \begin{cases} \dfrac{3(1-p)(1+a+m)+3p\underline{\beta}-3\delta}{4bv(1-p)} & iff\ 0 \le p \le \dfrac{1+a+m-\delta}{1+a+m-\underline{\beta}} \\ 0 \quad iff\ \dfrac{1+a+m-\delta}{1+a+m-\underline{\beta}} < p < 1 \end{cases}$

Then the integer part is as follows $\lfloor n^{***} \rfloor = \dfrac{3(1+a+m)}{4bv}$ and is greater than $\lfloor n^{**} \rfloor = \dfrac{3(1+a)}{4bv}$

about $\dfrac{3m}{4bv}$.

We notice that the number of potential borrowers based on increasing ability is greater than the case of wealth judgment. However, lender could not allow this quantity because of some reasons as lack of workers, high costs of transportation, etc. Consequently, this strategy needs some enforcement in order to conduct it to the optimality. To make lenders and Borrowers better off, there must be funds to finance these additional services.

4.3.2.2. Borrowers selection by the MFIs

Reaching financial self-sufficiency is the goal of most of the MFIs. Let's continue with the Stackelberg duopoly game. At this step, we assume that the leader and Follower

choose simultaneously their borrowers and analyze that in two situations of game: one with pure strategies and the mixed strategies.

Case 1: Pure strategies game (selection criteria: level of wealth)

MFIs must choose whether or not, they give loan to poor or rich borrower. Both are the same action set $A_j = \{poor, rich\}$ $with$ $j = 1, 2$

Concerning the payoffs, we are working with the integer parts of the number of borrowers.

Assuming the leader chooses rich and the follower chooses poor, then their payoffs will be as follows:

$$\pi_r^l = \frac{3(1+a)}{4}\theta\left[1-p)(1+\frac{a-3}{4})+p\underline{\beta}-\delta\right]-F_1 \qquad [4.20]$$

$$\pi_r^f = \frac{3(1+a)}{4}(1-\theta)\left[1-p)(1+\frac{a-3}{4})+p\underline{\beta}-\delta\right]-F_2$$

Assuming the leader chooses poor and the follower also chooses rich, and then they get

$$\pi_p^l = \frac{3(1+a)}{4}(1-\theta)\left[1-p)(1+\frac{a-3}{4})+p\underline{\beta}-\delta\right]-F_1 \qquad [4.21]$$

$$\pi_r^f = \frac{3(1+a)}{4}\theta\left[1-p)(1+\frac{a-3}{4})+p\underline{\beta}-\delta\right]-F_2$$

Assuming the leader chooses poor and the follower chooses also poor, and then they get

$$\pi_p^l = \frac{(1+a)}{2}(1-\theta)\left[1-p)(1+\frac{a-3}{4})+p\underline{\beta}-\delta\right]-F_1 \qquad [4.22]$$

$$\pi_p^f = \frac{(1+a)}{4}(1-\theta)\left[1-p)(1+\frac{a-3}{4})+p\underline{\beta}-\delta\right]-F_2$$

Assuming the leader chooses rich and the follower chooses also rich, and then they get

$$\pi_r^l = \frac{(1+a)}{2}\theta\left[1-p)(1+\frac{a-3}{4})+p\underline{\beta}-\delta\right]-F_1 \qquad [4.23]$$

$$\pi_r^f = \frac{(1+a)}{4}\theta\left[1-p)(1+\frac{a-3}{4})+p\underline{\beta}-\delta\right]-F_2$$

Let's assume without loss of generality that the number in brackets is equal to 1 and the fixed costs are equal to zero. Consequently, the matrix form of this game is given as follows:

Table 4.14: Borrower choice Payoffs

	Follower	
	rich	Poor
rich	$\dfrac{1+a}{2}\theta$; $\dfrac{1+a}{4}\theta$	$\dfrac{3(1+a)}{4}\theta$; $\dfrac{3(1+a)}{4}(1-\theta)$
poor	$\dfrac{3(1+a)}{4}(1-\theta)$; $\dfrac{3(1+a)}{4}\theta$	$\dfrac{1+a}{2}(1-\theta)$; $\dfrac{1+a}{4}(1-\theta)$

(Leader — rows)

Several possible games can be derived according to the value of θ. If $\theta = 0$, the optimal strategies for the leader and follower can play are $(poor, poor)$. Then, if $\theta = 1$, the optimal strategies are $(rich, rich)$

Both situations do not reflect the reality of potential borrowers.

Model 2: Mixed strategies game (selection criteria: wealth)

When the leader falls for *rich* and *poor*, the follower plays *rich* if $q < 2\theta - \dfrac{1}{2}$, and *poor* if $q > 2\theta - \dfrac{1}{2}$. Then, follower will be indifferent between the two actions if $q = 2\theta - \dfrac{1}{2}$ with $0 \le q \le 1$ *iff* $\dfrac{1}{4} \le \theta \le \dfrac{3}{4}$.

When the follower falls for *rich* and *poor*, the leader plays *rich* if $w < 5\theta - 2$, and *poor* if $w > 5\theta - 2$. Then, follower will be indifferent between the two actions if $w = 5\theta - 2$ with $0 \le w \le 1$ *iff* $\dfrac{2}{5} \le \theta \le \dfrac{3}{5}$.

Since $0 \le q \le 1$ *iff* $\dfrac{1}{4} \le \theta \le \dfrac{3}{4}$ and $0 \le w \le 1$ *iff* $\dfrac{2}{5} \le \theta \le \dfrac{3}{5}$, hence (q, w) are defined in the interval $\theta \in \left[\dfrac{1}{4}, \dfrac{3}{4}\right] \cap \left[\dfrac{2}{5}, \dfrac{3}{5}\right]$

This interval is $\left[\dfrac{2}{5},\dfrac{3}{5}\right]$, that means the leader and follower will play the probabilities

$\dfrac{3}{10}\le q\le\dfrac{7}{10}$ and $\dfrac{3}{10}\le w\le\dfrac{7}{10}$ respectively.

Some implications could be derived from this optimal set of probabilities. First, any MFIs do not have a pure strategy. Indeed, for a MFI with poverty objectives, she will play the probability 3/10 for rich and 7/10 for poor. For a MFI with sustainability objectives, she will play 7/10 for rich and 3/10 for poor.

4.3.3. Funding mechanisms and borrowers selection

In this section we are dealing with two mechanisms of funding: the direct subsidy and the share equity financing. We are also trying to know how they impact on the number of poor borrowers.

Case 1: Subsidy

Assuming that donors give them a subsidy S to grant loans to poor borrowers, then the payoff of each lender would be as follows:

Table 4.15: Borrower choice Payoffs after Subsidy

		Follower	
		rich	Poor
Leader	rich	$\dfrac{1+a}{2}\theta\,,\ \dfrac{1+a}{4}\theta$	$\dfrac{3(1+a)}{4}\theta\,;\ \dfrac{3(1+a)}{4}(1-\theta)+S$
	poor	$\dfrac{3(1+a)}{4}(1-\theta)+S\,;\ \dfrac{3(1+a)}{4}\theta$	$\dfrac{1+a}{2}(1-\theta)+S\,;\ \dfrac{1+a}{4}(1-\theta))+S$

Again here, since $0 \leq q \leq 1$ *iff* $\dfrac{1}{4} + \dfrac{S}{1+a} \leq \theta \leq \dfrac{3}{4} + \dfrac{S}{1+a}$

and $0 \leq w \leq 1$ *iff* $\dfrac{2}{5} + \dfrac{4S}{5(1+a)} \leq \theta \leq \dfrac{3}{5} + \dfrac{4S}{5(1+a)}$,

Hence (q, w) are defined in the interval

$$\theta \in \left[\dfrac{1}{4} + \dfrac{S}{1+a}, \dfrac{3}{4} + \dfrac{S}{1+a}\right] \cap \left[\dfrac{2}{5} + \dfrac{4S}{5(1+a)}, \dfrac{3}{5} + \dfrac{4S}{5(1+a)}\right]$$

This interval is $\left[\dfrac{2}{5} + \dfrac{4S}{5(1+a)}, \dfrac{3}{5} + \dfrac{4S}{5(1+a)}\right]$, that means the leader and follower will play

the probabilities $\dfrac{3}{10} - \dfrac{2S}{5(1+a)} \leq q \leq \dfrac{7}{10} - \dfrac{2S}{5(1+a)}$ and $\dfrac{3}{10} - \dfrac{2S}{5(1+a)} \leq w \leq \dfrac{7}{10} - \dfrac{2S}{5(1+a)}$

respectively. As conclusion, subsidy reduces the probability of choosing rich borrowers if

and only if the proportion of rich borrowers varies between $\dfrac{2}{5} + \dfrac{4S}{5(1+a)}$ and $\dfrac{3}{5} + \dfrac{4S}{5(1+a)}$.

In other words, subsidy allows the increase of the number of poor borrowers if the proportion of rich borrowers is higher in the population of potential borrowers. The implication of this result is that the lenders will reduce the probability of playing rich when the proportion of rich borrowers is high. Another implication of this result is that the MFIs will continue to choose rich borrower if nothing is made in order to render effective the use of the subsidies.

Case 2: Equity financing

For understanding equity financing, it is important to know the different liabilities and the actors evolving relationship. The credit unions are mainly savings based institutions. Loans are primarily funded through deposits. Institutional capital, and share held by members constitute a small percentage of their liabilities (McDonald, 2000). These share held by members represent equity on the credit unions' balance sheets, which are not included in the savings balances.

Share capital is the act of raising money for company activities by selling common or preferred stock to individual or institutional investors. In return for the money paid,

shareholders receive ownership interests in the corporation. Consequently, Equity financing is an exchange of money for a share of ownership.

Table 4.16: Borrower choice Payoffs after equity financing

		Follower	
		rich	Poor
Leader	rich	$(1-c)\dfrac{1+a}{2}\theta - E$;	$(1-c)\dfrac{3(1+a)}{4}\theta - E$;
		$(1-c)\dfrac{1+a}{4}\theta - E$	$(1-c)\dfrac{3(1+a)}{4}(1-\theta) - E$
	poor	$(1-c)\dfrac{3(1+a)}{4}(1-\theta) - E$;	$(1-c)\dfrac{1+a}{2}(1-\theta) - E$;
		$(1-c)\dfrac{3(1+a)}{4}\theta - E$	$(1-c)\dfrac{1+a}{4}(1-\theta) - E$

Here Again, since $0 \le q \le 1$ iff $\dfrac{1}{4} \le \theta \le \dfrac{3}{4}$ and $0 \le w \le 1$ iff $\dfrac{2}{5} \le \theta \le \dfrac{3}{5}$, hence (q, w) are

defined in the interval $\theta \in \left[\dfrac{1}{4}, \dfrac{3}{4}\right] \cap \left[\dfrac{2}{5}, \dfrac{3}{5}\right]$. This interval is $\left[\dfrac{2}{5}, \dfrac{3}{5}\right]$, that means the leader

and follower will play the probabilities $\dfrac{3}{10} \le q \le \dfrac{7}{10}$ and $\dfrac{3}{10} \le w \le \dfrac{7}{10}$ respectively.

As conclusion, we can say that equity financing leads to the same results when the loan provision is financing with the savings only. In other words, equity financing reduces the number of poor borrowers if the proportion of rich borrowers is low. The implication of this result is that the lenders will increase the probability of playing rich when the proportion of rich borrowers is low. This result is applicable to the MFI with poverty reduction objective and the MFIs with profitability objective.

In summary, the model shows that the increase of the number of borrowers in the loan portfolio requires that a lender improves the ability of borrowers by providing some additional services. At the second step, the results show that the choice of the borrower based on the wealth depend on the value of θ, i.e. the proportion of rich borrowers in the population in the case of mixed strategies. In addition, Subsidy has an effect on the choice

of poor borrowers for the higher value of θ. On the contrary, equity financing gives the same results when for example the loan provision is financed by the savings only. That means equity financing does not contribute to increase the number of poor borrowers in the loan portfolio.

4.4. Summary of the chapter

This chapter presents the findings on mechanisms by combining sustainability and extending low income access to credit. The results revealed that the sustainability of MFIs and household access to credit influenced by factors under MFIs controls and some other factors depending on households' decision for the kind of sources he may choose to borrow money. In addition, it demonstrates that under competitive environment, the provision of additional services contribute to increase the loan portfolio and borrowers as well. Since, these additional services induce the costs; subsidies remain the way to finance the inclusion of poor people in the microfinance institution credit portfolio.

CONCLUSION

1. Summary and policy implications

The failure of banks and public policies in serving poor households, in particular the rural people, have led to find another strategy. That new strategy is a market based strategy and is called microfinance. The ability of lending to the poor leads to the widespread of Microfinance throughout the world. This rapid growth of microfinance has allowed this latter to be most widely recognized as an anti-poverty tool. This system has been growing and as a matter of fact, has become a major component of most financial systems in developing countries. This growth has drawn increasing competition for scarce funding received as subsidies. Donors require that microfinance institutions should be sustainable and be eligible for subsidies (UNCDF, 2004). Therefore, since some decades, MFIs are required to be sustainable in order to allow their integration in the banking system. Lots of them are in the process of undertaking this transformation or at least, considering it. This transformation of microfinance industry towards commercial banks is subject to a great debate, based on the effectiveness of access of the poor and excluded people. In fact, there is a risk that sustainability and profitability might lead MFIs to seek for better-off clients for larger loans. Hence, most microfinance programs state that their primary goal is to alleviate rural poverty by delivering credit and other financial services to poor households, especially to women.

Most of the Ivorian MFIs follow this process. Such an inclusive strategy of MFIs that move towards sustainability would once again leave poor households with limited access to capital in a country whereby the accessibility rate is low. In effect, the analysis of this sector reveals that the penetration rate of financial services is low. Statistics give a geographic penetration of .74 branches over 1000 km2 and a rate of beneficiary of 1.3 branches per 100000 people. At the same time, they could not record a higher rate of financial performance. Further, the analysis shows that the attainment of high performance is the crucial problem faced by the microfinance institutions (return on asset in 2005 is -6.35). The summing up of the study was about investigation on what kind of mechanism should be used in order to achieve sustainability and extending credit access to low income households.

[143]

The next sections resume the major findings of this study, makes some suggestions concerning policies that should be adopted. Again, some contributions and suggestions are made for researchers and future research.

1.1.   Summary of major findings

This study reveals that the Ivorian microfinance sector is facing serious problems of financial performance (low capitalization, non-compliance with regulatory standards established by the authorities, etc.). The penetration rate remains low.

In order to improve both microfinance institutions performance and the rate of penetration, an analysis implemented three steps. The first step concerned the analysis of factor leading both to sustainability and accessibility. An investigation on these factors finds that the Ivorian MFIs sustainability is influenced positively by the equity and the percentage of women in the clients' portfolio. However, MFIs sustainability is influenced negatively by the administrative expense. The results also reveal that the subsidy and savings positively play on the accessibility to credit. However, equity has a negative effect on the accessibility to credit. From all results, the hypothesis one of this dissertation is not confirmed unlike hypothesis which is confirmed.

Knowing the variables which drive sustainability and accessibility is not enough because this analysis concerns the supply side of the market. It is important to find what leads the household to choose one source of borrowing. The reason is that the household can be sensitive to higher interest rate or prefer large loan size. Then the variable influencing the choice of the other sources can be exploited by the microfinance institutions. In other word, it is important to assess institutional sustainability.

The Heckman two steps regression has been used for this issue. The following variables have been found relevant to explain the demand of loan: income, owned land, Own business, household size, no development project, other urban areas and Eastern rural forest. And, amongst the variables that explain these preferences, the major ones are defined in the sense that income has a negative effect on the choice of formal sources. Indeed, whenever an income increases, the probability of choosing these sources

decreases as well. . However, wealth has a positive effect on the choice of formal. Indeed, asset index, proxy of wealth, has a positive and significant sign on the choice of formal source.

Studies have revealed that a head of a given household living in the different areas is a negative effect for on the choice of the formal sources. Furthermore, the ethnicity seems to play a great role in the household's behavior in the matter of the choice of source of credit. Comparatively to other ethnics, the Group of kru prefers borrowing from formal sources. Indeed, the probit results display a positive and significant sign. The marginal effect is an increase of 8.4%. Again, the expected amount demanded has an effect on the choice of sources. Whenever a loan size is larger, household will choose the source that will give large loans as well. The Heckman two steps results display a positive and significant effect of the loan size on the choice of formal sources.

The variables, such as trade activities and agricultural activities, have been used to capture whether the purpose of involvement in productive activities induces the household in the choice of source of borrowing. A positive effect is observed on the choice of formal sources concerning agricultural loans comparatively to other activities. The magnitude is about 5.16%.

As another result from the Stackelberg model, the provision of additional services contributes to increase the loan portfolio and borrowers as well. By so doing, borrower's ability will get improved. However, the selection of the borrowers, under wealth judgment and in case of mixed strategies, reveals for some values of the proportion of the rich, a MFI with poverty reduction objective combine small proportion of rich with high proportion of poor. For the MFI with profitability objective, there will be higher proportion of the rich borrower with small proportion of poor. In order to increase the proportion of the poor, two mechanisms have been analyzed: direct subsidies and equity financing. Our model showed that direct subsidies contribute increase the proportion of poor for the higher value of the rich proportion in both cases. Equity financing does not lead to any change in both cases.

1.2. Recommendation of some policies

From these results, some polices can be drawn as follows:

1. The Ivorian MFIs must reduce the administrative expense through the using of group lending technology. In addition, they can organize weekly meeting in order to reduce the transaction costs.

2. All policy with the objective to improve their operational sustainability of the Ivorian microfinance institutions must integrate the strategies which allow a great inclusion of women.

3. The Government must give some subsidies to MFIs in order to increase the access to credit for the poor. However, since the effect depends on the number of rich borrowers, that must be accompanied by the mechanisms of supervision and monitoring of these subsidies. In addition, that must be also accompanied by some overall social and economic policies which will permit to decrease the poverty level.

4. In order to encourage the households to be interesting by the formal source, it would be important to reduce the procedure of borrowing.

5. The MFIs must increase the loan size, and provide some additional services (trainings in education and basic accounting, search market opportunity, sign some contracts with providers of raw materials, insurance products etc.) for borrowers in order to push up their ability.

Other recommendations are:

1-The creation of a better environment for the development of microfinance; by maintaining a stable macro-economic atmosphere with both, interest rates and inflation kept at reasonable levels. Studies had revealed that the lack of a macro-stability could seriously constrain the growth of microfinance in several countries. Government's regulatory board must adopt some policies by creating an appropriate environment for the growth of the sector, outreaches in particular. Again, government must invest a lot in basics utilities (roads, water, energy, telecommunication, etc.), since poor physical infrastructures, inadequate road networks, poor transportation system and telecommunication systems also increases the costs of operations run by microfinance. In addition, that will encourage the MFIs to locate in the others areas and will increase the low income households' access to credit.

2-There must be a provision of financial statement for MFIs. It will help to conduct a good monitoring of the sector, since the real obstacle encountered for a better sustainability analysis in that industry is the lack of data.

3-The Government must encourage the entry of other microfinance institutions and implement a law for their development and sustainability since it envisages poverty alleviation. Credit unions are essentially profit oriented structures unlike social microfinance structures.

2. Contribution to the empirical research in Côte d'Ivoire

Our contribution to the empirical research in Côte d'Ivoire is in several orders:

1. The results of the various estimates and econometric tests carried out have resulted in concrete proposals for economic policy in the direction of policy makers to reconcile sustainability and access to credit for low-income households in Côte d'Ivoire.

2. The thesis also demonstrates that the subsidy, although designated to help increase access to credit for the poor, the fact remains that its effectiveness depends on the population of rich borrowers. In other words, the grant shall be effective only if other measures are taken to improve social well-being of people, increasing their wealth.

3. Because of this relevance, methodology, results obtained, the thesis is a specific approach, original, and product value, since it sheds light on the understanding of how microfinance in developing economies where Low income households are becoming ever important.

3. Limitations about the study

1. The main limit of this study is the data collection. Research made it clear that few MFIs regularly provide their financial statement to regulators. The unavailability of data could not allow the use of panel data for analysis. In any empirical study, the size of the population is crucial for results. The inclusion of a number of explanatory variables is important as well.

2. Microfinance system encompasses different structures such as village banks, credit union, NGOs, etc.) which provide the microproducts to the excluded people. In our dissertation, working with only the credit unions has an influence on the findings.

4. Suggestions for future research

This dissertation did not bring answers to some relevant questions. Unfortunately, there might have been some methodological limitations during the study. There are some suggestions to enrich future researches on microfinance institutions, not only in Côte d'Ivoire, but in other developing countries.

1. A similar study can be undertaken by using another measure of sustainability instead of the Operational Self Sustainability (OSS) since the information required to construct this measure are available.

2. A similar study can be undertaken empirically by using the panel data if it permits that the unobserved effects should be taken into account and see if the pattern of probability of being sustainable can change over time. It also allows the study of the efficiency of the MFIs.

3. Other researches can explore the integration of the costly state Verification. This could have an effect on the use of equity financing for MFIs and their conduct as well.

4. Studies of field experimentation can be undertaken in order to know the willingness to pay for the additional services.

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APPENDICES

Appendix A

Table A1: Financial statement useful to compute Operational Self Sufficiency (OSS) ratio

REVENUE		EXPENSE	
Financial Revenue from Loan Portfolio	✓	Financial Expense on Liabilities	✓
Financial Revenue from Other Financial Assets	✓	Net Inflation Adjustment Expense	
Other Revenue Related to Financial Services	✓	Subsidized Cost-of-Funds Adjustment Expense	
		Other Financial Expenses	✓
		Loan Loss Provision Expense	✓
		Recovery on Loans Written-Off	✓
		Operating Expense(personal expense plus administrative expense)	✓

Table A.2: The main indicators of outreach

Indicators	Definition	Units of measure
Number of active borrowers	Number of borrowers with loans outstanding, adjusted for standardized write-offs	number
Percentage of women borrowers	Number of active women borrowers/ Adjusted Number of Active Borrowers	percentage
Number of loans outstanding	Number of loans outstanding, adjusted for standardized write-offs	number
Gross loan Portfolios	Gross Loan Portfolio, adjusted for standardized write-offs	Monetary value
Average loan balance per borrower	Adjusted Gross Loan Portfolio/ Adjusted Number of Active Borrowers	Monetary value
Average loan balance per borrower/GNI per capita	Adjusted Average Loan Balance per Borrower/ GNI per Capita	percentage
Average outstanding balance	Adjusted Gross Loan Portfolio/ Adjusted Number of Loans Outstanding (US $)	Monetary value
Average outstanding balance/GNI per capita	Adjusted Average Outstanding Balance/ GNI per Capita (%)	percentage
Number of voluntary savers	Number of savers with voluntary savings demand deposit and time deposit accounts	number
Number of voluntary savings accounts	Number of voluntary savings and time deposit accounts	number
Voluntary savings	Total value of voluntary savings demand deposits and time deposits accounts	Monetary value
Average savings balance per saver	Voluntary savings/ number of voluntary savers	Monetary value
Average savings account balance	Voluntary savings/ number of voluntary savings accounts	Monetary value

Source: The MicroBanking Bulletin, 2009

Table A3: Reports of the descriptive statistics (the means and standard deviations) of the MFIs sample

Variables	Obs	Mean	Std.Dev.	Min	Max
Administrative expense	30	-1.089	1.097	-2.815	.867
subsidy	30	6.806	7.507	0	18.831
Portfolio yield	30	2.418	2.228	0	8.22
Portfolio at risk 30 days	30	-2.102	.597	-4.621	-1.791
yearregul	30	.946	.762	0	2.197
percwomen	30	3.459	1.152	-1.556	4.605
Operational self sustainability	30	.517	.436	0	1.61
outindex	30	-5.46e-09	2.289	-1.021	11.51
Savings	30	17.95	2.438	13.05	24.67
Equity	30	.466	.507	0	1

Table A4: Collinearity diagnostics of variables used in the simultaneous equations estimation

Variables	OSS equation		Outindex equation	
	VIF	SQRT VIF	VIF	SQRT VIF
Outindex	1.85	1.36		
OSS			1.54	1.24
Portfolioyield	2.30	1.52		
yearregul	1.66	1.29	1.54	1.24
Percwomen	1.30	1.14	1.46	1.21
Admexp	1.40	1.18		
Equity	1.24	1.12	1.23	1.11
Par30	1.19	1.09		
Subsidy			1.09	1.04
Savings			1.58	1.26
Mean VIF	1.56		1.47	
Conditional Number	15.457		32.5500	
Det (correlation matrix)	.1970		.3708	

Appendix B

Table B.1: Reports of the descriptive statistics (the means and standard deviations) of the surveyed households

Variable	Description	Mean	St dev	Min	Max
Source					
Formal	= 1 if the household borrows from formal sources				
Gender	= 1 if head of household is male	.823	.381	0	1
Demand of loan	= 1 if the household answer he has been borrowed				
Education					
No education	= 1 if head of household has no education	.535	.498	0	1
Low education	= 1 if head of household has some primary schooling.	.194	.395	0	1
Medium education	= 1 if head of household finished primary schooling or continued to secondary school	.225	.417	0	1
High education	= 1 if head of household completed secondary or higher.	.045	.208	0	1
schooling	= 1 if the head household head has some literacy level	.448	.497	0	1
Socioeconomic group					
Agriculture	=1 if head of household is employed in Agriculture	.229	.420	0	1
Public service	=1 if head of household is employed in Public service	.054	.226	0	1
Private formal service	=1 if head of household is employed in private formal service	.202	.401	0	1
Own business	=1 if head of household is doing its own business	.167	.373	0	1
Other occupation	=1 if head of household is doing other occupation			0	1
Area					
Abidjan	=1 if household lives in Abidjan	.172	.377	0	1
Other urban areas	=1 if household lives in the other urban areas	.306	.461	0	1
Eastern rural	=1 if household lives in Rural eastern forest	.171	.377	0	1
Western Rural	=1 if household lives in Rural western forest	.184	.388	0	1
Savannah	=1 if household lives in Rural savannah	.165	.371	0	1
Time of repayment	the time of repayment of the loan	2.676	4.119	0	75
Loan size	The amount of loan demanded by the household head	1161877	6790604	1e+03	1.34e+08
Matrimonial status					
Married	=1 if head of household is married	.705	.456	0	1
Unmarried	=1 if head of household is no married	.166	.372	0	1
Other matrimonial status	=1 if others (separated, widow)	.128	.334	0	1

Table B1   **Continued**

Religion					
christians	=1 if head of household is Christian	.367	.482	0	1
Moslem	=1 if head of household is muslim	.381	.486	0	1
Other religions	=1 if head of household is other religion	.109	.313	0	1
Household size	Number of household members	5.664	4.009	1	30
Age	Age of head household	42.59	14.461	11	99
Income	Total income of household head (FCFA/month)	60404.9	141891.7	0	3e+06
Type of house					
Villa	=1 if household lives in a villa, apartment	.123	.328	0	1
Set of house	=1 if household lives in a set of house	.506	.500	0	1
Detached house	=1 if household lives in a detached house	.146	.353	0	1
Other (hut, shack)	=1 if household lives in an hut, a shack	.224	.417	0	1
Occupation status of house					
Owner	=1 if household owns the house	.489	.500	0	1
Rented	=1 if household rents the house	.340	.474	0	1
Other occupation	=1 for other occupation	.170	.225	0	1
No project	=1 if the head of household has no project of development of its activity	.038	.193	0	1
Use of loan					
Trade activities	=1 if the head of household demanded the loan for the trade activities	.313	.464	0	1
Agricultural activities	=1 if the head of household demanded the loan for the agricultural activities	.594	.491	0	1
Transport activities	=1 if the head of household demanded the loan for the transport activities	.0057	.075	0	0
Other activities	=1 if the head of household demanded the loan for the other activities	.086	.281	0	1
Ethnicity					
Akan	=1 if the head of household is akan	.274	.446	0	1
Kru	=1 if the head of household is kru	.134	.341	0	1
North mande	=1 if the head of household is north mande	.122	.327	0	1
South mande	=1 if the head of household is south mande	.121	.326	0	1
voltaic	=1 if the head of household is voltaic	.135	.342	0	1
Other ethnics	=1 if the head of household is other ethnic	.212	.409	0	1

source: Own computation from the INS survey 2002

Table B2: Collinearity diagnostics of variables used in the demand of loan estimation

Variables	VIF	SQRT VIF	Tolerance	R-Squared		Eigenval	Cond Index
Income predicted	1.11	1.05	0.8995	0.1005	1	8.4447	1.0000
married	2.96	1.72	0.3377	0.6623	2	1.9051	2.1054
unmarried	2.72	1.65	0.3671	0.6329	3	1.5566	2.3292
House owner	1.40	1.18	0.7164	0.2836	4	1.3411	2.5094
Land owner	1.41	1.19	0.7098	0.3196	5	1.1036	2.7663
Agricultural worker	1.47	1.21	0.6804	0.3196	6	1.0443	2.8437
Public service	1.37	1.17	0.7320	0.2680	7	1.0212	2.8756
Private service	1.66	1.29	0.6037	0.3963	8	0.9804	2.9349
Own service	1.49	1.22	0.6726	0.3274	9	0.9749	2.9431
gender	1.56	1.25	0.6392	0.3608	10	0.8350	3.1801
Household size	1.34	1.16	0.7478	0.2522	11	0.8016	3.2457
Abidjan	1.44	1.20	0.6929	0.3071	12	0.7286	3.4044
Eastern rural	1.58	1.26	0.6313	0.3687	13	0.7092	3.4508
Western rural	1.69	1.30	0.5914	0.4086	14	0.6622	3.5711
Rural savannah	1.66	1.29	0.6030	0.3970	15	0.5810	3.8124
No project	1.07	1.03	0.9379	0.0621	16	0.5435	3.9418
Low education	1.24	1.11	0.8068	0.1932	17	0.3385	4.9944
Medium education	1.53	1.24	0.6553	0.3447	18	0.2978	5.3247
Higher education	1.40	1.18	0.7143	0.2857	19	0.2630	5.6662
Christians	1.76	1.33	0.5686	0.4314	20	0.2491	5.8225
Muslim	1.81	1.35	0.5521	0.4479	21	0.2233	6.1493
Age less than 24	1.74	1.32	0.5742	0.4258	22	0.1722	7.0024
Age between 25 and 39	2.83	1.68	0.3538	0.6462	23	0.1274	8.1422
Age between 40 and 59	2.36	1.54	0.4237	0.5763	24	0.0595	11.9087
					25	0.0361	15.2988
Mean VIF	1.69					Condition Number	15.2988
						Det (correlation matrix)	.0036

Cond Index from scaled raw SSCP (w/ intercept)

Table B3: Collinearity diagnostics of variables used in the formal source choice estimation

Variables	VIF	SQRT VIF	Tolerance	R-Squared		Eigenval	Cond Index
Income	1.07	1.03	0.937	0.063	1	8.147	1.0000
Gender	1.14	1.07	0.874	0.125	2	1.920	2.0598
Age	1.35	1.16	0.743	0.257	3	1.487	2.3411
Household size	1.22	1.11	0.819	0.181	4	1.186	2.6207
Christians	1.81	1.34	0.553	0.447	5	1.042	2.7962
Muslims	3.05	1.75	0.328	0.672	6	1.031	2.8105
Schooling	1.50	1.23	0.665	0.334	7	0.945	2.9368
Akan	2.84	1.68	0.353	0.647	8	0.926	2.9659
Kru	2.21	1.49	0.453	0.547	9	0.777	3.2381
North mande	1.60	1.27	0.624	0.376	10	0.671	3.4850
South mande	1.76	1.33	0.569	0.431	11	0.637	3.5774
Voltaic	1.63	1.28	0.614	0.386	12	0.565	3.7969
Other Urban areas	2.05	1.43	0.488	0.512	13	0.427	4.3692
Eastern rural	1.89	1.37	0.529	0.471	14	0.389	4.5726
Western rural	2.09	1.44	0.479	0.521	15	0.275	5.4416
Rural savannah	2.08	1.44	0.482	0.519	16	0.247	5.7248
Time of repayment	1.03	1.02	0.967	0.033	17	0.121	8.1966
Loan size	1.15	1.07	0.872	0.128	18	0.088	9.6316
Trade activities	4.46	2.11	0.224	0.777	19	0.068	10.9750
Agricultural activities	4.54	2.13	0.220	0.779	20	0.042	13.8560
					21	0.007	33.5283
Mean VIF	2.02					Condition Number	33.5283
						Det (correlation matrix)	.0032

Cond Index from scaled raw SSCP (w/ intercept

Appendix C

C1: Estimation of income

Consider the income model;

$$income_i = \beta_0 + \beta_1 income2_i + \beta_2 t\exp_i + \beta_3 typh_i + \beta_4 msta_i + \beta_5 osta_i$$
$$+ \beta_6 sgrp_i + \beta_7 gend_i + \beta_8 area_i + \beta_9 landowner_i + \beta_{10} motifs_i \quad [C.1]$$
$$+ \beta_{11} Educ_i + \beta_{12} relig_i + \beta_{13} age_i + \varepsilon_i$$

Where:

Inc2	Secondary income from other activities (credit, remittance…)
texp	Total expenditure of the head of household
typh	Type of house captured by a dummy variable
	=1 if villa
	=1 if set of house
	=1 if detached house
mstat	Matrimonial status captured by a dummy variable
	=1 if married
	=1 if no married
	=1 if other matrimonial status
ostat	Occupation status captured by a dummy
	=1 if owner
	=1 if rented
	=1 if other occupation status
sgrp	Socioeconomic group captured by dummy
	=1 if agriculture
	=1 if public business
	=1 if private service
	=1 if owner service
gend	Gender of head of household captured by dummy
	= 1 if male
area	Area where lives the households captured by a dummy
	= if Abidjan
	=1 if other urban areas
	=1 if eastern rural forest
	==1 if western rural forest
	=1 if rural savannah
Landowner	=1 if the household has a land
Noproject	= 1 if the household has no development project
Educ	The level of the education of the household head captured by a dummy
	=1 if no education
	=1 if low education
	= 1 if medium education
	=1 if higher education
Relig	The religion practiced by the household is captured by a dummy
	=1 if Christian
	=1 if Muslim
	=1 if other religion
Age	Age of the head of household captured by
	=1 if less or equal to 24 years
	=1 if comprised between 25 and 39 years
	=1 if comprised between 40 and 59 years

Table C1: Estimation results of Income

Dependent variable: Income

Explanatory Variables	coefficients	Standard error	P>t
Income2	1.0026	.0033	.000
Expenditure	1.072	.2391	.000
Type of house			
Villa	20938.15	6936.23	.003
Set of house	-7325.27	3537.16	.038
Detached house	985.32	3718.51	.791
Matrimonial status			
Married	12586.63	3287.22	.000
unmarried	-15960.12	4724.95	.001
Occupation status			
Owner	4143.46	3476.11	.233
Rented	1906.61	5510.41	.729
Socioeconomic group			
Agriculture	22632.5	3548.63	.000
Public business	103113.6	12530.24	.000
Private service	78475.86	5040.45	.000
Own service	62440.79	5484.64	.000
gender	14670.1	3067.02	.000
Household size	6182.55	1088.39	.000
Area			
Other urban areas	-7531.69	7906.35	.341
Eastern rural forest	4676.04	8782.74	.594
Western rural forest	-8152.87	8798.97	.354
Rural savannah	-11501	7618.77	.131
Landowner	3829.54	3455.02	.268
No project	8003.81	4238.71	.059
Education			
low education	-2813.69	3709.56	.448
medium education	7907.56	5912.28	.181
Higher education	103143.8	13726.18	.000
Religion			
christian	-4380.94	4001.46	.274
muslim	-4655.13	3638.96	.201
Age			
Age less or equal 24 years	5545.83	7388.89	.453
Age between 25 and 39 years	-1853.89	6028.51	.758
Age between 40 and 59 years	16557.58	5924.59	005
cons	-75870.16	16887.18	.000
Number of observations	= 10800	Prob > F	= .000
F(29,10770)	= 3949.173	R-squared	= .6228

Table C2: River and Vuong's endogeneity test

Dependent variable: demand of loan

Explanatory Variable	coefficients	Standard error	P>t
Income	-1.84e-07	1.20e-07	.127
Matrimonial status			
Married	-.0419	.0621	.500
unmarried	.0078	.0724	.914
Houseowner	.0561	.0391	.151
landowner	.2014***	.0391	.000
Socioeconomic group			
Agriculture	-.0605	.0466	.195
Public business	.0509	.0878	.562
Private service	-.0206	.0517	.690
Own service	-.1410***	.0511	.006
gender	.0111	.0531	.833
Household size	.0186***	.0052	.000
Area			
Other urban areas	.1578***	.0498	.002
Eastern rural forest	.101*	.0605	.092
Western rural forest	.064*	.0613	.295
Rural savannah	.101	.064	.116
No project	-2.4633***	.300	.000
Education			
low education	.0089	.0462	.846
medium education	-.0115	.0484	.811
Higher education	-.0857	.0900	.341
Religion			
christian	.0361	.0447	.418
Muslim	-.0321	.04517	.477
Age			
Age less or equal 24 years	.0339	.0834	.684
Age between 25 and 39	-.0256	.0569	.653
Age between 40 and 59	-.0294	.0530	.579
Residuals fitted	**2.91e-07****	**1.29e-07**	**.024**
cons	-1.203***	.0847	.000
Number of observations	= 10800	Prob> Chi2	=.000
Wald chi2(25)	= 163.00	Pseudo R2	= .1016
Pseudo log likelihood	= -3728.5969		

Note: z denotes z-statistics; *** significant at 1%, ** significant at 5%, *significant at 10%

Appendix D

D1: Determination of the sign of n when constant marginal cost is $\delta > \underline{\beta}$

$$n^* = \frac{3(1-p)(1+a)+3p\underline{\beta}-3\delta}{4bv(1-p)}$$

Let's study the sign of n^*. Before deriving the sign of n^*, notice n exist if $4bv(1-p) \neq 0$.

That means if $p \neq 1$

<u>First derivative of n</u>

$$n^{*\prime} = \left(\frac{3(\underline{\beta}-a-1)p+3(1+a-\delta)}{-4bvp+4bv} \right)^{\prime}$$

$$n^{*\prime} = \frac{12bv(\underline{\beta}-\delta)}{4bv(1-p)}$$

Let's find the sign of this first derivative

$$\frac{12bv}{(4bv(1-p))^2} > 0 \text{ Consequently, the sign depends on the one of } (\underline{\beta}-\delta)$$

By assumption $\delta > \underline{\beta} \Rightarrow \underline{\beta}-\delta < 0$

Therefore, n^* is a decreasing function of the probability of failure p.

$$For\ p = 0, \quad n^* = \frac{3(1+a)-3\delta}{4bv}$$

$$\lim_{\substack{p \to 1 \\ p<1}} n^* = \lim_{\substack{p \to 1 \\ p<1}} \frac{3(1-p)(1+a)+3p\underline{\beta}-3\delta}{4bv(1-p)} = -\infty$$

At which value of p the number of borrower equal zero, i.e. n=0

$$n=0, \quad \frac{3(1-p)(1+a)+3p\underline{\beta}-3\delta}{4bv(1-p)} = 0$$

$$\Rightarrow 3\left[(1-p)(1+a)+p\underline{\beta}-\delta\right] = 0$$

$$(\underline{\beta}-a-1)p+1+a-\delta = 0$$

$$\Rightarrow p = \frac{1+a-\delta}{1+a-\underline{\beta}}$$

Finally,

$$n^* \geq 0 \ \text{ iff } \ 0 \leq p \leq \frac{1+a-\delta}{1+a-\underline{\beta}}$$

$$n^* < 0 \ \text{ iff } \ \frac{1+a-\delta}{1+a-\underline{\beta}} < p < 1$$

Computation of the integer part of n in the interval $\ 0 \leq p \leq \dfrac{1+a-\delta}{1+a-\underline{\beta}}$

$$n^* = \frac{3(1-p)(1+a)+3p\underline{\beta}-3\delta}{4bv(1-p)}$$

$$= \frac{3(1-p)(1+a)}{4bv(1-p)} + \frac{3p\underline{\beta}-3\delta}{4bv(1-p)}$$

$$n = \frac{3(1+a)}{4bv} + \frac{3p\underline{\beta}-3\delta}{4bv(1-p)}$$

$$\left\lfloor n^* \right\rfloor = \frac{3(1+a)}{4bv}$$

D2: Derivation of the payoffs of pure strategies

Case 1: $\{rich, poor\}$

The payoff of the leader

$$\pi_r^l = (1-p)(1+\frac{a-3}{4})\theta nv + p\underline{\beta}\theta nv - \delta\theta nv - F_1$$

$$= (1-p)(1+\frac{a-3}{4})\theta\frac{3(1+a)}{4bv}v + p\underline{\beta}\theta\frac{3(1+a)}{4bv}v - \delta\theta\frac{3(1+a)}{4bv}v - F_1$$

$$= \frac{3(1+a)}{4}\theta\left[1-p)(1+\frac{a-3}{4}) + p\underline{\beta} - \delta\right] - F_1$$

The payoff of the follower

$$\pi_p^l = (1-p)(1+\frac{a-3}{4})(1-\theta)nv + p\underline{\beta}(1-\theta)nv - \delta(1-\theta)nv - F_2$$

$$= (1-p)(1+\frac{a-3}{4})(1-\theta)\frac{3(1+a)}{4bv}v + p\underline{\beta}(1-\theta)\frac{3(1+a)}{4bv}v - \delta(1-\theta)\frac{3(1+a)}{4bv}v - F_2$$

$$= \frac{3(1+a)}{4}(1-\theta)\left[1-p)(1+\frac{a-3}{4}) + p\underline{\beta} - \delta\right] - F_2$$

Case 2: $\{rich, rich\}$

The payoff of the leader

$$\pi_r^l = (1-p)(1+\frac{a-3}{4})\frac{2}{3}\theta nv + p\underline{\beta}\frac{2}{3}\theta nv - \delta\frac{2}{3}\theta nv - F_1$$

$$= (1-p)(1+\frac{a-3}{4})\frac{2}{3}\theta\frac{3(1+a)}{4bv}v + p\underline{\beta}\frac{2}{3}\theta\frac{3(1+a)}{4bv}v - \delta\frac{2}{3}\theta\frac{3(1+a)}{4bv}v - F_1$$

$$= \frac{(1+a)}{2}\theta\left[1-p)(1+\frac{a-3}{4}) + p\underline{\beta} - \delta\right] - F_1$$

The payoff of the follower

$$\pi_r^f = (1-p)(1+\frac{a-3}{4})\frac{1}{3}\theta nv + p\underline{\beta}\frac{1}{3}\theta nv - \delta\frac{1}{3}\theta nv - F_2$$

$$= (1-p)(1+\frac{a-3}{4})\frac{1}{3}\theta\frac{3(1+a)}{4bv}v + p\underline{\beta}\frac{1}{3}\theta\frac{3(1+a)}{4bv}v - \delta\frac{1}{3}\theta\frac{3(1+a)}{4bv}v - F_2$$

$$= \frac{(1+a)}{4}\theta\left[1-p)(1+\frac{a-3}{4}) + p\underline{\beta} - \delta\right] - F_2$$

Case 3: $\{poor, rich\}$

The payoff of the leader

$$\pi_p^l = (1-p)(1+\frac{a-3}{4})(1-\theta)nv + p\underline{\beta}(1-\theta)nv - \delta(1-\theta)nv - F_1$$

$$= (1-p)(1+\frac{a-3}{4})(1-\theta)\frac{3(1+a)}{4bv}v + p\underline{\beta}(1-\theta)\frac{3(1+a)}{4bv}v - \delta(1-\theta)\frac{3(1+a)}{4bv}v - F_1$$

$$= \frac{3(1+a)}{4}(1-\theta)\left[1-p)(1+\frac{a-3}{4}) + p\underline{\beta} - \delta\right] - F_1$$

The payoff of the follower

$$\pi_r^f = (1-p)(1+\frac{a-3}{4})\theta nv + p\underline{\beta}\theta nv - \delta\theta nv - F_2$$

$$= (1-p)(1+\frac{a-3}{4}\theta\frac{3(1+a)}{4bv}v + p\underline{\beta}\theta\frac{3(1+a)}{4bv}v - \delta\theta\frac{3(1+a)}{4bv}v - F_2$$

$$= \frac{3(1+a)}{4}\theta\left[1-p)(1+\frac{a-3}{4}) + p\underline{\beta} - \delta\right] - F_2$$

Case 4: {poor, poor}

The payoff of the leader

$$\pi_p^l = (1-p)(1+\frac{a-3}{4})\frac{2}{3}(1-\theta)nv + p\underline{\beta}\frac{2}{3}(1-\theta)nv - \delta\frac{2}{3}(1-\theta)nv - F_1$$

$$= (1-p)(1+\frac{a-3}{4})\frac{2}{3}(1-\theta)\frac{3(1+a)}{4bv}v + p\underline{\beta}\frac{2}{3}(1-\theta)\frac{3(1+a)}{4bv}v - \delta\frac{2}{3}(1-\theta)\frac{3(1+a)}{4bv}v - F_1$$

$$= \frac{(1+a)}{2}(1-\theta)\left[1-p)(1+\frac{a-3}{4}) + p\underline{\beta} - \delta\right] - F_1$$

The payoff of the follower

$$\pi_p^f = (1-p)(1+\frac{a-3}{4})\frac{1}{3}(1-\theta)nv + p\underline{\beta}\frac{1}{3}(1-\theta)nv - \delta\frac{1}{3}(1-\theta)nv - F_2$$

$$= (1-p)(1+\frac{a-3}{4})\frac{1}{3}(1-\theta)\frac{3(1+a)}{4bv}v + p\underline{\beta}\frac{1}{3}(1-\theta)\frac{3(1+a)}{4bv}v - \delta\frac{1}{3}(1-\theta)\frac{3(1+a)}{4bv}v - F_2$$

$$= \frac{(1+a)}{4}(1-\theta)\left[1-p)(1+\frac{a-3}{4}) + p\underline{\beta} - \delta\right] - F_2$$

D3: derivation of pure strategies equilibriums

Table D1: Borrower choice Payoffs ($\theta = 0$)

<center>Follower</center>

		rich	Poor
	rich	$(0, 0)$	$(0, \frac{3(1+a)}{4})$
Leader	poor	$(\frac{3(1+a)}{4}, 0)$	$(\frac{1+a}{2}, \frac{1+a}{4})$

Table D2: Borrower choice Payoffs ($\theta = 1$)

		Follower	
		rich	Poor
Leader	rich	$(\dfrac{1 + a}{2}, \dfrac{1 + a}{4})$	$(\dfrac{3(1 + a)}{4}, 0)$
	poor	$(0, \dfrac{3(1 + a)}{4})$	$(0, 0)$

D4: Derivation of mixed strategies equilibriums

In this section, we derive the set of mixed-strategy equilibrium of the game of borrower choice between Leader and Follower. First, recall that in any mixed-strategy equilibrium q must be strictly greater than zero.

In an equilibrium in which Leader strictly mixes over *rich* and *poor* with probability q and (1-q), the follower will play rich if

$$\pi_r^f = \frac{1+a}{4}q\theta + \frac{3}{4}(1-q)\theta > \pi_p^f = \frac{3}{4}q(1-\theta) + \frac{1}{4}(1-q)(1-\theta) \qquad [D.]$$

That means $\dfrac{3(1+a)}{4}\theta - \dfrac{1+a}{2}q\theta > \dfrac{(1+a)}{2}q - \dfrac{(1+a)}{2}q\theta - \dfrac{1+a}{4}\theta + \dfrac{1+a}{4}$

Hence, $q < 2\theta - \dfrac{1}{2}$

In conclusion, when the leader mixed over *rich* and *poor*, the follower plays *rich* if $q < 2\theta - \dfrac{1}{2}$, and *poor* if $q > 2\theta - \dfrac{1}{2}$. Then, follower will be indifferent between the two

actions if $q = 2\theta - \dfrac{1}{2}$.

Let's find the sign of q

First derivative of q

$$q' = 2 > 0$$

Therefore, q is an increasing function of. θ

$$For\ \theta = 0, \quad q = -\frac{1}{2}$$

$$For\ \theta = 1, \quad q = \frac{3}{2}$$

At which value of θ q=0

$$q = 0 \ if \ 2\theta - \frac{1}{2} = 0$$

$$q = 0 \ if \ \theta = \frac{1}{4}$$

At which value of θ q=1

$$q = 1 \ if \ 2\theta - \frac{1}{2} = 1$$

$$q = 1 \ if \ \theta = \frac{3}{4}$$

Finally, since the probability of equilibrium must greater than zero, thus the probability

$$0 \leq q \leq 1 \ iff \ \frac{1}{4} \leq \theta \leq \frac{3}{4}$$

In an equilibrium in which follower strictly mixes over *rich* and *poor* with probability w and (1-w), the leader will play rich if

$$\pi_r^l = \frac{1+a}{2} w\theta + \frac{3(1+a)}{4}(1-w)\theta > \pi_p^l = \frac{3(1+a)}{4} w(1-\theta) + \frac{1+a}{2}(1-w)(1-\theta)$$

That means $\dfrac{3(1+a)}{4}\theta - \dfrac{1+a}{4}w\theta > \dfrac{(1+a)}{4}w - \dfrac{(1+a)}{4}w\theta - \dfrac{1+a}{2}\theta + \dfrac{1+a}{2}$

Hence, $w < 5\theta - 2$

In conclusion, when the follower mixed over *rich* and *poor*, the leader plays *rich* if $w < 5\theta - 2$, and *poor* if $w > 5\theta - 2$. Then, follower will be indifferent between the two actions if $w = 5\theta - 2$.

Let's find the sign of w

First derivative of w

$$w' = 5 > 0$$

Therefore, q is an increasing function of. θ

For $\theta=0$, $w=-2$

For $\theta=1$, $w=3$

At which value of θ w=0

$w=0$ *if* $5\theta-2=0$

$w=0$ *if* $\theta=\dfrac{2}{5}$

At which value of θ w=1

$w=1$ *if* $5\theta-2=1$

$w=1$ *if* $\theta=\dfrac{3}{5}$

Finally, since the probability of equilibrium must greater than zero, thus the probability

$0\leq w\leq 1$ *iff* $\dfrac{2}{5}\leq\theta\leq\dfrac{3}{5}$

The optimal outcomes are when both probability equates, i.e. $q=w$

$$2\theta - \frac{1}{2} = 5\theta - 2$$

$$\Rightarrow \quad \theta = \frac{1}{2}$$

After some computation, the optimal probabilities are the following $q=w=\dfrac{1}{2}$

Graphically, the best response function of each lender is given as follows:

Figure D3.1: Leader-followers best responses
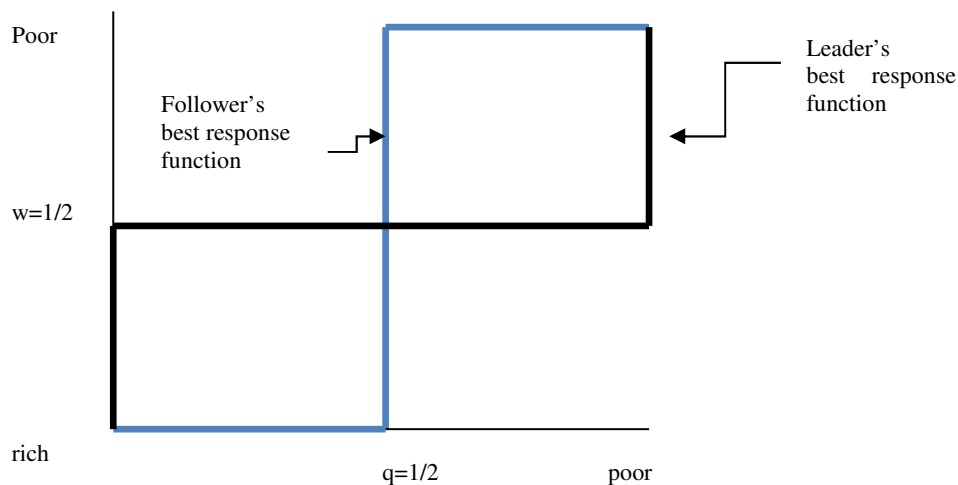
At which set of θ, both probabilities are mutually feasible. In other words, in which interval, the optimal outcome (q, w) are always defined.

We know that $0 \le q \le 1$ *iff* $\dfrac{1}{4} \le \theta \le \dfrac{3}{4}$ and $0 \le w \le 1$ *iff* $\dfrac{2}{5} \le \theta \le \dfrac{3}{5}$,

Hence (q, w) are defined in the interval $\theta \in \left[\dfrac{1}{4}, \dfrac{3}{4}\right] \cap \left[\dfrac{2}{5}, \dfrac{3}{5}\right]$

This interval is $\left[\dfrac{2}{5}, \dfrac{3}{5}\right]$, that means the leader will play the probabilities $\dfrac{3}{10} \le q \le \dfrac{7}{10}$

D4: Funding mechanisms and borrowers selection
Case 1: subsidy
In an equilibrium in which Leader strictly mixes over *rich* and *poor* with probability q and (1-q), and both receives some grants. The follower will be indifferent between rich and poor if

That means $\dfrac{3(1+a)}{4}\theta - \dfrac{1+a}{2}q\theta > \dfrac{(1+a)}{2}q - \dfrac{(1+a)}{2}q\theta - \dfrac{1+a}{4}\theta + \dfrac{1+a}{4}$

Hence, follower will be indifferent between the two actions if $q = 2\theta - \dfrac{1}{2} - \dfrac{2S}{1+a}$.

At which value of θ q=0

$q=0$ *if* $2\theta - \dfrac{1}{2} - \dfrac{2S}{1+a} = 0$

$q=0$ *if* $\theta = \dfrac{1}{4} + \dfrac{S}{1+a}$

At which value of θ q=1

$q=1$ *if* $2\theta - \dfrac{1}{2} - \dfrac{2S}{1+a} = 1$

$q=1$ *if* $\theta = \dfrac{3}{4} + \dfrac{S}{1+a}$

Finally, since the probability of equilibrium must greater than zero, thus the probability

$0 \le q \le 1$ *iff* $\dfrac{1}{4} + \dfrac{S}{1+a} \le \theta \le \dfrac{3}{4} + \dfrac{S}{1+a}$

In an equilibrium in which follower strictly mixes over *rich* and *poor* with probability w and (1-w), and receives a grant, the leader will be indifferent between *rich* and *poor* if

$$\frac{1+a}{2}w\theta+\frac{3(1+a)}{4}(1-w)\theta=w[\frac{3(1+a)}{4}(1-\theta)+S]+(1-w)[\frac{1+a}{2}(1-\theta)+S]$$

Hence, when the follower mixed over *rich* and *poor*, the leader will be indifferent between

the two actions if $w=5\theta-2-\frac{4S}{1+a}$.

At which value of θ w=0

$w=0$ *if* $5\theta-2-\frac{4S}{1+a}=0$

$w=0$ *if* $\theta=\frac{2}{5}+\frac{4S}{5(1+a)}$

At which value of θ w=1

$w=1$ *if* $5\theta-2-\frac{4S}{1+a}=1$

$w=1$ *if* $\theta=\frac{3}{5}+\frac{4S}{5(1+a)}$

Finally, since the probability of equilibrium must greater than zero, thus the probability

$0\le w\le1$ *iff* $\frac{2}{5}+\frac{4S}{5(1+a)}\le\theta\le\frac{3}{5}+\frac{4S}{5(1+a)}$

At which set of θ, both probabilities are mutually feasible? In other words, in which interval, the optimal outcome (q, w) are always defined.

We know that $0\le q\le1$ *iff* $\frac{1}{4}+\frac{S}{1+a}\le\theta\le\frac{3}{4}+\frac{S}{1+a}$ and

$0\le w\le1$ *iff* $\frac{2}{5}+\frac{4S}{5(1+a)}\le\theta\le\frac{3}{5}+\frac{4S}{5(1+a)}$,

Hence (q, w) are defined in the interval $\left[\frac{2}{5}+\frac{4S}{5(1+a)},\frac{3}{5}+\frac{4S}{5(1+a)}\right]$, that means the leader and follower will play the probabilities

$\frac{3}{10}-\frac{2S}{5(1+a)}\le q\le\frac{7}{10}-\frac{2S}{5(1+a)}$

Case 2: Equity financing

In an equilibrium in which Leader strictly mixes over *rich* and *poor* with probability q and (1-q), and both sell some assets E. The follower will be indifferent between rich and poor if

$$(1-c)\frac{3(1+a)}{4}\theta-\frac{(1-c)(1+a)}{2}q\theta-E=\frac{(1-c)(1+a)}{2}q-\frac{(1-c)(1+a)}{2}q\theta-\frac{(1-c)(1+a)}{4}\theta+\frac{(1-c)(1+a)}{4}-E$$

Hence, follower will be indifferent between the two actions if $q=2\theta-\frac{1}{2}$.

At which value of θ q=0

$q=0$ if $2\theta-\frac{1}{2}$

$q=0$ if $\theta=\frac{1}{4}$

At which value of θ q=1

$q=1$ if $2\theta-\frac{1}{2}=1$

$q=1$ if $\theta=\frac{3}{4}$

Finally, since the probability of equilibrium must greater than zero, thus the probability

$0\leq q\leq1$ iff $\frac{1}{4}\leq\theta\leq\frac{3}{4}$

In an equilibrium in which follower strictly mixes over *rich* and *poor* with probability w and (1-w), and sells some assets E, the leader will be indifferent between *rich* and *poor* if

$$w[\frac{1+a}{2}\theta-E]+(1-w)[\frac{3(1+a)}{4}\theta-E]=w[\frac{3(1+a)}{4}(1-\theta)-E]+(1-w)[\frac{1+a}{2}(1-\theta)-E]$$

Hence, when the follower mixed over *rich* and *poor*, the leader will be indifferent between the two actions if $w=5\theta-2$.

At which value of θ w=0
$w=0$ if $5\theta-2=0$

$w=0$ if $\theta=\frac{2}{5}$

At which value of θ w=1
$w=1$ if $5\theta-2=1$

$w=1$ if $\theta=\frac{3}{5}$

Finally, since the probability of equilibrium must greater than zero, thus the probability

$0 \le w \le 1$ *iff* $\dfrac{2}{5} \le \theta \le \dfrac{3}{5}$

At which set of θ, both probabilities are mutually feasible? In other words, in which interval, the optimal outcome (q, w) are always defined.

We know that $0 \le q \le 1$ *iff* $\dfrac{1}{4} \le \theta \le \dfrac{3}{4}$ and

$0 \le w \le 1$ *iff* $\dfrac{2}{5} \le \theta \le \dfrac{3}{5}$,

Hence (q, w) are defined in the interval $\left[\dfrac{2}{5}, \dfrac{3}{5}\right]$, that means the leader and follower will play the probabilities

$\dfrac{3}{10} \le q \le \dfrac{7}{10}$

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