EXAMINING CLIENT EXIT IN MICROFINANCE: THEORETICAL AND EMPIRICAL PERSPECTIVES

DISSERTATION

Presented in Partial Fulfillment of the Requirements for

the Degree Doctor of Philosophy in the Graduate

School of The Ohio State University

By

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* * * * *

The Ohio State University
2003

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Repeat borrowing is critical for the long-term viability of microfinance organizations (MFOs), which provide invaluable financial services to low-income households in developing countries. Repeat borrowers reduce MFO administrative costs, lower risks, and increase organizational productivity. In practice, however, several MFOs worldwide are experiencing high borrower exit, \textit{i.e.}, termination of the lender-client relationship, which hamper organizational and financial sustainability. This dissertation sets out to determine and analyze the factors that influence borrower/client exit. A choice theoretic dynamic model and duration methods are developed and used to accomplish this goal.

In the choice theoretic dynamic model, a firm wants to maximize profits over her life cycle by investing in her business on an on-going basis. To do this she strives to establish a long-term relationship with a formal bank; however, she lacks the necessary physical collateral required by the bank to obtain loans. Instead, she engages in a sub-optimal strategy of group-lending in which she is jointly liable for her own repayment as well as her co-members’ payments in the event they cannot repay their loan shares. However, if the group demonstrates good repayment behavior, \textit{i.e.}, never defaults, after \( n \) loan cycles, then the members are rewarded with an admission into an individual loan program.
There are two types of firms in this economy, high and low ability. Her rewards are greater if she picks a high ability type partner than if she chooses a low ability type since high types succeed more often than low types. Due to uncertainty about fellow partner ability type, i.e., high or low, the optimizing firm forms a belief about her partner’s type and uses Bayes’ Rule to update this belief each period based on business outcomes that she observes. Each period the firm has an option to stay in the borrowing relationship with her partner or exit, i.e., terminate the relationship and use self-financing. An optimizing agent chooses an optimal stay/exit policy for the life of the contract.

The outcomes of this model are as follows. Each period there exists a critical probability value that her partner is of high ability. If her subjective belief is greater than that value, she remains in the contract, otherwise she exits. In the beginning of the contract, this critical value is low, demonstrating the optimizing agent’s willingness to remain in and learn about her partner. However, this critical probability value increases with time, reflecting an unwillingness of the optimizing agent to remain in the contract in the later periods since new information has little additional value. In addition, critical probability values are affected by the terms of the contract, risk aversion, and loan return. Namely, the critical probability value is an increasing function of loan size, interest rate, and relative risk, and a decreasing function in loan return.

When end rewards are explicitly accounted for in this model, the optimizing agent’s behaviors change. In other words, reward scheme prompt an
optimizing agent to stay in the borrowing contract when she would not have done
in the absence of the scheme.

A duration model is used to empirically examine the factors that affect the
borrowing relationship length. Two field surveys conducted on 260 microfinance
clients from one MFO in Bamako, Mali make up the data set. It is found that loan
return, income shocks, and borrower’s dependency ratio decrease client exit rates.
Group member repayment behaviors, education, and excessive MFO growth
increase client exit in this setting.
To Gary, Adam, and Ellen
ACKNOWLEDGMENTS

Graduate school has been a long and challenging journey. There are several people who have made this journey an amazingly rich and rewarding experience. I would like to acknowledge and thank them here. First, I wish like to thank my adviser, Douglas H. Graham, for his invaluable mentoring and constant support throughout this process. At all times I felt that he had only my best interests at heart. His intellectual curiosity, professionalism, and generosity have left indelible impressions on my life.

I wish to thank Professor Claudio Gonzalez-Vega for encouraging me to further explore the theoretical dimensions of this research. Because of this effort I produced a better dissertation. His intellectual rigor is admirable.

I also wish to thank Professor Priyo Banerjee for spending hours exploring several possible theoretical dimensions of my research problem. His patience and kindness in working with me and answering my questions will never be forgotten.

I wish to thank Professor Mario Miranda for the constant guidance and availability during the theoretical modeling exercise of this dissertation. His unique gift of explaining often very complex dynamic concepts in a manner that I could easily grasp was invaluable.

I am also grateful to Professor Tim Haab for his econometric support. His approachability is something that should be replicated by all in the teaching profession. I
wish to thank Professor Dave Kraybill for his feedback and support on earlier drafts of this dissertation. His knowledge on firm dynamics was very useful to me.

This research effort would not have been possible without the cooperation of the microfinance clients and staff of Piyeli who willingly gave of their time to respond to all of my questions during two field studies in Bamako. In addition, I am grateful to World Education and The Ohio State University for their financial support of my work.

I wish to thank several friends and colleagues. Alka Gandhi for her invaluable feedback on my work and unwavering support through it all. Roisin O’Sullivan, Peter Kower, and Rob Dietz for critical advice on earlier versions of my work. Mike Taylor for his practical feedback throughout this process. Mehnaz Safavian for her sound council and constant support through it all.

I wish to thank my family, especially my mom and dad for the love and support that they have given so freely to me. I wish thank my sister, Michele, for her selfless help with my children during this process. Without her assistance I truly could not have accomplished this goal. I also wish to thank Annie, Karen, Susan, and Jennifer for their support and always helping out in times of need, especially during the critical periods of this process.

I wish to thank the most important person in my life, Gary, for his constant love and encouragement throughout this process. His unwavering support gives me the courage and strength to strive for great things.
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CHAPTER 1

INTRODUCTION

1.1 Problem Statement

Lack of credit is a major obstacle faced by poor people around the world who want to improve their livelihood. Without capital, people cannot invest in productive activities, fuel existing businesses, and/or smooth consumption when needed, thus significantly limiting their chances of escaping poverty. Recently, the microfinance industry\(^1\) has received much attention from the development community (practitioners, donors, policy makers, academics) for its ability to lend successfully to poor people, something development banks significantly failed to do during the 1960s and 70s (Gonzalez-Vega and Graham, 1995). Many people think microfinance holds much promise as a poverty alleviation strategy (Morduch, 1999).

This promise, however, comes at a hefty price. Several of the leading microfinance organizations (MFOs) are not financially sustainable and rely heavily on direct or indirect subsidies from donors (Morduch, 1999). In 1998 a survey conducted by the Microbanking Standards Project documented that only 34 of 72 MFOs committed to

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\(^1\) The Microfinance industry is made up of specialized organizations that provide financial services to low-income households in developing countries and in some poor communities in the United States.
financial sustainability were profitable (Microbanking Bulletin, 1998). This statistic is far bleaker when examining all MFOs worldwide and not just this select group dedicated to sustainability. Experts in the field estimate that less than one percent of all MFOs have achieved financial sustainability, and only five percent will do so in the future (Morduch, 1999). Why are most MFOs not profitable? Some stated reasons include: interest rates set below cost recovery levels; inefficient allocation of resources; high delinquency ratios; inflexible and narrowly defined financial products; and high client exit rates, among others. Each issue is of tantamount importance; however, this research focuses on client exit behavior\(^2\) of microentrepreneurs in developing countries, which in the end are closely related to the other issues stated above.

Why should one be concerned with high client exit in microfinance? First, MFOs and clients have much to gain from a quality, long-term banking relationship. As the relationship matures, the lender benefits from lower screening and monitoring costs, increased revenue, assuming loan balances grow over time, and improved lending decisions given that risk decreases as more information about the borrower is revealed. Benefits to the client include a continued and often expanded access to credit, a cost reduction in capital as terms and conditions improve over the long run, and an opportunity to establish a valuable reputation as a trustworthy borrower (Ongena and Smith, 2001). Given the relationship is valuable to both MFOs and clients, it is important to examine the factors that may diminish its quality and/or shorten its length.

\(^2\) Clients that have exited are defined as those whom have left the MFO completely, i.e., the borrowing relationship has been severed. They, for all practical purposes, are not resting and have no intention of returning to the MFO.
Secondly, high client exit increases operational costs for MFOs, thus making it more challenging to become financially viable organizations in the long run. Donors and policymakers and, ultimately, taxpayers most likely will not continue to support an industry that is showing little signs of sustainability. In short, they are afraid of repeating the same mistakes of the development strategies from the 1960s through the 1980s. During this period, subsidized credit targeted to poor farmers through state-run development banks produced lamentable outcomes (Gonzalez-Vega and Graham, 1995). Not wanting to make similar mistakes, donors are cautious about creating a subsidy dependent industry, especially one that they will not be able to sustain. In fact, they argue that subsidization should only be used to cover start up costs (Morduch, 1999). Given this warning, MFOs are forced to examine financial sustainability issues, like client exit, more seriously, if they want to survive in the long run.

Lastly, one should be concerned with this issue because finance matters. Levine (1997) contends that the development of financial markets and institutions is a critical and inextricable part of the growth process. Currently, about 1.2 billion people globally live at or below the poverty line of one US dollar per day. If microfinance can become truly sustainable, adequately meeting the financing needs of this population, then the potential for it to affect economic growth in developing countries is high.
1.2 Client Exit and the Virtues of Group Lending

A critical trend that emerges from the stylized facts on client exit as presented in the following chapter of this dissertation is that client exit is more problematic for MFOs using the joint liability, group lending technology compared to those offering individual loan contracts. At the same time, the recent literature on development finance has touted group lending as an efficient way to mitigate informational asymmetries that exist between borrowers and lenders that are often exaggerated in developing countries where institutional infrastructure is weak. Many scholars and development practitioners have devoted much time to the study of group lending methods (Besley and Coate, 1995; Conning, 1999; Ghatak and Guinnane, 1999; Madajewicz, 1997; Paxton, 1996; Rodriguez-Mesa, 2000).

In their theoretical survey on group lending mechanisms Ghatak and Guinnane (1999) state that a well structured group lending product can effectively deal with the four information and enforcement problems inherent in financial intermediation by using local information and social capital that exists amongst borrowers. These problems are: 1) adverse selection – identifying what kind of risk the potential borrower represents; 2) moral hazard – making sure the borrower is not encouraged to engage in any opportunistic behavior during realization of the project; 3) auditing costs – verifying that the project really did fail when a borrower declares her inability to repay, also termed as costly state verification; and 4) contract enforcement – implementing methods to coerce a borrower to repay if she refuses.

The key assumption about joint liability loan contracts is that borrowers know more about other borrowers’ reputations, behaviors, and states of contingency than
formal lenders do, thus permitting them to be more efficient in screening and monitoring other members. By using the social capital that exists amongst borrowers, lenders can effectively enforce loan contracts (Besley and Coate, 1995). In theory this seems quite plausible; however, what happens when this assumption breaks down in practice? What happens when the screening, monitoring and social capital mechanisms do not work in some social settings, such as in large urban centers where people may be more mobile and may not know each other very well, and where the costs of monitoring are greater given the higher opportunity cost of time of entrepreneurs in this setting? What happens when the lending technology is new to the financial market and clients have very incomplete information about the true cost and quality of the loan product? If clients are unfamiliar with joint liability of loan contracts, they will need time to learn about how these loan products works in practice. Is it feasible to assume that clients are able to effectively deal with information and enforcement issues of group lending when they are just beginning to experience and form perceptions about how it works in practice? This research attempts to answer some of these questions.

1.3 Client Exit and the Relevant Literature

Client exit, in finance and banking, has not been modeled explicitly per se; however, an extensive literature exists on the benefits of banking relationships. Theoretically, bilateral benefits of long-term relationships are formally modeled in Diamond (1991), Rajan (1992), Berglof and von Thadden (1994), Boot and Thakor (1994), Chemmanur and Fulghieri (1994), and von Thadden (1995). In addition,
Greenbaum et al. (1989), Sharpe (1990), Rajan (1992) and Petersen and Rajan (1995) model how a firm may become locked into a relationship and subject to monopoly rents as the bank acquires information over time.


Although the banking relationship literature is rich in the way it models the benefits of the relationship, none of the work to date explicitly models the termination decision. In fact, Ongena and Smith (2001) only implicitly use the existing theoretical literature as a broad background for developing their empirical framework. Therefore, one of the main contributions of this research is to provide a theoretical model that explicitly focuses on the termination of the banking relationship.

Exploring exit issues in other fields, such as labor economics, is useful in building a client exit model. In this field, economists have examined and modeled worker and career exit rates based on search, human capital, and turnover theory (Nickell, 1979; Narendranathan, 1984; Meitzen, 1986; Murnane and Olsen, 1989; Preston, 1994; Dolton and von der Klaauw, 1995; Munasinghe, 2000). These authors compare current and opportunity wages as a basis for decision making on job and/or career exit. Particularly
interesting is Murnane and Olsen’s (1989) model in which they implicitly focus on the cumulative effect of the agent’s knowledge gained over time on her decision to exit the teaching profession.

Firm theory, in particular the branch dealing with technology adoption, is also useful in modeling exit decisions (Reinganum, 1983; Saloner and Shepard, 1995; Stoneman and Kwon, 1996). In these applications, a representative firm makes a decision on technology adoption based on its net maximum benefits, or conversely, its minimum costs of adopting. These models employ net present value techniques to examine the flow of benefits and costs over time, therefore focusing on the trade off between the time in which one adopts a technology and its effects on overall firm profit.

Drawing upon these two areas as well as from the literature on group lending, a model of client exit is developed. Until quite recently the literature on group lending dealing with adverse selection focused solely on the full information case in which borrowers are perfectly informed about each other’s types (Armendariz de Aghion and Gollier, 1996; Ghatak and Guinnance, 1999; Ghatak, 2000). Given full information, borrowing groups are formed based on an assortative matching process, e.g. safe with safe types and risky with risky types, thereby reducing the effective cost of borrowing to safer borrowers. This result is shown to improve repayment rates and overall welfare (Ghatak, 1999). Armendariz de Aghion and Gollier (2000) and Laffont and N’Guessan (2000), however, show that this matching process is not necessary for group lending to be welfare improving. In fact, they demonstrate that group lending with imperfect information, in which random matching occurs, is also welfare enhancing. Although the framework proposed here focuses primarily on the exit decision of the borrower, the
imperfect information assumption is a central feature of the model. In this scenario, a representative firm engaged in a joint liability contract learns about her partner’s type over time. As her partner’s business outcomes are revealed, the firm updates her subjective belief about her partner’s type using Bayes Rule, and then, based on this belief, calculates her expected costs due her partner’s inability to pay the loan share in the future.

1.4 Research Objectives and Key Hypotheses

The overall goal of this research is to better define and determine the factors that affect client exit in microfinance. To accomplish this goal, the first objective of this dissertation is to build a logical framework of stylized facts on client exit in an attempt to better understand the current climate worldwide in regards to this issue. This framework is constructed from a detailed examination of over 30 microfinance field studies on client exit.

The second objective is to theoretically model client exit behavior in joint liability contracts. Drawing upon theories of job matching and technology adoption, as explained above, client exit is modeled in a dynamic, choice theoretic framework. Basically, when faced with a decision of staying or exiting, an MFO client compares her current and expected future benefits of staying to the net present value of exiting. She exits when it is no longer beneficial to stay in the borrowing relationship, i.e., the value of exit is greater than the value of staying. Interesting exit/stay outcomes arise when joint liability is modeled into the choice. The borrower learns about her partner’s type by observing her business outcomes as they are revealed over time. She then uses this information to
update her belief about her partner’s type. Given her belief she calculates her expected value of staying in the relationship and compares this to her value of exiting. The theoretical model used to analyze this problem focuses solely on the borrower’s optimal decision to exit the bank relationship, i.e., group lending program, given her belief about her partner’s type and her own outside financing options. This model does not examine the lender’s decision to terminate the relationship. Instead it is assumed that the lender’s purpose is to maximize borrower’s welfare. To fully capture the nature of this problem, it is setup in a dynamic setting, permitting the optimizing agent, i.e., the borrower, to evaluate her current and future rewards of staying in versus those of exiting the borrowing relationship at the end of each \( n \) periods given her belief about her partner’s type.

The last objective of this study is to empirically examine the factors that significantly affect the length of time in the banking relationship. An empirical model is developed, which incorporates the key features of the theoretical model as well as the stylized facts on client exit. In particular, a duration model is used to analyze the length of time an individual has survived a certain state, i.e., the length of time in a banking relationship, given her individual, business, household, and group characteristics.

The main hypothesis of this study is that the length of the borrowing relationship is affected by the costs incurred due to fellow group members’ inability to repay, the terms and conditions of the loan contract, and the borrower’s return on the loan.\(^3\)

In addition it is hypothesized that learning has value. In this framework, an entrepreneur/firm enters into a group loan contract with another borrower but does not

\(^3\) In this dissertation, strategic default, i.e., willingness to pay is assumed away. Instead, borrowers repay their loans as long as they are able to, i.e., ability to pay.
know her type, *i.e.*, high or low ability type. Partners repay their loan share when they experience high, *i.e.*, a successful business outcome, and nothing otherwise. It is assumed that high type partners experience high(low) business outcomes more(less) often than low, *i.e.*, less successful, type partners. Over time, the entrepreneur *learns* the true nature of her partner. It is hypothesized that learning has more value in the beginning periods than in later periods of the partnership. In other words, the entrepreneur in the beginning periods is willing to remain in the borrowing relationship to learn more about the “type” characterizing her partner. However, as time passes, she becomes less patient since she knows that she will gain very little observing new outcomes.

It is also hypothesized that rewards matter. Assume that an entrepreneur receives a reward after successfully completing, *i.e.*, without default, *n* cycles of group loans. In this instance, it is hypothesized that in this arrangement an entrepreneur may remain in the borrowing relationship, even if they know their partner is a low type. In other words, she may be willing to bear the costs associated with her partner’s low type in order to reach the end reward. A terminal reward system may induce group stability; however, the nature of the system will affect the behavior or the borrowers.

### 1.5 Research Contributions

The main contribution of this research is to the academic field. This research is beneficial to researchers who are interested in examining client exit and/or other related topics, such as the benefits of banking relationships, client retention, etc. Future researchers should be able to use and expand upon the theoretical and empirical frameworks developed in this dissertation. First, the dynamic framework that explicitly
models the exit decision is presented in Chapter 3. A key feature of this model is that as a maximizing agent observes her partner’s business outcomes she is able to update her subjective belief concerning her performance type. Over time she learns the true nature of her partner and is able to make a better estimate about expected future costs of engaging in joint liability contracts with this person, permitting her to make an optimal stay/exit decision.

Second, the author of this dissertation carried out an extensive field study examining client exit issues in an MFO in Mali. In this effort many lessons were learned, especially those relating to the empirical framework and the data collected. Sharing these lessons will be beneficial to future researchers interested in examining client exit. In addition, the findings of this study will no doubt have major policy implications for many MFOs. By better understanding the factors that affect client exit, practitioners will be able to adjust their policies to improve retention rates. This in the short run will dramatically reduce their costs and increase revenue. In the long run will have a beneficial impact on overall sustainability of these organizations.

The last contribution of this dissertation is development of the summary framework of stylized facts on client exit drawn from over 30 field studies worldwide. Since this topic is relatively new, at least in the field of microfinance, it is important to understand the basic stylized facts on client exit in many parts of the world. To accomplish this task, the author collected, reviewed and summarized findings on this issue from over 30 field studies (those carried out primarily by practitioners). This summary framework will no doubt be beneficial to practitioners, researchers, donors, and others interested in this issue and the microfinance industry in general.
The remaining content of this dissertation is organized in the following manner. Stylized facts on client exit of MFOs are presented and discussed in Chapter 2. Drawing upon job matching and technology adoption theories as well as the banking literature, a dynamic, choice theoretic model on client exit is presented in Chapter 3. The physical, social, and economic environment in which clients live and work in the Piyeli program in Mali is described in Chapter 4. An empirical model of duration is proposed in Chapter 5 based on the behavioral model from Chapter 3 and the stylized facts on client exit presented in Chapter 2. Concluding remarks are presented in Chapter 6.
CHAPTER 2

STYLIZED FACTS ON CLIENT EXIT

2.1 Introduction

Microfinance practitioners, especially those of older, more established microfinance organizations (MFOs) for which growth has slowed, are starting to take a serious look at client exit and its drain on profitability. This is not to say that younger MFOs are not experiencing problems associated with client exit. It is just that the impact of this phenomenon for younger MFOs is eclipsed by high client growth in which the rate of new incoming clients is much greater than the rate of exiting clients. Once growth begins to wane, the impact of client exit on profitability and overall sustainability becomes much more visible and dramatic.

MFO practitioners usually portray client exit as a negative phenomenon, mostly perceived as a threat to the organization’s financial health. This is a valid portrayal if MFOs are losing good clients, i.e., those that pay on time, generate larger interest revenue, and require less monitoring. On the other hand, client exit can be a positive phenomenon if MFOs are losing bad clients, i.e., those that are delinquent, have poor cash flows, require much monitoring, and generate little interest revenue. Until recently MFO practitioners have not known who (good or bad clients) was leaving their
organizations. In the last couple of years, however, practitioners have begun to investigate client exit in some detail. From their research, several interesting stylized facts have emerged. These facts are presented and discussed in the sections that follow.

In fact, the main objective of this chapter is to provide a detailed synthesis of client exit studies worldwide, focusing mainly on why clients leave. To organize the discussion a taxonomic framework is developed and exit reasons are classified by region according to this framework. A more in-depth examination of client exit issues for the MFO under study, Piyeli, is presented at the end of the chapter.

2.2 Client Exit versus Client Retention

Before reviewing client exit issues worldwide, it is important to highlight the lack of consensus that exists in the microfinance industry on client exit. To date no standardized method of measuring client exit exists. Until the industry settles on a uniform way of measuring exit, it will be difficult to compare MFOs performance in this area. A few analysts and researchers, however, have opened the discussion on standardizing a measurement of client exit or its complement, client retention. For example, Rosenberg (2001) reviews five retention and dropout rate formulas, highlighting the strengths and weaknesses of each. Although he singles out one retention rate formula, the Waterfield/CGAP Formula, as suitable in most situations because it is simple and easy to use, the Accion Formula and the Schreiner Formula are also of interest. Following Rosenberg’s (2001) discussion closely, these three formulas are reviewed below.

Rosenberg (2001) defines client retention and desertion (dropout) as follows:
“….a retention rate (RR) answers the question: When clients had a chance this period to take out a repeat loan, what percent actually took the loan? Whereas a desertion or dropout rate (DR) answers the question: When clients had a chance this period to take out a follow-on loan, what percent failed to take the loan? …… Both rates are period specific.”

The Waterfield/CGAP Formula is a retention rate formula that focuses on the client’s main decision point, the point at which she decides to take a follow-on loan. At the time that she has taken the new loan she is considered retained, even if there was a resting period before her repeat loan. This formula is calculated as follows:

$$RR = \frac{FL}{LP}$$

where,

RR = retention rate;

FL = the number of follow-on loans made during the period; and

LP = the number of loans paid off during the period.

The Waterfield/CGAP Formula is a retention rate per loan cycle. To obtain a retention rate per year, one would have to estimate the average loan term. Rosenberg (2001) says, for example, if the above formula calculates an 80 percent retention rate for the loan cycle, and the MFO has four loan cycles per year, then the retention rate per year is $$(0.80)^4$$ or 41 percent.
The Accion Formula is a desertion (dropout) rate formula and is calculated as follows:

$$DR = \frac{AC_{begin} + NC - AC_{end}}{AC_{begin}}$$

where,

- $DR$ = desertion rate;
- $AC_{begin}$ = number of active clients at the beginning of the period;
- $NC$ = number of new clients entering during the period;
- $AC_{end}$ = number of active clients at the end of the period.

Rosenberg (2001) highlights a couple of weaknesses in this formula. First, this formula does not work well for startup programs in which $AC_{begin}$ is zero. Second, by including new clients, *i.e.*, clients that have not had a chance to be retained or to desert, it overstates the frequency of clients eventually returning for another loan. The Schreiner Formula resolves the first issue by calculating the retention rate as follows:

$$RR = \frac{AC_{end}}{AC_{begin} + NC}$$

where,

- $RR$ = retention rate;
- $AC_{end}$ = number of active clients at the end of the period;
- $AC_{begin}$ = number of active clients at the beginning of the period;
- $NC$ = number of new clients entering during the period

Although this formula can be used by start up MFOs, it has the same constraint as the Accion Formula. It also does not take into account that some of the clients included
in the calculation have not had a chance to desert, and thus distorts the calculation. This formula, however, is more user friendly as it uses information that is commonly available to outside analysts.

Although some analysts have attempted to come up with a standardized way of measuring client retention or exit (or at least started the debate on it), no consensus has been achieved. Once the industry resolves this issue research on client exit will be easier to conduct and comparisons across MFOs in this respect will be more meaningful. Until then, the best that one can do is to inventory client exit rates and the stated reasons across organizations without making comparisons across organizations. It is in that spirit that client exit issues are reviewed here.

2.3 Regional and Lending Technology Biases

Another issue needs to be addressed before delving into the literature on client exit. The literature appears to be biased according to geographic location and lending technology, meaning that most exit studies were conducted on MFOs located in a certain geographic region or offered a particular type of loan product. In this section, these biases are presented in detail with possible explanations for their occurrence.

The literature underscores that client exit is prevalent throughout the southern hemisphere of the world, namely in Asia, Africa, and Latin America. Client exit within each region varies greatly and is often concentrated in one or two countries. As one might expect Bangladesh and Bolivia dominate the literature in their regions given their longer traditions of microfinance activity. Client attrition, however, is also problematic in countries like Kenya, Uganda, South Africa, and Colombia.
Another bias that is highly visible in the client exit literature pertains to lending technology. In almost all of the work that has been written on this issue the focus has been on group lending and village banking mechanisms. Out of the thirty MFOs evaluated for this review, only three institutions offer loans to individuals. And of those three, two of them also offer group loans.

What explains these biases? In the case of geography, as pointed out above, one explanation is associated with the long history of microfinance in specific countries compared to the rest of the region. With a longer track record these MFOs have had the opportunity to document, study, and work through client attrition issues. This is not the case for younger institutions that most likely have more pressing, early growth issues than client exit with which to be concerned. Microfinance in Bangladesh has by far the longest history worldwide. Several MFOs in Bangladesh were founded in the mid to late 1970s. Bolivia is also characterized by a long microfinance history beginning in the late 1980s, the longest when compared to other countries within its region. However, this does not hold true for the East African MFOs (Kenya and Uganda) whose relatively short histories are comparable to MFOs in other parts of the continent, especially in West Africa.

Another explanation that may explain the geographical bias on client exit research pertains to the size of the microfinance industry in the country. It is logical that the largest institutions would receive the most research attention. Bangladesh and Bolivia have large industries, made up of some of the biggest programs in the world. In fact, the Microbanking Standards Project (MBSP), which classifies MFOs by region and scale, highlights the fact that both of these countries dominate their peer groups in terms of
scale. For example, in MBSP’s *Asian-large* peer group classification, Bangladeshi MFOs represent 40 percent of the MFOs that make up the group. In the case of the *Latin American-large* peer group, 44 percent of the organizations are Bolivian MFOs (MicroBanking Bulletin, 2001). The scale classification is not as clear-cut in the African region, in which no country or sub-region dominates in scale.

Explaining the lending technology bias in these studies is not as obvious. The most logical explanation is that in an individual lending program the loan is tailor made to fit the needs of a client whereas group loans are designed for an entire group in a one size fits all approach. In essence, an individual loan is less risky than a group loan since a client does not have to bear the additional risk of paying for co-members. If a client ends up in a group of risky members, her chance of exit is higher than if she would have taken out an individual loan.

2.4 Classifying Stylized Facts on Client Exit

2.4.1 A Taxonomic Framework

In reviewing the available literature on reasons for client exit a broad spectrum of stylized facts emerges. To organize these facts the following taxonomic framework is developed and used: 1) those reasons defined as *adverse push factors*; and 2) those reasons defined as *market driven pull factors*. *Adverse push factors* highlight the vulnerability of the client and her inability to continue the borrowing relationship due to...

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4 Scale is measured by the total gross loan portfolio of the MFO.  
5 This taxonomy is borrowed the literature on rural-urban migration. Economic agents migrate due to *economic pull or push factors*. *Pull factors* refer to agents being pulled out of rural areas because of their human capital and growth in the demand for their labor in urban settings. *Push factors* refer to agents being pushed out of rural areas due to destitute conditions (e.g., drought, crop failures, etc.). In this second case, the agent does not likely possess the most appropriate human capital that can be easily exploited in urban markets.
negative factors encountered. In essence, she is forced or involuntarily pushed out of the credit market. *Adverse push factors* can then be divided into three subcategories: *organizational design and policy failures, idiosyncratic shocks* and *systemic shocks*. In this discussion *organizational design and policy failures* refer to poor microfinance product design and services that negatively impact her borrowing relationship. Indeed it is the inappropriate terms and conditions of the loan size or installment repayment schedules vis-à-vis the cash flows of the client’s business that frequently push clients out into competing credit markets. *Idiosyncratic shocks* pertain to any personal, family, and/or business shocks experienced by the client that affect her borrowing relationship, whereas, *systemic shocks* describe shocks felt by the entire community, such as, adverse weather conditions, civil insurrection, or adverse macroeconomic conditions negatively impacting the business community.

*Market driven pull factors* highlight *client maturity* and *healthy competition* in the microfinance industry. Examples of *client maturity* are when a client is pulled away from a specific lender or the credit market altogether because she has reached a level in her business in which she can and prefers to use self-finance from increased retained earnings, or when she has successfully *graduated* into a higher level of debt finance offered by formal banks. Another example of *client maturity* is when a person in a joint liability group loan contract decides for risk management reasons to voluntarily step out of the borrower relationship when loan differentials among group members becomes too high. In this case, the client does not want to guarantee other members’ loan amounts that are inordinately higher than her amount. She prefers to pull out of this credit market in search of a safer debt financing mechanism.
A second *market driven pull factor* is due to the level of competition in the microfinance environment. In this case, the client is pulled out of one MFO and lured into another that offers financial services with better terms and conditions. This occurs in highly competitive microfinance settings in which these markets overlap. Reasons for client exit in microfinance are summarized in Figure 2.1 below.

**Panel A: Adverse Push Factors**

**Organizational Design and Policy Failures**
- Loan sizes and terms inappropriate
- Forced and inaccessible savings
- Poor staff quality
- Deficient operational policies

**Idiosyncratic Shocks**
- Business failure
- Competition/loss of market
- Fire/theft
- Illness/death
- Ceremonies
- Economic difficulties of family members

**Systemic Shocks**
- Severe weather
- Economic recession
- Civil unrest

**Panel B: Market Driven Pull Factors**

**Client Maturity**
- Business growth
- Sufficient retained earnings
- Risk management reasons
- Graduated into individual loan program, either with new MFO, commercial lender, or formal bank

**Competitive MF Industry**
- Better terms and conditions received with another institution

*Figure 2.1: Summary of Push and Pull Factors Cited in the Literature on Microfinance Client Exit Experience*
2.4.2 Client Exit Issues Worldwide

In this section client exit factors from MFOs worldwide are reviewed. Using the taxonomic framework presented above, results from over 20 field studies on client exit are discussed by region. Overall, most people are pushed out of MFOs, especially in Africa, due to adverse push factors (organizational failures, idiosyncratic shocks, and/or systemic shocks). Market driven factors, however, also play a role in pulling clients away from MFOs, especially in Latin America and Asia, where the microfinance industry is more developed and competition is higher.

Asia

Several studies in Asia, primarily in Bangladesh, were conducted on four group-lending institutions, which examined client exit issues in detail (Hasan and Shahid, 1995; Khan and Chowdury, 1995; ASA, 1996; Mustafa, et al., 1996; Hulme and Mosley, 1997).6 As previously mentioned, much research on client exit has been conducted in Bangladesh due to a long history of microfinance as well as the scale of MFOs in the country.7 Some studies provide actual client exit rates on an annual basis, ranging from 11 to 20 percent. Comparing rates across these MFOs is problematic since no uniform measure is used as previously discussed in this chapter.

Client exit in these programs is due to both adverse shock push and market driven pull factors. Adverse push factors are primarily due to organizational design and policy failures whereas idiosyncratic and systemic shocks, respectively, only play a minor

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6 The five institutions reviewed in the literature are: Association for Social Advancement (ASA), Bangladesh Rural Advancement Committee (BRAC), Grameen Bank, and a Women’s Worldwide Banking Affiliate in Bangladesh.

7 The MicroBanking Standards Project denotes the average number of active borrowers for MFOs in the Asian Large peer group, which ASA and BRAC fall into, is 2,046,752. This is statistically different at the 0.01 level from all other regions of the world.
and/or no role in prompting exit. Several of the organizations noted the principal reasons for exit are due to poor loan products and services. On the depositor side, inaccessibility and low interest on savings contribute to client attrition (Hassan and Shahid, 1995; Khan and Chowdury, 1995; Mustafa et al., 1996). On the borrower side, complaints about the frequency and length of group meetings, the small loan amounts and high interest rates, and negligence of staff and their overall poor quality all lead to client exit (Khan and Chowdury, 1995; ASA, 1996). Not wanting to pay for defaulting group members and other group dynamic issues also play a role in client exit in this region (Hassan and Shahid, 1995; and Mustafa et al., 1996). Idiosyncratic shock factors that provoke exit include family problems and/or disapproval, migration, death, or cash flow problems within the business (Hassan and Shahid, 1995; Khan and Chowdury, 1995). Evans et al. (1999) show that former clients were less educated and had smaller households than current clients, demonstrating that overall household vulnerability plays a role in exit.

Market driven factors in the Bangladeshi MFO industry are the result of competition. Former clients typically shifted to another MFO because of better products and services (Hassan and Shahid, 1995; Khan and Chowdury, 1995; Hulme and Mosley, 1997; Evans et al., 1999).

Latin America

The Latin American studies focus on nine MFOs in the region, of which four are in Bolivia\(^8\). All but one of the MFOs utilize the group lending or village banking methodology and attrition rates are not typically documented. However, in a study on village banking in four different countries retention rates were provided. On average,  

\(^8\) MFOs studied include: Agape, BancoSol, Compartamos, PRODEM, one anonymous MFO in Bolivia, and four village banks in Bolivia, Colombia, Guatemala, and Honduras.
these banks experienced a 29 percent client retention rate after three years of activity or, conversely, a 71 percent dropout rate by the end of the period (Painter and MkNelly, 1999). In the Latin American studies reviewed, reasons for exit are due to both adverse shock push and market driven pull factors.

Adverse push factors due to organizational failures and idiosyncratic shocks appear to provoke client attrition more than systemic shocks in Latin America. In fact, none of the studies reviewed cited systemic problems as reasons for exit. Organizational design and policy failures, such as small loan amounts, too rapid repayment schedules, and high interest rates contribute to client exit (Painter and MkNelly, 1999; and Churchill and Halpern, 2001). In addition, clients leave due to limited access to savings and group problems, such as length and frequency of meetings, personality conflicts, and an overall dissatisfaction with the joint-liability system (Painter and MkNelly, 1999). Idiosyncratic shocks that prompt exit include seasonality factors that adversely influence a client’s market activity, business failures, illness, and personal problems (Painter and MkNelly, 1999; Churchill and Halpern, 2001).

Market driven pull factors in Latin America are due to both competition and client maturity. Churchill (2000) states that competition in the Latin American setting, in general, is one explanation why clients leave MFOs. This was true in Bolivia in which competition from Chilean consumer finance companies caused dropouts to double for a large Bolivian MFO offering individual loans (Schreiner, 2001). Clients also leave because they are resting, meaning they are not interested in another loan at the time. This resting is a result of no expressed need, or a realization that the client’s opportunity cost of time is too high to engage in further group borrowing (Churchill, 2000).
Studies in Africa, primarily East Africa, examine client exit issues of 17 MFOs, most of which offer group loans. Annual exit rates are high in this part of the world, ranging from 14 to 60 percent. Clients in this region are more frequently pushed out of the microfinance market due to organizational failures and idiosyncratic and systemic shocks, than they are pulled out from competition and client maturity factors.

In Africa, similar to the other two regions, organizational failures are cited frequently as reasons for client exit. Clients complain of inappropriate loan sizes and repayment schedules, complicated and poorly explained lending regulations, and dissatisfaction with the joint liability system as key factors for leaving (Painter and MKnelly, 1999; Wright et al., 1999; Kuwik and Mashaba, 2000; and Churchill and Halpern, 2001). In addition, compulsory and inaccessible savings as well as group dynamic issues, such as absenteeism, personality conflicts among members, and frequency of group meetings prompt client attrition (Kashangaki, 1999; Maximambali, 1999; Painter and MKnelly, 1999; Wright et al., 1999; Kuwik and Mashaba, 2000; Churchill and Halpern, 2001).

Idiosyncratic shocks, such as business problems like cash flow issues, seasonality factors, and lack of business skills cause clients to exit (Maximambali, 1999; Wright et al., 1999; Kuwik and Mashaba, 2000; Simanowitz, 1999; Churchill and Halpern, 2001).

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9 African MFOs studied include: ABA, CARE-WEDCO, Centenary, Finca-Uganda, FOCCAS, Faula, KREP, KWFT, NCCK, Pride-Kenya, Pride-Tanzania, Pride-Uganda, PTF, SEDA, SEF, and village banks in Burkina Faso and Uganda.
Personal and family illness and death also encourage client exit in this region (Maximambali, 1999; Wright et al., 1999; Kuwik and Mashaba, 2000; Simanowitz, 1999).

Researchers in Africa also found that client exit is provoked by systemic shocks. Some of the studies document natural disasters, e.g., drought or excessive rains, the closing of key industries, and general macroeconomic downturns as factors that provoke client exit (Kashangaki, 1999; Maximambali, 1999; Wright et al., 1999; Simanowitz, 1999).

Very limited evidence exists on clients being pulled out of MFOs in Africa due to market driven factors. In one program in Uganda clients left because they wanted to rest or seek larger loans elsewhere (Painter and MkNelly, 1999; Wright et al., 1999). In contrast to the other two regions studied, it appears that clients of African MFOs are less likely to leave due to competition from other institutions. The African microfinance industry, especially in East Africa, is much younger and smaller than those in Asia and Latin America.

2.5 Client Exit: A Case Study of PIYELI

2.5.1 Exit Reasons

As previously stated, the above discussion was generated from a critical review of the available literature on client exit reasons. In this section, however, a case study examines these issues for Piyeli, a Malian MFO. Data for this study were collected twice over a period of eighteen months (September 1999 – March 2001) in Bamako, Mali. The main objective of the research was to assess the socio-economic impacts of financial
services on microentrepreneurs/clients of this MFO; however, during the second phase of the study the questionnaire was expanded to include questions on client exit.

A randomly stratified sample of clients was drawn based on client activity, i.e., active and inactive clients. From the first to the second stage of the study the percentage of clients in an inactive status almost doubled, increasing from 29 to 52 percent, indicating an extremely high rate of exit, either temporary or permanent. During the second phase, respondents were asked explicitly if they had left the program, either temporarily or permanently. Those that confirmed their exit were then asked a series of questions on why they chose to leave. For each reason listed they were asked to rank the importance it played in provoking exit, 1 for not important, 2 for somewhat important, 3 for important, and 4 for extremely important. The responses of exited clients are listed in Table 2.1 below. Column 5, the total of columns 3 and 4, ranks client exit reasons in descending order of importance. For example, 66 percent of exited clients felt that repayment frequency too fast was an important or extremely important reason for exit (Table 2.1, column 5).10

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10 It is important to note that the exit reasons documented in Table 2.1 are subjective responses of clients who said they had exited the MFO. Actual reasons for exit are examined in Chapter 5.
<table>
<thead>
<tr>
<th>Rank Order of Importance</th>
<th>Not Important (1)</th>
<th>Somewhat Important (2)</th>
<th>Important (3)</th>
<th>Extremely Important (4)</th>
<th>Total Rank Order (3+4) (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repayment frequency too fast</td>
<td>24</td>
<td>10</td>
<td>10</td>
<td>56</td>
<td>66</td>
</tr>
<tr>
<td>Loan length too short</td>
<td>32</td>
<td>10</td>
<td>24</td>
<td>34</td>
<td>58</td>
</tr>
<tr>
<td>Repayment amount too high</td>
<td>27</td>
<td>18</td>
<td>18</td>
<td>37</td>
<td>55</td>
</tr>
<tr>
<td>Fees and interest rate too high</td>
<td>35</td>
<td>13</td>
<td>8</td>
<td>44</td>
<td>52</td>
</tr>
<tr>
<td>Problems with other group members</td>
<td>66</td>
<td>5</td>
<td>10</td>
<td>19</td>
<td>29</td>
</tr>
<tr>
<td>Group broke up/dissolved</td>
<td>66</td>
<td>5</td>
<td>14</td>
<td>15</td>
<td>29</td>
</tr>
<tr>
<td>Loan amount too small</td>
<td>68</td>
<td>6</td>
<td>8</td>
<td>18</td>
<td>26</td>
</tr>
<tr>
<td>Business failed</td>
<td>75</td>
<td>5</td>
<td>10</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Problems with MFO personnel</td>
<td>85</td>
<td>3</td>
<td>3</td>
<td>9</td>
<td>12</td>
</tr>
<tr>
<td>Joined other MFO</td>
<td>84</td>
<td>4</td>
<td>3</td>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td>Own default problems</td>
<td>86</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>Savings requirement too high</td>
<td>87</td>
<td>8</td>
<td>3</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>No time for group meetings</td>
<td>98</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Source: OSU survey 2001

Table 2.1: Reasons for Client Exit from Piyeli Clientele (n = 119)
In the Malian case, clients said that they left mostly because of inappropriate loan terms and conditions, \textit{i.e.}, repayment frequency too fast, loan length too short, repayment amount high, fees and interest rate too high, and group problems. Factors such as, lack of time for group meetings, joined other MFO with better terms and conditions, problems with MFO staff, savings requirement too high, and own default problems played a much lesser role in provoking client exit in this case. No explicit questions were asked on idiosyncratic shocks, such as fire, theft, birth, death, illness, marriage, divorce, and economic difficulties of family members as they pertain to client exit; however, respondents (active and exited) where asked to describe the nature and value of these types of shocks experienced by them 12 months prior to study interviews. It appears that idiosyncratic shocks do not play a significant role in provoking exit in the Malian case, since no significant differences emerged between the value of active clients’ shocks and those of exited clients.

\subsection*{2.5.2. Speed of Exit}

In addition to examining exit reasons of the Piyeli clientele, it is revealing to analyze the speed at which exit occurred. In Table 2.2 below, the number of loans that clients received prior to exit is shown.\footnote{Number of loans is used here as a proxy for time. Typically the first loan is for three months, followed by subsequent loans of increasing length up to one year, e.g., 3, 6, 9, and 12 months.} In the case of Piyeli, clients exited very early on in the borrowing relationship, namely eighty percent of the total exited population left after only their second loan. This could indicate a mismatch between expectations about and the actual experience of the loan product. Given the newness of the group lending technology in this setting, \textit{i.e.}, urban Bamako, clients probably did not know the true price and qualities of the group-lending product. With time, however, price and quality
information is revealed to the person, who then decides if she will repurchase, *i.e.*, borrow again, or exit and look for other debt financing options elsewhere. In this respect, a group loan is an experience good, one that requires purchase and consumption in order to evaluate its utility (Nelson, 1970).

<table>
<thead>
<tr>
<th>Number of Loans Received</th>
<th>Total ClientsExited</th>
<th>Cumulative ClientsExited</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Percent</td>
<td>Percent</td>
</tr>
<tr>
<td>1</td>
<td>38</td>
<td>38</td>
</tr>
<tr>
<td>2</td>
<td>42</td>
<td>80</td>
</tr>
<tr>
<td>3</td>
<td>16</td>
<td>96</td>
</tr>
<tr>
<td>4+</td>
<td>4</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: OSU survey 2001

**Table 2.2: Number of Loans Received before Exit**

### 2.6 Conclusions

The primary driving factors for pushing clients out of MFOs in Asia, Latin America, and Africa, are due to organizational design and policy failures: inappropriate loan sizes and terms, forced and inaccessible savings, poor staff quality, and deficient operational policies. In the Malian case, Piyeli clients also stated that inappropriate terms and conditions of the loan contract were the primary reasons for exit.
Since no uniform study design was used to examine client exit, it is difficult to make meaningful comparisons across MFOs. It appears, however, that regional differences do emerge. In the broader African context clients appear to leave MFOs due to idiosyncratic and systemic shocks more frequently than their Asian and Latin American counterparts, indicating a high level of vulnerability within the household and the overall environment in which clients live. Although not documented in the dropout studies reviewed, Asia, and in particular, Bangladesh, is also extremely vulnerable to natural disasters. For example, in 1998 Bangladesh was hit with the worst flood in its history. Researchers are beginning now to study and document the negative effects of natural disasters on MF operations there (Brown and Nagarajan, 2000). Exit in the Malian case was not due to these factors.

Lastly, market driven factors, such as competition and client maturity explain client exit in Asia and Latin America. These factors, however, do not appear to play much of a role in Africa, where the microfinance industry is much younger and smaller. In the next chapter a theoretical model on client exit is presented.
CHAPTER 3

A DYNAMIC CLIENT EXIT MODEL IN GROUP LENDING

3.1 Introduction

When actions of and private information held by economic agents are unobservable, markets can be profoundly distorted. This is true in financial markets where information asymmetries are especially pronounced (Leland and Pyle, 1977). Information asymmetries are problematic for lenders because they do not know the true types and behaviors of their borrowers. Likewise, borrowers are disadvantaged because they do not know the true qualities and costs of the lenders’ products and services. To make better lending and borrowing decisions banks and clients strive to reduce these asymmetries by producing information about one another. Lenders do this by using a variety of screening and monitoring devices, such as interest rates, collateral, successive loan contracts, and/or joint liability (Stiglitz and Weiss, 1981; Besley and Coate, 1995; Madajewicz, 1997; Rodriguez-Meza, 2000). Borrowers, on the other hand, can collect information about the lender’s products and services either by search or
experience mechanisms. These information-generating processes reduce uncertainty, permitting lenders and borrowers to establish better bank relationships of long lasting quality.

A quality, long-term relationship is beneficial to both the lender and the borrower. As the relationship matures, the lender benefits from lower screening and monitoring costs, increased revenue assuming loan balances grow over time, and improved lending decisions given that risk decreases as more information about the borrower is revealed. Benefits to the borrower include a continued and often expanded access to credit, a cost reduction in capital as terms and conditions improve over the long run, and an opportunity to establish a valuable reputation as a trustworthy borrower (Ongena and Smith, 2001).

Given that both the lender and the borrower benefit from a sound, long-term relationship, it is important to examine the factors that may diminish its quality and/or shorten its length. Therefore, one of the main objectives of this study is to examine the dynamics that affect the length of the bank relationship. Examining the dynamics of this relationship is useful to both MFO practitioners and donors. As practitioners strive to reach sustainability, understanding why borrowers end bank relationships is imperative, especially for MFOs in competitive microfinance markets or those faced with diminishing donor support. With this information they will be able to adjust their current

---

12 In the terminology of Nelson (1970), search goods are products or services whose quality and price can be observed prior to their purchase. Experience goods are those that have to be purchased in order to determine price and quality. In this study, the bank relationship is modeled as an experience good.

13 Bank relationship is used as a short-hand expression to include all organizational types of lenders. In the scope of this dissertation, bank relationship refers to the borrower-lender relationship of a group lending program.
policies and/or develop new products and services to better meet the needs of their clientele, ultimately resulting in longer, more sustainable bank relationships.

Today donors discourage “on-going” subsidization of MFOs (Morduch, 1999). Rather, they focus on funding startup costs and require MFOs to meet strict sustainability targets in the medium term, i.e., 5-7 years. Therefore, any information that helps donors to better understand a problem that threatens MFO sustainability, such as client exit, is useful. With this information active donors, i.e., those that offer more than funding, can better assist MFOs through more appropriate technical assistance, especially in the areas of product, policy and staff development. With this information they may also decide to facilitate a larger scale research project to examine the issue in more detail.

One of the main contributions of this research is to provide a theoretical framework that explicitly focuses on the termination of the bank relationship. The theoretical model used to analyze this problem focuses solely on the borrower’s optimal decision to exit the bank relationship, i.e., group lending program, given her belief about her partner’s type and her own outside financing option. This model does not examine the lender’s decision to terminate the relationship. Instead it is assumed that the lender’s purpose is to maximize borrower’s welfare.

To fully capture the nature of this problem, it is set up in a dynamic setting, permitting the optimizing agent, i.e., borrower, to evaluate her current and future rewards of staying in or exiting the borrowing relationship at the end of each $n$ periods. Therefore, a brief description of dynamic economic models is provided in the next section for the reader’s reference.
3.2 Dynamic Economic Models

Dynamic economic models make it possible to analyze complex human systems by incorporating the following facts simultaneously:

1). Humans are cogent, future looking individuals capable of evaluating how their actions will affect their future as well as their present well being.

2). Human behavior is unpredictable.

3). The predictable part of human behavior is complex.

Given these aspects of human behavior, dynamic models are typically future-looking, stochastic, and inherently nonlinear, and require the use of numerical methods to explicitly solve them. Due to the proliferation of the personal computer over the last two decades as well as the development of user-friendly software programs, economists can more easily incorporate numerical methods to analyze dynamic models.

Dynamic models consist of the following basic components. In every period $t$, an agent observes the state of an economic system, $s_t$, takes an action, $x_t$, and earns a reward, $f(s_t, x_t)$. The reward depends on both the state ($s_t$) of the process and the action taken ($x_t$). The state of the process follows a controlled Markov Probability Law, which asserts that the probability distribution of next period's state, conditional on all currently available information, depends only on today's state and actions of the agent depicted as follows:

$$P(s_{t+1} = s' | x_t = x, s_t = s) = P(s' | s, x)$$  \hspace{1cm} (3.1)

The agent seeks a policy of state contingent actions $x_t^*(s)$ that maximizes the present value of current and expected future rewards over time.

---

14 This section follows closely Miranda and Fackler’s (2002) discussion on dynamic economic models.
Dynamic programming methods, based on the Principle of Optimality, are used to analyze discrete Markov decision models. Richard Bellman (1956) developed these methods and formally expressed the Principle of Optimality in the form of the Bellman equation which implies that the value functions $V_t : S \rightarrow \mathbb{R}$ must satisfy the following optimization problem:

$$V_t(s_t) = \max_{x \in X(s)} \left\{ f(s_t, x_t) + \delta \sum_{s' \in S} P(s'|s, x) V_{t+1}(s') \right\}$$

(3.2)

where,

$t = 1, 2, \ldots, T$;

$V_t$ = value function in period $t$;

$s_t$ = state of the process in period $t$;

$x_t$ = action of agent in period $t$;

$f(s_t, x_t)$ = reward function;

$P(s'|s, x) = $ Markov Probability Law;

$\delta = $ discount factor.

Equation (3.2) describes the problem faced by the optimizing agent, the need to balance current rewards with expected future rewards.

Dynamic models have a finite or infinite horizon. In a finite horizon model an optimizing agent is faced with decisions in each period. At the end of the horizon, $T$, she also receives a terminal reward, which in most model qualifications is fixed at zero. If a terminal reward does exist, however, it must have a relevant economic meaning. In an
infinite horizon model, the value functions do not depend on time, $t$. Given this, the maximization problem turns into a fixed-point equation whose single unknown is the common value function, $V(s)$.

In this dissertation a finite horizon, stochastic model is used to qualify the optimizing agent’s problem to stay or exit the banking relationship in each period. The model is described in detail in the following section of this chapter.

### 3.3 General Model Framework

Assume an economy is made up of heterogeneous, anonymous, relatively mobile, credit constrained borrowers, *i.e.*, firms. A firm $i$ wants to maximize profits over her life cycle by investing in her business on an on-going basis. To do this she strives to establish a long-term relationship with a formal bank; however, she lacks the necessary physical collateral required by the bank to obtain loans. Instead, she engages in a sub-optimal strategy of group-lending in which she is jointly liable for her own repayment as well as her co-members’ payments in the event they cannot repay their loan shares. However, if the group demonstrates good repayment behavior, *i.e.*, never defaults, after $n$ loan cycles, then the members are rewarded with an admission into an individual loan program.

To simplify the model assume firm $i$ forms a group over the life cycle with one other member, firm $j$. Each member receives loan share, $l$, and pays an interest rate, $r$, at the end of the cycle. It is assumed once firm $i$ has selected firm $j$ that they are together until the end of the relationship, *i.e.*, until both firms graduate to individual lending or
one or the other exits the group lending program, whichever comes first. The pool of potential borrowers from which firm \(i\) chooses her group member is made up of two types of firms, *high ability* firms and *low ability* firms. Firms, irrespective of type, have either *high* or *low* outcomes.

Firm \(i\)'s objective is to maximize her utility over the life cycle. Firm \(i\) derives utility in each period from her income, \(\bar{y}\), plus the return on her loan, \(r^*\), minus her borrowing costs, \(r_l\), as well as her costs due to firm \(j\)'s nonpayment. She pays an additional \((1+r)l\) when her partner has a low outcome and nothing otherwise. Assume firm \(i\) is a high ability firm who is able to repay her loan as well as her partner’s share, when necessary. In other words, firm \(i\) always repays even if she knows that she is going to exit the borrowing relationship. Firm \(i\) does this because she does not want to jeopardize her credit worthiness, a valuable asset to be drawn upon in the future. Firm \(j\)'s business outcomes and repayment behaviors are as follows. If she has a high outcome, she repays her loan share; however, in the event her outcome is low she earns nothing and is unable to repay. In the latter scenario, firm \(i\) is forced to repay firm \(j\)'s share.

In addition, firm \(i\) does not know the ability type of her partner before choosing her. Given this, she is faced with uncertain costs as long as they remain partners due to joint liability of the loan contracts. If she picks a low ability type she will have to pay for her partner more often than if she picks a high ability type, since low types experience low outcomes more often than high types. Even though firm \(i\) does not know firm \(j\)'s type with certainty, she *learns* about her type by observing firm \(j\)'s productive outcomes as
they are revealed over time.\footnote{In this sense the match, \textit{i.e.}, the borrowing group relationship, is modeled as an \textit{experience good}, one in which the true price and qualities are not known until one \textit{experiences} it.} Firm, knows the distribution of firms in the population is as follows: firms are of \textit{high ability} with probability, $p$, and \textit{low ability} with probability, $1-p$. She also knows the conditional probabilities of outcomes given firm type are as follows:

\begin{align*}
Pr(\text{high}|\text{high}) &= q_{11} \\
Pr(\text{high}|\text{low}) &= q_{10} \\
Pr(\text{low}|\text{high}) &= q_{01} \\
Pr(\text{low}|\text{low}) &= q_{00}.
\end{align*}

Since low ability firms fail more often than high ability firms, $q_{00}$ is greater than $q_{01}$. With this information firm, calculates a subjective probability about firm’s type, $p$, and uses it to estimate an expected cost that she will have to bear due to her partner’s probable non-payment in the future. At the end of each loan cycle, \textit{i.e.}, after full repayment of the group loan, she updates her prior belief about her partner’s type using Bayes’ Rule and recalculates her cost of remaining in the borrowing relationship. At that point, firm, decides whether to remain in the borrowing group and take another loan or exit and use self-financing. To make this decision she compares her subjective belief about her partner being a \textit{high type}, $p$, to a critical probability value, $\hat{p}$. The critical probability is the value at which firm, is indifferent about staying in or exiting the group loan contract. If $p$ is greater (less) than $\hat{p}$, she stays (exits). The critical value, $\hat{p}$, is an increasing function of time which reflects the diminishing returns to learning. The longer firm, remains in the contract the less impact new information has on her belief about her
partner’s type and the less willing she is to remain with a low ability type partner. In contrast, in the beginning of the relationship (more periods to go) firm$_i$ is more tolerant of low outcomes of firm$_j$, and is more willing to remain in the relationship to see if she is really a low ability type firm. Over time, her belief about her partner’s type becomes closer to firm$_j$’s true type since high ability types succeed more often than low ability types.

This model framework focuses explicitly on the client’s decision to remain or exit the borrowing relationship, i.e., group loan program. Therefore, the MFO is not modeled explicitly into the design. Instead the MFO is considered to be a passive lender whose only objective is to maximize borrowers’ utility. In this setting the MFO delegates all screening, monitoring, and repayment responsibilities to the borrowers. The organization penalizes default by denying future access to credit. However, good behavior is rewarded to firms who have successfully completed $n$ cycles of group loans. At that stage they are admitted into the individual loan program. In essence, once a firm receives this contract she can do no better than this.

To maximize profits over the life cycle firm$_i$ needs to choose an optimal stay-exit policy. To fully capture the nature of this problem, it is setup in a dynamic setting, permitting the optimizing agent to evaluate her current and future rewards given her state contingent actions. This model has the following setup.

---

16 This is a natural objective function for non-profit organizations, the way most MFOs are officially registered and recognized in countries where they operate. This assumption is equivalent to considering a perfectly competitive credit market (Madajewicz, 1997).
This is a finite horizon, stochastic model with time $t$ measured in loan cycles. The 
state variable

$$p \in [0,1]$$

is the probability representing firm$_i$'s belief about firm$_j$ being a high ability firm. The 
action variable

$$x \in \{ \text{stay, exit} \}$$

is the stay-exit decision. The state transition function is

$$g(p, x) = \begin{cases} 
p', x = \text{stay} \\
p, x = \text{exit} 
\end{cases},$$

where,

$$p' = \frac{pq_{11}}{(pq_{11} + (1-p)q_{10})} \quad \text{for high outcome, and}$$
$$p' = \frac{pq_{01}}{(pq_{01} + (1-p)q_{00})} \quad \text{for low outcome.}$$

Firm$_i$'s subjective probability about firm$_j$'s type is updated at the beginning of each period using Bayes' Rule.\textsuperscript{17} If firm$_i$ exits in the current period, her belief about her partner’s type is no longer updated so it remains at the current belief of $p$. The reward functions for staying and exiting are

$$f(p|\text{stay}) = (pq_{11} + (1-p)q_{10})U(\hat{Y}+r^*-rl) + (pq_{01} + (1-p)q_{00})U(\hat{Y}+r^*-rl-(1+r)l);$$
$$f(p|\text{exit}) = U(\hat{Y}).$$

where,

$\hat{Y}$ is firm$_i$'s income;

$r^*$ is her return on the loan net of principal;

\textsuperscript{17}DeGroot (1975) states “……Bayes' Theorem is a simple rule for computing the conditional probability of each event $A_i$ given $B$ from the conditional probability of $B$ given each event $A_i$ and the unconditional probability of each $A_i$. “
is her interest cost associated with the loan;

\((1+r)l\) is firm_i’s additional loan costs (principal and interest) in the event her partner is not able to repay. She pays \((1+r)l\) when partner has a low outcome and nothing otherwise.

It is assumed that firm_i makes her decision at the beginning of each period, t. Firm_i’s reward function when she stays is an expected utility given that there are two possible outcomes at each point in time, high or low. Therefore, the reward function when she stays is the expected utility she gains from staying. This is the conditional probability of a high outcome times the utility given she stays when outcome is high plus the conditional probability of a low outcome times the utility given she stays when outcome is low.

Firm_i’s subjective probability about firm_j’s type, \(p\), satisfies the following Bellman equation:

\[
V_t(p) = \text{Max} \{ U(\text{stay}|p), U(\text{exit}|p) \},
\]

where,

\[
U(\text{stay}|p) = [pq_{11} + (1-p)q_{10}] \times \left[ U(\tilde{Y} + r^* - rl + \delta V_{t+1}(\frac{pq_{11}}{pq_{11} + (1-p)q_{10}})) \right]
\]

\[
+ \ [pq_{01} + (1-p)q_{00}] \times \left[ U(\tilde{Y} + r^* - rl - (1+r)l + \delta V_{t+1}(\frac{pq_{01}}{pq_{01} + (1-p)q_{00}})) \right];
\]

\[
U(\text{exit}|p) = \sum_{\tau=t}^{T} \delta^{\tau-t} \tilde{Y}.
\]
The value function, $V_t(p)$, describes the maximum stream of discounted returns of firm $i$’s two options: staying or exiting. For the stay option firm $i$’s calculates her present and discounted future returns given her belief about firm $j$’s type in each time period. As previously stated firm $i$ updates her belief about firm $j$’s type using Bayes’ Rule. She compares the value of staying to the value of exiting, a stream of discounted returns given her self-financing option. The terminal condition

$$V_{T+1}(p) = \frac{1}{1-\delta} U(\bar{y}+r^*-rI)$$

(3.4)

is the discounted utility received from receiving an individual loan contract for her future financing needs.

### 3.4 Numerical Methods and Solutions

Generally, numerical methods are chosen when models lack an analytic, closed-form solution. This model could be solved analytically; however, as the time horizon expands, calculating its solution would become cumbersome and quite time-consuming. Therefore, a numerical approach is preferred. In particular interpolation methods are used to calculate the unknown value function as defined by Equation (3.3). A brief description of these methods is provided for the reader’s reference. This discussion follows closely Miranda and Fackler, 2002.

An interpolation scheme allows one to solve the Bellman’s equation by approximating the unknown value function. This is accomplished using the collocation
method in which a value function approximant is written as a linear combination of \( n \) known \emph{basis functions} \( \phi_1, \phi_2, \ldots, \phi_n \) and unknown \emph{basis coefficients} \( c_1, c_2, \ldots, c_n \) as follows:

\[
V(s) \approx \sum_{j=1}^{n} c_j \phi_j(p) \quad (3.5)
\]

where \( p \) is the state variable in this model, \( i.e. \), firm\(_i\)’s subjective probability about firm\(_j\)’s type. In this setup, basis coefficients are determined by designing an interpolation scheme that requires the approximant to satisfy the Bellman equation at \( n \) prescribed collocation nodes, \( p_1, p_2, \ldots, p_n \) as follows:

\[
\sum_{j=1}^{n} c_j \phi_j(p_i) = \max_{x \in X(p_i)} \left\{ f(p_i, x) + \delta \sum_{j=1}^{n} c_j \phi_j(g(p_i, x)) \right\}. \quad (3.6)
\]

Equation (3.6) is the collocation equation evaluated at the \( i^{th} \) collocation node which can be expressed in the following vector notation:

\[
\Phi c = v(c).
\]

The collocation matrix, \( \Phi \), is the \( n \times n \) matrix whose \( ij^{th} \) element is the \( j^{th} \) basis function evaluated at the \( i^{th} \) collocation node. This is represented as follows:

\[
\Phi_{ij} = \phi_j(p_i).
\]

The collocation function, \( v \), is the function from \( \mathbb{R}^n \) to \( \mathbb{R}^n \) whose \( i^{th} \) element is:

\[
v_i(c) = \max_{x \in X(p_i)} \left\{ f(p_i, x) + \delta \sum_{j=1}^{n} c_j \phi_j(g(p_i, x)) \right\}. \quad (3.7)
\]

Equation (3.7) is evaluated at a particular vector of basis coefficients \( c \), which yields a
vector whose $i^{th}$ element is the value of the Bellman equation at the $i^{th}$ collocation node, \( p_i \), replacing the value function \( V \) with its approximant, \( \sum_j c_j \phi_j \) (Miranda and Fackler, 2002).

The collocation equation, \( \Phi c = v(c) \), can be solved as a fixed point problem, \( c = \Phi^{-1} v(c) \), or a rootfinding problem, \( \Phi c - v(c) = 0 \). In this setup, the collocation equation is solved as a fixed-point problem using function iteration with the following iterative updating rule:

\[
    c \leftarrow \Phi^{-1} v(c) .
\]

The model as described in Section (3.3) is solved using MATLAB, a vector processing language. Function approximation and numerical quadrature routines contained in the COMPECON library as designed by Miranda and Fackler (2002) simplify the coding of this model. The solution to this model explicitly maps out firm$_i$’s value function of staying in each period given a continuum of subjective probabilities on the interval \([0,1]\). Remember, at the beginning of each period firm$_i$ calculates her value of staying in given her current belief about firm$_j$’s being a high type, \( p \). This calculation is based on current rewards plus a stream of discounted future rewards. She chooses the maximum value between staying and exiting in each period. She remains in the borrowing relationship as long as her staying value is greater than her exiting value. The following steps are used to develop a MATLAB program to solve this maximization problem.
First, the parameters of the model are specified. The relative risk factor, periods in the model, the discount factor, firm’s income, the return on the loan, the interest rate of the loan, the principal amount of the loan, and the conditional probabilities of high/low outcomes given high/low type are defined, respectively:

\[
\begin{align*}
\alpha &= 0.5; \\
T &= 5; \\
\delta &= 0.95; \\
\bar{y} &= 1.0; \\
\bar{r} &= 0.5; \\
r &= 0.1; \\
l &= 0.2; \\
q_{00} &= 0.7 \\
q_{01} &= 0.3; \\
q_{10} &= 1-q_{00}; \\
q_{11} &= 1-q_{01}.
\end{align*}
\]

At this stage the terminal reward of receiving individual loans is set to zero. Implications of a terminal reward are examined in to some degree in Section 3.5.

Second, the basis functions and collocation nodes are specified. Here a 50-function Chebychev polynomial basis function on the interval $[0,1]$ is used to approximate the unknown value function. To evaluate the collocation function the COMPECON library routines \texttt{fundefn}, \texttt{funnode}, and \texttt{funbas} are used:

\[
\begin{align*}
n &= 50; \\
f_{\text{space}} &= \text{fundefn(‘cheb’,}n,0,1); \\
p_{\text{nodes}} &= \text{funnode}(f_{\text{space}}); \\
\Phi &= \text{funbas}(f_{\text{space}}).
\end{align*}
\]
Third, the utility function is specified. Firm_i derives utility from income and net gain from borrowing. A constant relative risk aversion utility function is used with a factor of relative risk aversion equal to \( \alpha \). In addition the state transition probabilities and the value function are defined.

\[
\text{for } t=T:-1:1 \\
\quad v_{\text{exit}}(t) = u(y_{\text{bar}}, \alpha) + \delta v_{\text{exit}}(t+1); \\
\quad \text{for } i=1:n \\
\quad \quad p = \text{pnodes}(i); \\
\quad \quad p_0 = p*q_{01} + (1-p)*q_{00}; \\
\quad \quad p_1 = p*q_{11} + (1-p)*q_{10}; \\
\quad \quad p_{\prime 0} = p*q_{01}/p_0; \\
\quad \quad p_{\prime 1} = p*q_{11}/p_1; \\
\quad \quad v_{\text{next}0} = \max(v_{\text{exit}}(t+1), \text{funeval}(c(:, t+1), fspace, p_{\prime 0})); \\
\quad \quad v_{\text{next}1} = \max(v_{\text{exit}}(t+1), \text{funeval}(c(:, t+1), fspace, p_{\prime 1})); \\
\quad \quad V(i, t) = p_0*(u(y_{\text{bar}}+r_{\text{star}}*l-r*l-(1+r)*l, \alpha) \\
\quad \quad \quad + \delta v_{\text{next}0}) + p_1*(u(y_{\text{bar}}+r_{\text{star}}*l- \\
\quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad r*l, \alpha) + \delta v_{\text{next}1}); \\
\quad \text{end}
\]

Fourth, the model is solved using the collocation method described above. A conditional value function is derived instead of the value function of the maximization problem, which is inherently kinked, i.e., the maximum value between staying and exiting. In addition, a critical probability function, \( p_{\text{crit}} \), is derived using the \text{ncpsolve} routine. This function yields the critical probability that firm_i has about firm_j being a high type at each point in time. Literally \( p_{\text{crit}} \) is the probability value at which firm_i is indifferent between staying and exiting the relationship. If firm_i’s subjective
probability about firmj’s type is greater(less) than $pcrit$ then she stays(exits) the borrowing relationship. Another way to state this is that subjective probability values, $p$, greater than $pcrit$ will yield a staying value higher than an exiting value.

The solution of this maximization problem as depicted in Figure 3.1 tells an interesting story about learning and tolerance. First, the vertical axis is the value of staying in the credit relationship divided by the value of exiting, or the value function of staying in. On the horizontal axis is a continuum of firmi’s subjective probability values. At each subjective probability on the interval $[0, 1]$ the value of staying in the credit relationship is computed, *i.e.*, the conditional value function of staying in. Values above(below) 1 are the values at which firmi stays(exits) the borrowing relationship. When a subjective probability yields a staying value of 1, it is called the critical probability value. This is the value at which firmi is indifferent between staying and exiting the relationship. Subjective probabilities above(below) this value prompt firmi to stay(exit) the borrowing relationship. When firmi is certain firmj is a low type, *i.e.*, $p=0$, her staying in value is less than her exiting value. This is true for all subjective probability values less than 0.55.
As depicted in Figure 3.1, there are five critical probability values, one for each time period where the staying in value function crosses the critical value of 1. These $p_{crit}$ values are increasing with time. This is explained by the following. In the beginning of time, learning has much value. In other words, since firm $i$ has no information in period one she is tolerant and willing to stay in and learn about her partner. As time passes, however, learning looses value as firm $i$ knows there is not much more new information about firm $j$ to be gained. At this point, her $p_{crit}$ value is large making it more difficult to remain in the contract with low types. In essence, she is less
willing to remain in the contract because there is not much additional knowledge to be gained about her partner at later periods in the relationship. This is reflected by the marginal increases in critical probability values over time. In the beginning, marginal increases in the critical probability values are very small reflecting firm\textsubscript{i}’s high value of learning. Marginal increases in later periods are relatively large, reflecting firm\textsubscript{i}’s low value of learning. The critical probability values yielded in this model are depicted in Figure 3.2. In this figure, pcrit values are high when there are few to no periods remaining and low in the beginning when there are several periods to go. In other words, firm\textsubscript{i} stays in at lower values of \( p \) when there are many periods to go and exits in later periods for the same \( p \) values as pcrit increases over time.

![Figure 3.2: Critical Probabilities over Time](image)

Increasing the parameter value of the horizon value, \( T \), reiterates firm\textsubscript{i}’s optimal behavior on learning. Figure 3.3 is the solution to the main model where \( T=10 \) periods.
As shown, firm_i’s critical probability values in the beginning periods increase at very small amounts reflecting the high value she places on learning. As time passes, however, pcrit values increase at larger increments with each period. Comparing Figure 3.1 and 3.3, one sees that in periods 6-10 in Figure 3.3 firm_i has the same critical probability values as in periods 1-5 in Figure 3.1.

![Figure 3.3: The Conditional Value Function of Staying In the Credit Relationship](image)

This model is solved at several different parameter values for the following parameters: loan size, interest rate, relative risk aversion, and loan return. In Figures 3.4
– 3.7, critical probability values are plotted against these parameters in periods one, five, and ten. Some interesting dynamics emerge. First, in Figure 3.4 one observes that critical probability values are increasing in loan size. This means at larger loan amounts firm, is less tolerant of staying with a low type partner. Although she benefits from the larger loan amount, this benefit is tempered by the fact that she will incur a large cost if her partner is unable to pay. Knowing this she increases her critical probability as the loan size increases. Given this, for the same subjective probability, \( p \), her stay/exit decision may be different given the critical probability values associated with loan size. In other words a \( p \) value that was large enough to stay in at a loan size of 0.2 may not be large enough to keep her in at a loan size of 0.6.

![Figure 3.4: Critical Probabilities and Loan Size Over Time](image-url)
Similar to loan size, critical probabilities are increasing in interest rates (Figure 3.5). As loans become costlier, firm_i is less willing to stay in a contract with a partner of low type. In fact, at a 0.15 percent rate, she never enters the relationship. In essence it is too costly for her to engage in this arrangement at this price, given the other parameter values of this model.

Figure 3.5: Critical Probabilities and Interest Rate over Time
As one would expect, critical probabilities increase in relative risk aversion (Figure 3.5). The more risk averse firm is the less tolerant she is about staying in a borrowing group with a low type partner. For example, assume two individuals have the same subjective belief about her partner’s type. The more risk averse individual will exit sooner than the less risk averse person given her critical probability value will be higher. Remember that the stay/exit rules are as follows:

\[
P > p_{\text{crit}} \quad \text{stay}
\]
\[
P < p_{\text{crit}} \quad \text{exit}
\]

This result is exacerbated over time as critical probability values increase over time.

Figure 3.6: Critical Probabilities and Relative Risk Aversion over Time
Critical probabilities decrease with loan returns (Figure 3.7). This means that firm, is more willing to stay in the contract as loan returns increase; however, she requires a minimum return to even enter the contract given the parameter values of this model. In essence, as returns increase, she has more resources to cover the costs associated with her partner’s inability to pay the loan. However, over time critical probabilities increase, tempering this effect over all.

Figure 3.7: Critical Probabilities and Loan Return over Time
3.5 Model Simulations on Survival Paths

In this model firm<sub>i</sub> makes an optimal stay/exit decision in each period given the observed business outcomes of her partner. As modeled, business outcomes are totally exogenous in this economy. Firm<sub>i</sub> does not know what outcomes will arise in each period. However, she does know the conditional probabilities about outcomes given her partner’s type. Given the length of the horizon T, i.e., the number of loan cycles, an optimizing agent can calculate a survival probability path of being with a high type and that of being with a low type. She does this in the following manner.

First, given that there are two possible outcomes (high and low) in each period, one knows that there are exactly 2<sup>T</sup> possible outcome paths. For a horizon of T=3, there would be eight different possible outcome paths; for T=5, 32 possible paths, for T=10, 1024 possible paths, and so. Given an initial value of her subjective probability about her partner being of high type, p<sub>i</sub>, firm<sub>i</sub> can calculate 2<sup>T</sup> subjective probability paths given the 2<sup>T</sup> possible outcome paths discussed above. With these p values she can map out the stay/exit paths given her critical probability in each period. One should bear in mind, that once firm<sub>i</sub> exits she is out for good. Therefore if she exits in period one, she is out for the remaining time in the horizon.

With the conditional probabilities on outcomes given her partners type, she is able to calculate a probability on a low (high) type experiencing a particular outcome path. In essence, she calculates two probabilities for each outcome path, one probability for the outcome path given a low type partner and one probability for the outcome path given a high type. For 2T outcomes she will have 2T conditional probabilities on outcomes for
each low and high type partner. Last, with these conditional probabilities she can calculate survival probability paths, one if her partner is a low type and one if her partner is a high type. She does this by multiplying her conditional probability outcomes by the stay/exit paths for each type. This results in a survival probability for each partner type at each period in time. The original dynamic model describe in Section 3.4 is extended to include these additional actions of firm$_i$. For the base model here, Figure 3.9 depicts firm$_i$’s survival probability paths for low and high type partners.

In Figure 3.9 survival probability paths are decreasing with time for firm$_i$ with a either a high or low type partner. As expected, the survival probability with a high type partner is larger than the survival probability with a low type partner at all points in time. In the beginning, the survival probability is 1, meaning that firm$_i$ agrees to enter the contract with firm$_j$. However, the survival probabilities for high and low type partners decrease to 0.45 and 0.05, respectively, by the end of the time horizon.
Figure 3.8: Survival Probability Paths with High/Low Type Partners (T=5)

In Table 3.1 the survival probabilities of several models are presented. Changing parameter values affects the survival probabilities given high and low type partners. Recall the parameter values of the base model:

\[
\begin{align*}
\text{alpha} &= 0.5; \\
T &= 5; \\
\text{delta} &= 0.95; \\
\text{ybar} &= 1.0; \\
\text{rstar} &= 0.5;
\end{align*}
\]
\[ \begin{align*}
    r & = 0.1; \\
    l & = 0.2; \\
    q_{00} & = 0.7 \\
    q_{01} & = 0.3; \\
    q_{10} & = 1 - q_{00}; \\
    q_{11} & = 1 - q_{01}. \\
\end{align*} \]

In the first class of models the impact of interest rate and loan size on survival are examined. In the base case, firm's survival to the end is estimated at 45 percent if she is with a high type and 5 percent if she is with a low type partner. When loan size is increased and the interest rate is lowered, these survival probabilities increase to 65 and 15 percent for high and low type partners, respectively.

In classes II and III, the interest rate is held constant along with the other parameters of the model while loan size is increased incrementally. In both cases, survival probabilities are diminished as loan size increases; however, in Class III when the interest rate is held at 0.05, survival probabilities diminish at a slower rate. When this exercise is repeated using a higher value of risk aversion, the survival probabilities diminish at faster rate as loan size increases than those in Classes II and III where risk aversion is 0.5. In summary, better (worse) terms, \textit{i.e.}, larger (smaller) loan and lower (higher) interest rate, increase (decrease) survival probabilities. However, it appears that increasing loan size alone ultimately decreases the survival probabilities of the firm. These results are exacerbated at high levels of risk aversion.
<table>
<thead>
<tr>
<th>MODELS</th>
<th>$r$</th>
<th>$l$</th>
<th>Survival w/high type</th>
<th>Survival w/low type</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1</td>
<td>0.10</td>
<td>0.2</td>
<td>0.45</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>0.05</td>
<td>0.3</td>
<td>0.64</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>0.15</td>
<td>0.1</td>
<td>0</td>
</tr>
</tbody>
</table>

Holding $r$ constant at 0.1 and increasing $l$

| II     | 4   | 0.10| 0.2                  | 0.45                |
|        | 5   | 0.10| 0.3                  | 0.45                |
|        | 6   | 0.10| 0.4                  | 0                   |

Holding $r$ constant at 0.05 and increasing $l$

| III    | 7   | 0.05| 0.2                  | 0.64                |
|        | 8   | 0.05| 0.3                  | 0.64                |
|        | 9   | 0.05| 0.4                  | 0.55                |

Holding $r$ constant at 0.1 and increasing $l$ for $\alpha = 0.8$

| IV     | 10  | 0.10| 0.2                  | 0.45                |
|        | 11  | 0.10| 0.3                  | 0                   |
|        | 12  | 0.10| 0.4                  | 0                   |

Holding $r$ constant at 0.05 and increasing $l$ for $\alpha = 0.8$

| V      | 13  | 0.05| 0.2                  | 0.64                |
|        | 14  | 0.05| 0.3                  | 0.55                |
|        | 15  | 0.05| 0.4                  | 0.55                |

Table 3.1: The Effect of Different Parameter Values on Survival Probability Paths

Keeping groups together is beneficial to MFOs as it saves them costs and increases overall return on group investment. Therefore, it seems logical to induce stability by offering groups that stay together a reward. To examine the effect a reward system may have on individuals in groups, an end reward is modeled into the framework.
In this setting once groups make it through a predetermined number of loan cycles together they are awarded access into the MFO’s individual loan program. Interesting behaviors emerge in this setting.

In short, rewards do affect the behavior of an optimizing agent making stay/exit decisions. For some parameter values an agent will not enter into the contract when there are no rewards, but will when rewards are introduced into the scheme (Models 1 and 3). For other parameter values, the agent would enter the contract with or without rewards. The only difference is that a reward scheme induces the optimizing agent to enter and remain for the entire period of the agreement (Model 2). There are other parameter values, however, in which an optimizing agent would never engage in group loans irrespective of a set reward scheme (Models 5 and 6). In both of these models the horizon is set at ten loan cycles. When this assumption is relaxed to five loan cycles the optimizing agent would enter the group and stay for all five periods with certainty (Models 6 and 7). Although it was not worth it for her to remain in the relationship for 10 periods, it becomes much more attractive for a shorter period of five.
Table 3.2: Comparison of Outcomes in ‘No Reward’ and ‘Reward’ Models

What this means is that rewards do matter; however, one should be extremely cautious in interpreting these results. Although, rewards do matter, implementing a system such as granting successful groups access to individual loans could have severe repercussions on the MFO’s loan portfolio. With such a system it is difficult to differentiate between good and bad borrowers. If the objective is to induce group stability, then some type of reward system is beneficial. The nature of the system, however, should be carefully constructed to avoid problems associated with rewarding the wrong type of clients, *i.e.*, those that had difficulty paying and were carried by other group members.
CHAPTER 4

GROUP LENDING IN MALI

To study the factors that affect the length of time a client remains in the borrowing relationship, one must have a solid understanding of the physical, social, and economic environment in which clients live and work. As presented in Chapter 2, it appears that environmental factors do affect borrowing relationships. From natural disasters and economic downturns to competition in the workplace and from other MFOs, environmental factors play an important role in a client’s decision to stay or leave the institution. Changes in this environment in and of itself may shed important light on the reasons for client exit. Therefore, the main objective of this chapter is to examine the physical, social, and economic environment of the clients under study. The knowledge gained can be used to shape the theoretical and empirical components of this research. In the following section, a detailed description of the national and local environments is presented. This is followed by a presentation of Piyeli’s\(^{18}\) organizational design and performance, and a description of client characteristics in the sample.

\(^{18}\) Piyeli, a Bambara word meaning to gather/hold, is the official name of the microfinance organization under study.
4.1 Physical, Social, and Economic Environment in Mali

4.1.1 National Level

Mali is a landlocked country in West Africa, sharing borders with Algeria to the north, Niger and Burkina Faso to the east, Cote d’Ivoire and Guinea to the south, and Senegal and Mauritania to the west. It is a large country with a land area of 1.24 million square kilometers, slightly less than twice the size of Texas (CIA World Factbook, 2002). This makes it the second largest country in West Africa. The northern two-thirds of its landscape consist mainly of flat rolling plains covered by sand, while the southern third is sub-tropical savanna. Only four percent of its land is arable, and due to risky climatic conditions, annual rainfall is only adequate for 25 percent of the arable land. Mali’s main water source is the Niger River, which traverses the country from west to east. The bulk of agricultural production occurs in the southern third of the country, and is more concentrated along the banks of the Niger (FAO, 2000).

Figure 4.1: Map of Mali
Mali is one of the least developed countries in the world, characterized by high population growth, poor living standards, and an unstable economic environment. Over the last 30 years Mali has not made great progress in reducing its population growth. During this period crude birth rates have been sustained by a high total fertility rate, most likely due to a large percent of the population engaged in agriculture, the low status of women, and a high infant mortality rate (Table 4.1). All of these factors, influence childbearing decisions because children are needed to assist in farming activities; women with little economic opportunities due to a low literacy rate bear more children; and in an environment where infant mortality is high, people have more children to replace those that might not live past the age of five. Also, in the Malian environment in which a social security system is poor to non-existent, children are seen as future retirement insurance to their parents.
--- | --- | --- | --- | --- | ---
Population (millions) | 5.3 | 6.6 | 8.5 | 10.8 | 11.1
Population Growth (%) | 2.2 | 2.2 | 2.9 | 2.4 | 2.3
Crude Birth Rate (per 1,000) | 51.2 | 49.2 | 50.7 | 49.0 | --
Crude Death Rate (per 1,000) | 26.0 | 22.3 | 18.3 | 20.0 | --
Total Fertility Rate | 7.1 | 7.1 | 6.6 | 6.3 | 6.4
Infant Mortality Rate | 191 | 144 | 118 | 120 | --
Female literacy Rate (%) | 3 | 8 | 18 | 28 | --
Labor Force in Agriculture (%) | 93 | 89 | 86 | 84 | --
Annual GDP Growth (%) | 6.1 | -4.3 | 0.42 | 3.7 | 1.4

Source: World Development Indicators, 2002

Table 4.1: Socio-economic Indicators of Mali

High population growth in Mali creates extreme pressure on an already fragile physical environment and an inadequate system of social services, basic infrastructure, and rudimentary labor markets. Other social indicators, such as those for education and health, are just as bleak. Only 35 percent of school-age children enrolled in primary education and less than 40 percent of the total population has access to basic health services (World Development Indicators, 2002).

With a per capita GNP of US$210 a year, Mali is considered one of the poorest countries in the world. As one might expect, the economic environment is just as fragile.
as the physical and social setting. The country experienced significant economic expansion and rise in exports after the historic 1994 devaluation, as demonstrated by an average real GDP annual growth rate of 4.8 percent during 1994-97 and a doubling of the export to GDP share. At the same time there was a drastic reduction in inflation, from 24.8 percent to –0.4 percent during the same period. Still many macroeconomic indicators remain weak. In 2000 the agricultural sector continued to account for 45 percent of the country’s GDP, employing 80 percent of the population, thus reflecting a low productivity of labor in agriculture. Account balances remain negative, with an import volume almost double that of exports. At the end of 2000, Mali’s official external public debt was US$1.3 billion, and total debt service as a proportion of exports and services was 13.4 percent (World Development Indicators, 2002). Economic growth was less favorable than predicted in 1999 and 2000 due to lower world prices of Mali’s key exports, cotton and gold, coupled with higher oil prices and the negative effects of tariff policies across UEMOA, the Economic Union of West African States affecting the growth in Mali’s exports (USAID, 2000).

In comparison to Sub-Saharan Africa and Low Income Countries, Mali lags behind in key economic indicators. In these regions on average, incomes are higher, GDP growth is less volatile, and smaller trade imbalances are incurred from higher export and lower import volumes (Table 4.2).
<table>
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<tbody>
<tr>
<td><strong>GDP per capita (current international $)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mali</td>
<td>--</td>
<td>489</td>
<td>582</td>
<td>797</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>--</td>
<td>1122</td>
<td>1453</td>
<td>1683</td>
</tr>
<tr>
<td>Low Income Countries</td>
<td>--</td>
<td>821</td>
<td>1490</td>
<td>2012</td>
</tr>
<tr>
<td><strong>GDP Growth Rate (%)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mali</td>
<td>6.1</td>
<td>-4.3</td>
<td>-1.9</td>
<td>4.5</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>8.1</td>
<td>5.7</td>
<td>1.1</td>
<td>3.1</td>
</tr>
<tr>
<td>Low Income Countries</td>
<td>6.1</td>
<td>5.6</td>
<td>3.1</td>
<td>4.2</td>
</tr>
<tr>
<td><strong>Exports (% of GDP)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mali*</td>
<td>12.5</td>
<td>14.7</td>
<td>17.1</td>
<td>25.0</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>22.5</td>
<td>32.1</td>
<td>27.2</td>
<td>31.9</td>
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<td>Low Income Countries</td>
<td>9.3</td>
<td>17.0</td>
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<tr>
<td><strong>Imports (% of GDP)</strong></td>
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<tr>
<td>Mali</td>
<td>18.2</td>
<td>29.1</td>
<td>33.7</td>
<td>40.4</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>25.1</td>
<td>30.5</td>
<td>25.6</td>
<td>32.4</td>
</tr>
<tr>
<td>Low Income Countries</td>
<td>11.1</td>
<td>17.5</td>
<td>20.2</td>
<td>28.0</td>
</tr>
</tbody>
</table>

Source: World Development Indicators, 2002

Table 4.2: Economic Indicators for Mali, Sub-Saharan Africa, and Low Income Countries

**Malian Financial Sector**

Mali has been a client of the West African Monetary Union since June 1984 when it joined six other member states, namely Benin, Burkina Faso, Cote d’Ivoire, Niger, Senegal, and Togo. This Union has a common central bank, the Central Bank of West African States (BCEAO), with its headquarters in Dakar, Senegal and national branches in each client state (Ouattara et al, 1997). In addition to the central bank, there are seven
commercial banks and two financial institutions in Mali. Commercial banks are headquartered in Bamako with branch offices in some regional capitals. To date there are no commercial branch offices in the rural areas in Mali.

In the last ten years Mali has experienced an emergence of semi-formal microfinance institutions (MFIs) that offer a variety of products and services that are better adapted than formal bank products to the needs of informal sector entrepreneurs in both rural and urban areas. In 1997 it was estimated that the MFI sector already accounted for 5 percent of savings mobilized and credit granted by the formal financial sector. These institutions range from mutualist credit unions, to financial institutions based on the solidarity group model. In addition, there are several non-governmental institutions that have credit and savings activities. A World Bank study on this sector, completed at the end of 1996, identified 30 microfinance institutions that were providing financial services to the informal sector in Mali. Out of the 30 institutions, 24 are divided as follows: three mutualist programs; four village bank programs; ten institutions based on the solidarity group principle; and seven organizations with a credit and savings component.

In August 1994, the first piece of legislation for this sector was enacted. This is known as the PARMEC (Portant Reglementation des Institutions Mutualistes ou Cooperatives d’Epargne et de Credit) law. This law requires that all semi-formal institutions be registered at the Ministry of Finance, provide quarterly data on key financial ratios, conduct an annual external audit, and submit year-end financial statements to the branch of the Ministry in charge of managing this sector. There are
obvious benefits of having this type of legal framework for the sector, such as: protection for the name of the institution, exemption from taxes, and a legally recognized right to operate (Ouattara et al., 1997). However, there have been several limitations in this law. For example, the law was written for one type of institution, a mutualist or credit union organization and their unions and federations. It does not include institutions like Piyeli that are distinctly different from credit unions. Recognizing this constraint the PARMEC law was amended in 1998 to include non-mutualist institutions on a case-by-case review. Although an improvement from the original text, the individual registration process has been very time consuming and expensive for Piyeli. This is due to lengthy legal meetings with its lawyers and the Ministry and the fees involved in hiring legal assistance. At the time of the second data collection in 2001, the Ministry of Finance had still not granted legal recognition to Piyeli.

At the far end of the spectrum are informal financial mechanisms such as loans from family members and friends, ROSCAs, traditional moneylenders, money holders, and suppliers’ credit. In Mali, these vehicles are characterized by a limited and irregular supply of financial services, high interest rates and fees, and lack of security. For example, entrepreneurs who use ROSCAs as their main savings mechanism are forced to wait their turn in the rotation and receive no interest on money saved.

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19 Piyeli is based on the solidarity group lending methodology. Group loans are granted for business investment. Credit unions, on the other hand, are savings and credit institutions that grant individual loans to its members for productive and consumptive purposes. Member clients manage most operations and make up the board of directors.

20 ROSCAs are rotating savings and credit associations. A ROSCA consists of members who agree to contribute a fixed amount of money on a regular basis to a fund that is distributed in turn to each member. A member’s turn is either determined randomly or non-randomly by a unanimous agreement of all association members (Von Pischke, 1991).
Many of the above statements on informal finance hold true for the Piyeli clients surveyed in this study. For example, 85 percent of the business startup loans came from family clients and friends. In addition, 73.3 percent of the sample has participated in a ROSCA in the last 12 months, but only 9.8 percent have used the savings services of money keepers. In this sample, 52.6 percent had granted loans to their family and friends within the last 12 months. There was very little evidence of the use of traditional money lenders, but several Piyeli entrepreneurs received credit from their suppliers on a daily or a weekly basis.

**Informal Sector**

In Mali, not surprisingly, the informal sector employs 85 percent of the economically active population accounting for 20-25 percent of GDP (Webster, 1995). In rural areas most non-farm activities consist of agricultural transformation and petty trade whereas in urban areas entrepreneurs are engaging in trade and services. Most enterprises in the informal sector are home-based with the owner or a family client financing startup costs. Salaried employees are an exception in this sector where owners themselves carry out the bulk of their business activities. Typically unpaid apprentices, usually family members, assist owners. In this sector, business owners largely earn only marginal profits due to fierce competition derived from easy market entry and exit.

The Malian informal sector faces several constraints, both non-financial and financial. The most pressing non-financial obstacles confronting entrepreneurs in Mali are: 1) a constraint on product demand due to overcrowded markets from easy entry; 2) lack of product differentiation due to the limited pool of skilled labor; 3) the poor state of
infrastructure to support the development of economic activities such as limited and poor roads making access to some areas difficult, high per unit utility costs, a poor communication infrastructure hampering information flows, as well as non-existent or limited storage facilities for perishable fruits and vegetables (Webster, 1995).

The principal financial constraint facing Malian entrepreneurs is the limited access to financial services due to barriers imposed by the formal banking sector as well as weaknesses in the provision of informal financial services. Terms and conditions of formal sector loans are too strict for this population, requiring entrepreneurs to guarantee assets they do not typically possess. In addition, banks do not lend to microentrepreneurs as they feel it is too costly to grant loans to this group. Instead, they prefer lending larger amounts to more established clients. At the other end of the spectrum, entrepreneurs use informal financial mechanisms to meet their credit and savings requirements. To date entrepreneurs are still experiencing ruptures in their business activities due to insufficient working capital and the lack of reliable borrowing sources. Finally, of tantamount importance, microentrepreneurs in Mali do not have secure places to deposit their savings to facilitate liquidity management.

4.1.2 Local Level

Bamako is the capital city of Mali. The District of Bamako is split up into six administrative districts and covers an area of approximately 18,000 hectares (Figure 4.2). There are approximately 66 neighborhoods in the six districts. From 1987 to 1997, the capital city experienced rapid population growth, at an annual rate of 4.4 percent (Sissoko-Breukers, 1997). The last national census (1997) recorded a total

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21 One hectare is equivalent to 2.471 acres.
population in Bamako of 1,016,167 inhabitants. This is projected to now be 1.5 million people.

An unequal population density across districts characterizes Bamako. Districts II and IV continue to be the most densely populated and are estimated to reach 145 and 104 inhabitants per hectare, respectively, by 2002, whereas district VI, despite its strong growth rate of 9.4 percent, is only expected to grow to 39 inhabitants per hectare in 2002, up from 12 habitants in 1987. Districts I, V, and VI are the most vast of all districts and show the highest growth rates in population at 4.3, 5.1, and 9.4 percent, respectively, (MEPI, April 1998). This uneven population density affects the economic opportunities of the microentrepreneurs in Bamako. More densely populated areas will have larger markets for entrepreneurs to buy and sell goods. In addition, larger markets will positively affect their business due to an increased access to inputs and transportation services. In the long run their transaction costs will be lower than entrepreneurs living and working in less dense areas.
The unemployment rate in Bamako remains high at 23.3 percent for the active population 15 years and older. This rate was higher for women than men, i.e., 37.8 percent and 16.5 percent respectively (MEPI, December 1998). This may explain why 74 percent of the active population in Bamako works in the informal sector. If this rate continues to increase, more people will enter the informal sector increasing competition in some sectors.

Microentrepreneurs and their businesses are directly affected by the level and condition of a city’s infrastructure. A rudimentary system negatively affects the business
resulting in higher transaction costs, *i.e.*, higher business expenses, as well as consumers resulting in higher prices. As demonstrated from the statistics below Bamako’s infrastructure has much room for improvement, especially in the area of public transportation and telecommunications.

In 1995 there were approximately 190 kilometers of redressed (asphalt and gravel) roads in Bamako. Of the paved roads in Bamako 60 percent were considered in very good condition, 20 percent in average condition, and 20 percent in very bad condition at that time.

The number of public transport vehicles quadrupled from 1986 to 1992. There are four types of public transportation in Bamako. They consist of covered pick-up trucks (bachees), public taxis, minibuses, and large city buses. Bachees dominate the public transportation sector with 1,366 vehicles. The main problems of public transport are: lack of coordination between transporters; an inadequate infrastructure for a modern transportation system; unequal demand (extremely high or low) for certain transportation routes; and a lack of transfer points (MEPI, December 1998).

The telephone network is rudimentary in Bamako. In 1995, there were 13,901 total available telephone lines of which 75 percent were already contracted to residential and commercial agents. At that time there were only 1.5 fixed lines and mobile telephones per 1000 inhabitants in Mali as whole. In 2000 the situation improved with 4.3 fixed lines and mobiles per 1000 people, and this figure is expected to get even better with the privatization of the telephone company, SOTELMA, which is well underway.
4.2 Organizational Design

In this section, a detailed explanation of Piyeli’s objectives and fundamental strategies are provided, savings and loan products as well as solidarity group dynamics are reviewed, and some of the MFO’s key performance indicators are analyzed.²²

4.2.1 Promotion Strategies

Piyeli was created in 1996 to provide a wide range of savings and credit services specifically adapted to the needs of the microentrepreneurs in Bamako, Mali. The provision of these financial services is an attempt to meet the expressed demand of local entrepreneurs. Piyeli’s main institutional strategy is to establish a decentralized, minimalist credit delivery program based on the “Grameen Bank” approach of group savings mobilization and loan provision.²³ More specifically, Piyeli’s program is modeled after the successful experience of the Kenyan Rural Enterprise Programme (K-REP) Juhudi credit schemes.²⁴ In the same fashion to these other programs, Piyeli’s solidarity group strategy is based on peer pressure to enforce loan repayment. In the event of non-payment by a member, the rest of the group is responsible for repaying in

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²² Field interviews with key Piyeli staff as well as the institution’s management guide were used as the main references for the information presented in this chapter. Little discrepancy was found between the two sources.

²³ The Grameen Bank is the most significant solidarity group lending program in the world. It was established in Bangladesh in 1983 with government help after a seven year experimental phase. Today, Grameen Bank is mostly privately owned with its member borrowers making up the largest shareholder group. The solidarity group lending approach is characterized by the following: 1). Three to ten microentrepreneurs join together in a group to receive access to individual loans; 2). Group members collectively guarantee loan repayment of all; 3). Access to future loans is dependent on successful repayment by all group members; 3). And loans granted are appropriate to borrowers’ needs in size, purpose and terms (Otero and Rhyne, 1994).

²⁴ K-REP’s Juhudi credit scheme is a solidarity group lending program that uses a minimalist credit approach to target poor households, particularly women, with small loan amounts for working capital. This program provides strong incentives for repayment, i.e., better terms and conditions for subsequent loans.
full the delinquent member’s portion of the loan before receiving a subsequent group loan.

Piyeli grants loans to microentrepreneurs for business development (working capital and investment) purposes. More specifically, Piyeli targets the following economic sectors:

- Small scale trade and artisan activities;
- Small scale productive activities;
- Service activities, such as, beauty shop, food, and repair services;
- Agro-industrial activities.

Most of Piyeli’s targeted entrepreneurs work in the informal sector and a majority of them are women (76 percent as of 12/2000). Their promotion strategy includes targeting entrepreneurs with the following characteristics:

- Entrepreneurs working in small scale trade, artisan activities, or services;
- Entrepreneurs employing less than five people of which most are family members. Most targeted enterprises are owned and operated by one person;
- Entrepreneurs earning between 1.00 and 75.00 USD in daily revenue and making between 0.50 and 10.00 USD in daily profits;
- Businesses housed in non-permanent structures, like market stalls and tables or those that are ambulatory in nature. Most, if not all, of the targeted entrepreneurs do not work in the formal sector and their business assets do not generally exceed 1,000 USD;
- Entrepreneurs having limited access to formal financial services.
4.2.2 Solidarity Group

Piyeli’s lending technology is based on group solidarity, i.e., joint liability, in which each member pledges to pay the group loan in full in the event of nonpayment by any member. In addition, each member attests to all other members’ trustworthiness and ability to respect group by-laws. In this section group eligibility and their characteristics are discussed.

*Group Eligibility*

An entrepreneur has to meet certain criteria in order to be eligible for group loans. These include:

- Being at least 18 years old;
- Running a viable business activity for a minimum of two years;
- Being a permanent resident of Bamako or the surrounding area;
- Respecting all Piyeli conditions, such as, making regular savings and participating in weekly meetings;
- Providing all the required information on the individual enrollment form which is filled out by a Piyeli promotion agent.

*Group Formation*

The first step in forming groups is the educational phase in which promotion agents go out and inform the public about Piyeli. During this stage the institutional objectives, the solidarity group methodology and eligibility criteria are explained. Once the preliminary conditions are met, entrepreneurs start forming groups, either small (5-9
members) or large (10 – 30 members).\textsuperscript{25} Although promotion agents help the entrepreneurs to form their groups, it is the members themselves that have the final decision in group formation. When forming these groups Piyeli strongly encourages members to have some sort of relationship to one another, either through their business activities or through the community. However, it is recommended that not all members come from the same family. Although the solidarity may be strong in a family, group pressure for repayment will most likely be difficult to maintain and the eldest family member may exercise undue influence over the others.

After a group is formed members set up their by-laws with the assistance of the promotion agent. Piyeli provides each group with a template to help the members determine the group by-laws. Specific topics in the by-laws include: group objectives, membership procedures, group management, and dissolution of the group. Once all members have adopted the by-laws, an internal election is held to designate the management committee that consists of a president, treasurer and secretary. This committee is responsible for reviewing all individual loan requests and determining whether the group member is capable of repaying the amount solicited. In addition, the group must name at least two members as cosigners for all financial operations with Piyeli. The treasurer must be one of the two cosigners.

\textsuperscript{25} Piyeli’s original promotion strategy, based on K-REP’s experience, attempted to discourage smaller groups by emphasizing that clients form large groups. This approach was a failure in Bamako due to the lack of trust amongst the microentrepreneurs. It was quickly discovered that entrepreneurs preferred smaller groups of five or six members. Thus, Piyeli shifted its strategy towards encouraging smaller groups as well as focusing on existing informal groups, such as women’s associations and tontines, to address the trust issue.
**Group Meetings**

Piyeli requires its groups to meet on a regular basis to collect savings, to make loan payments and/or to follow up on group members’ business activities. Meeting frequency is highly dependent on the loan product received by the group. For example, given that the first loan product requires weekly repayment, a group will often meet on a weekly basis. As the group matures and receives the second and third type of loans, group meetings may occur to coincide with the longer repayment frequencies of two weeks. It is not required that a credit agent be present at every group meeting. Piyeli’s strategy is to have their credit agents present at weekly meetings of all new groups while visiting the more mature groups on a bi-monthly or monthly basis. Credit agents help groups set up their by-laws, understand loan application procedures, and discuss loan repayment problems. They are not present to collect group savings or loan repayments. The group’s treasurer is required to make all deposits and payments at Piyeli’s branch office where the group is registered.

**Group Loans**

Loan amounts for each member in the group do not have to be the same size. Each member’s loan is based on her business needs and the amount of savings she has mobilized. Piyeli offers groups three different loan products, small loans of up to 83 USD, medium loans between 84 and 840 USD and large loans between 850 and 1,700 USD. Although the group is required to remain within the same loan product category, members in the group can receive different loan amounts according to her need and

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26 Type of loan is different than cycle of loan here since a borrower may elect to experience several loan cycles in one loan category or type. It is her choice to continue with the same loan type or advance to the next loan level (type), given her group is in good standing with Piyeli.
ability for repayment. The loan product determines loan length and repayment schedules. Therefore, group members have loans for the same period and repay them on the same frequency, either on a weekly, bi-monthly or monthly basis.

The treasurer and a second designated person in the group must go to their Piyeli branch office to sign the loan contract and to obtain the loan amount. It is entirely the treasurer’s responsibility to deliver the loan amounts to each designee. Piyeli credit agents are responsible to verify that each individual receives the amount approved by the Piyeli credit committee. The treasurer is also responsible for collecting and depositing group loan repayments. The group decides how and when this occurs so that all payments are made in full and on time.

It is the credit agent’s responsibility to follow up on groups’ repayment performance. If a group is one week late in repaying their loan, then the credit agent visits the group to discuss the problem and to give them a verbal warning. If that does not work, then an official written warning is given to the group in which they are called to meet with the branch manager. And if that doesn’t work, then the group is reported to the police. This policy seems to work well in getting the message out that Piyeli is a serious institution, but it has its costs. For their services the police charge ten percent of the recovered loan amount.

In the event that a group is 30 or more days late in repaying their loan, then all of their group loan requests are automatically suspended. This does not necessary mean that the members of the delinquent group can never receive another loan from Piyeli. It many cases groups have dropped or replaced delinquent members and continued to receive
loans only after delinquent loans have been repaid. Credit agents reported that larger groups typically do not replace delinquent members whereas smaller groups do. In fact, Piyeli requires each group to maintain a minimum size of three members. Therefore, small groups have no choice but to replace delinquent member or members.

4.2.3 Savings Products

Piyeli offers its clients two different savings products, a group savings account and an individual savings account. Each account possesses different terms and conditions as discussed below.

**Group Savings Account**

The group savings account is the principal savings product that Piyeli offers to its clients. Opening and maintaining this type of account is one criterion that members must meet in order to receive a group loan.\textsuperscript{27} It works in the following manner. Once the group has been formed and officers elected, the members have fourteen days to open a savings account, which includes each person paying the minimum deposit and the administrative fee of 5 and 1 USD, respectively. To be eligible to receive a loan, the group is then required to save between 20 and 50 percent of the requested loan amount in addition to the minimum deposit made when opening the account. This savings ratio varies according to the type of loan product requested and the savings amount must be

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\textsuperscript{27} The other requirements include 1). Having all individual client sheets filled out correctly with complete addresses; 2). Submitting a photocopy of each member’s identification card; 3). Providing a copy of the minutes of the meeting in which the group was established; 4). Providing two photos of each member within 7 days of opening the savings account; 5). Submitting a copy of the group’s by-laws within 14 days after opening the savings account; 6). Holding regular group meetings with all members present; 7). Maintaining a daily journal of all member deposits into group account; 8). Making regular deposits over a minimum time period into the group account at Piyeli.
saved on a weekly basis over a minimum period of four weeks. The group members decide how much they would like to save each week per member to meet the minimum savings requirement. The minimum savings balance serves as part of the loan guarantee and must remain in the account until all members have paid off their loans. For example, a member that has paid off her loan in advance must wait until all other members have paid their part of the loan before she can withdraw her savings. To make a withdrawal after a loan has been repaid requires written approval by each group member. To maintain active status, the group must always keep the minimum deposit amount that was made to open the savings account. If it is withdrawn, then the group’s savings account is closed, and the group is considered to have exited the program.

The advantage of a group savings account is that it gives a person access to group loans. However, this type of savings account is blocked, meaning a member cannot withdraw her savings until the group loan is paid off and she can only do this with the written approval of all group members. This is problematic when clients experience emergencies and are unable to access their savings. In addition, group savings accounts are not remunerated. This means that a client forgoes the interest income that she could earn on an individual savings account to have access to group loans. This implicitly raises the annual effective rate of borrowing by the forgone interest of an individual

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28 To be eligible for future Piyeli loans, group members are recommended to make regular deposits in their savings accounts. They must always meet the minimum saving period of four weeks for each loan. This means that if an individual quits saving after she has met the 20 percent minimum requirement over a period of four weeks for the first loan, she then becomes ineligible for future loans until she has met this requirement again.

29 This rule does not pertain to savings balances that are higher than the minimum savings requirement. In effect, only the minimum account balance is blocked until the entire amount of the group loan is repaid. All members of the group must adhere to this rule, even those that do not receive a portion of the group loan.
savings account, currently three percentage points per year. In effect, individual savings is implicitly discouraged through the forced savings requirement. In fact, at the time of this study, individual savings balance represented only 7 percent of total client savings (group and individual).

**Individual Savings Account**

As mentioned above, Piyeli offers its clients an individual savings account. The advantage of this type of account is that clients receive an interest rate of three percent per year on account balances in excess of 83.00 US$. In addition, a client can use this account to save according to her needs and not the needs of the entire group. One drawback is that this account does not grant her access to individual or group loans. Only a group savings account authorizes such access. To open this type of account the client must deposit a minimum of 8.00 US$ and this same amount must be maintained in the account as a minimum balance. In addition to depositing the minimum amount, the client is required to pay a fee of 1.50 US$ and provide two identification photos.

**4.2.4 Loan Products**

As briefly mentioned above, there are three different types of group loan products that Piyeli offers its clients. The loan products differ according to loan size. The first loan product is a group loan in which each member can receive a maximum loan amount of 83.00 USD. Once the first loan is properly reimbursed, the second loan product that is offered to the group is a loan amount between 84 and 840 USD per member. The third group loan product varies between 850 and 1,700 USD per member. The credit agent determines the loan amount granted to the group. In principle, the agent is responsible
for conducting an assessment of the individual’s business to determine her ability to repay to the loan amount requested. In the start up phase of operation this strategy worked well, but became impractical during the high growth phase of 1998-2000.

In principle, groups cannot have more than one loan out at a time. This means that each group’s loan balance must be paid off before the group can receive the next loan. In addition, a group must pass successively from the first loan product to the second before becoming eligible to receive the third loan product.

*Terms and Conditions*

Group solidarity is the principal requirement of all group loans. Piyeli requires each member to be guaranteed by all other members, both morally and physically. By guaranteeing a member morally, the other members in the group testify that all of the information on her group solidarity worksheet is correct and pledge that she respects of the group’s by-laws all of the time. By guaranteeing a member physically, each member agrees that the group savings can be used in the event of nonpayment.

The interest rate on all loans is 36 percent per year on a declining loan balance. Although this rate can be revised at any time, the interest rate given at the moment of loan disbursement remains valid until the end of the contract. As previously mentioned the forced group savings account implicitly raises the annual interest rate to 39 percent since members forgo three percent on their savings.
The length of the first loan product is between three and four months. Once a group has progressed to the second loan product this length can be extended to six months. For the last and largest loan type it can be lengthened to between eight and 12 months.

Repayment plans for the first loan product are scheduled on a weekly basis. Repayment plans for the second and third type of loan product are programmed on a bi-monthly basis. However, for some entrepreneurs due to the nature of their business activity, a repayment schedule can be programmed on a monthly basis if authorization is granted by Piyeli.

A grace period for loan repayment is granted to all groups according to the type of loan they possess. The notion is to give the entrepreneur enough time to generate revenue from the business loan invested. For the first loan product a grace period of two weeks is granted whereas the second and third loan product receive a period of one month. This grace period can be extended for special cases in which the nature of the entrepreneur’s business activity requires a longer period for revenue generation. This is the case for gardening activities as well as the buying and selling of grains.

Loans are typically granted to between 40 and 60 percent of the group members at one time. This means that two to three members receive a loan in a group of five people and 12 to 18 persons receive a loan for a group of 30 members. However, all members in a group can receive a loan as long as everyone has fulfilled all of the Piyeli loan conditions mentioned above. Typically, a member that has not fulfilled all of the requirements has to wait until the next loan cycle to receive a loan. This rule has not
been applied in full rigor as some groups have more than one loan out because group members met the loan conditions at varying times. In fact, in many cases all group members were granted loans at the same time.

Loans granted are expected to used for business purposes only. Credit agents attempt to verify loan use during periodic visits to the entrepreneur’s place of business. This is a difficult task due to the fungibility of money. In effect, a loan earmarked for business investment can easily be used to pay for children’s school fees or medical bills. This potentially could be less of a problem for institutions that closely monitor the loan activities of their clients; however, young institutions, such as Piyeli, quickly discover the challenge of close monitoring during high growth and expansion phases.

4.3 Institutional Growth and Performance

Piyeli’s organizational design is a dynamic framework that has evolved over time as the MFO learns what works and does not work in the field. Over the last five years Piyeli has experienced growth and performance similar to many first and second generation MFOs, typified by high growth, low retention, and uneven progress towards sustainability. Piyeli experienced rapid growth in client outreach and sustainability in the first four years of its operation (1996-1999). This growth, however, came with a price. Over the same period increases in client exit and loan delinquency rates were endured as well as an overall reduction in operational sustainability. In 2002, the impact of these ill
effects resulted in modest growth in the amount of loans granted and savings mobilized. This section describes Piyeli’s growth performance from 1996-2002.\textsuperscript{30}

4.3.1 Growth

Piyeli’s aggressive promotional efforts over the last few years resulted in an impressive growth in client outreach. From 1997 to 2000, Piyeli’s client base grew an astounding 386 percent, an annualized growth rate of 48.5 percent (Figure 4.3).

\[\text{Figure 4.3: Growth in Number of Clients}\]

\textsuperscript{30} Data presented on MFO growth and performance were drawn from Piyeli’s Annual Reports.
To service the rapidly growing client base, Piyeli granted 4.5 million US$ in loans while mobilizing 1.0 million US$ during that period. By the end of 2000, Piyeli granted 1.6 million US$ to meet the growing demand for loans. Also in that same year, clients deposited 372,000 US$ in savings. To meet these demands, Piyeli’s credit agents more than doubled in size, from five in 1997 to 17 in 2000. In addition, credit agents experienced a rapid increase in workload as demonstrated by the fast growth in clients per loan officer ratios. From 1997 to 2000, credit agents’ client portfolios increased by 71 percent, an annualized rate of 14.7 percent.

### 4.3.2 Performance

As mentioned earlier, Piyeli began to feel some negative effects of this rapid growth by the end of 1999. Due to rapid growth primarily during 1998 and 1999, Piyeli began to see a reduction in key performance indicators. From the end of 1997 through June 2000, Piyeli’s delinquency ratio began a strong ascent, from 1.6 percent to 12.0 percent. This signal provoked Piyeli management to shift its focus on reducing this rate, resulting in a four-point reduction by the year’s end (Figure 4.4). This operational strategy, however, compromised growth in outreach and sustainability in that year. Piyeli grew at a strong (57 percent), albeit slower rate from the previous year (87 percent).

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31 Piyeli considers loan balances that are more than 30 days late delinquent. If a more strict delinquency criteria is used, e.g., 1 or 7 days late, then these rates would have been much higher.
In addition, Piyeli experienced a growing trend in client exit over the same period. From 1997 to 2000, Piyeli lost a total of 4536 clients, roughly 33 percent of its client base (Figure 4.5).
Examining Piyeli’s client growth and exit trends together sheds light on its overall retention rate, *i.e.*, the net number of clients retained in a given period. Annual retention rates were calculated using Schreiner’s (2001) formula as follows:

\[
\text{Retention Rate} = \frac{AC_{\text{end}}}{AC_{\text{begin}} + NC}
\]

Where,

\(AC_{\text{end}}\) = number of *active clients* at the *end* of the period;

\(AC_{\text{begin}}\) = number of *active clients* at the *beginning* of the period;

\(NC\) = number of *new clients* entering during the period.

Retention rates are presented in Figure 4.4.
Piyeli’s retention rate was quite high in 1997, with only 128 exits in the period. This most likely is due to the slow growth during the end of 1996 and the first half of 1997. In 1998, however, this trend changes, with a dramatic reduction in client retention. Piyeli’s excessive growth in client outreach began in 1998. The total client base had increased from 2725 to 4463 clients from 1997 to 1998, representing a 63 percent annual growth rate. In the following years, Piyeli’s retention rate rebounds, mostly due to continued and excessive growth in clients, which expanded the denominator in the retention ratio. In 1999 it experienced an 87 percent jump in its client base from the previous year. And in 2000 even though growth slows a bit to 57 percent, it was still
enough to improve the overall retention rate. Basically, in the last two years growth in client outreach surpasses growth in client exit, resulting in an improved retention rate (Figure 4.6).

These improvements in retention rates may seem encouraging, however, one must look deeper into the dynamics of the period, especially the last two years. Although the excessive growth in 1997-1999 resulted in increased operational sustainability, it also compromised Piyeli’s credit portfolio as seen by the increased delinquency rates discussed above. Due to this increase, Piyeli contracted its growth in new clients, credit granted and savings mobilized. This resulted in a decrease in its operational sustainability (Table 4.3). In essence, credit agents spent the first half of 2000 focusing on delinquent loan recovery, leaving little time for granting loans. Once lending activities resumed in the second part of the year, credit agents were extremely cautious in the amount of loans they granted, not wanting to aggravate the delinquency condition. This reduction in credit decreased the amount of interest income received to cover operational costs, a sign that viability of the MFO was weakening.

<table>
<thead>
<tr>
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<tr>
<td>Number of New Clients</td>
<td>140</td>
<td>2713</td>
<td>2822</td>
<td>5443</td>
<td>6680</td>
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<tr>
<td>Credit (000 dollars)</td>
<td>3</td>
<td>363</td>
<td>979</td>
<td>1605</td>
<td>1637</td>
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<tr>
<td>Savings (000 dollars)</td>
<td>6</td>
<td>98</td>
<td>181</td>
<td>336</td>
<td>372</td>
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<tr>
<td>Operational Sustainability (%)</td>
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<td>18.5</td>
<td>69.5</td>
<td>91.5</td>
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Table 4.3: Trends in Key MFO Growth Indicators
4.4 Comparative Analysis of Client Groups

Piyeli services microentrepreneurs who operate in the informal sector of the economy. These entrepreneurs are in need of working capital and investment loans; however, they lack the physical collateral required by formal banks. Instead, they opt for group loans using implicit collateral of joint liability. In some environments this approach seems to be working, mostly in rural areas in West Africa where people know each other very well and the social costs of default are extremely high. This may not be the case, however, in an urban setting in which people are less familiar with one another’s affairs and where social costs of default are relatively lower (because social ties are weaker) than those in a rural environment. If it is true that individuals are at risk of being less informed about their fellow group members in the urban setting, then this informational risk may lead to poor group member choice, and inevitably higher borrowing costs for the individual which in turn affects her decision to continue in her borrowing group.

In addition to the risk associated with member choice, the borrower also faces risk at other levels, i.e., household/firm, macroeconomic, and environmental uncertainty, threatening her ability to repay the loan. Most would agree that individuals with more resources, i.e., human, physical, and/or financial capital, are more able to deal with risk in general. Learning about an individual’s resources may shed some light on why she decides to exit the borrowing group. Therefore a preliminary analysis is conducted to see how a client’s resource base and group member choice affect stay/exit decisions. Client characteristics pertaining to her household, business, and borrowing group are reviewed.
Differences across cohort groups, *i.e.*, active clients and exited clients (those that have permanently left the MFO) are examined. To examine the differences between those that have exited and those that have not, comparisons of means and frequencies are discussed below.

As presented in Table 4.4, the majority of borrowers falls between 36 to 51 years of age (53 percent), is married (74 percent), contributes more than 25 percent to household expenses (59 percent), and feels that their standard of living has improved compared to one year ago (50 percent). In addition, this population possesses an extremely low level of formal education (Table 4.5), with only 3.9 (mean) and 0.0 (median) years, respectively. The disparity between mean and median years reflects some well-educated outliers, possessing a high school diploma or higher; however, the vast majority has received little to no formal education.
<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total Sample (n=206)</th>
<th>Active Clients (n=68)</th>
<th>Exited Clients (n=138)</th>
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<tr>
<td>Age</td>
<td></td>
<td></td>
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<tr>
<td>&lt;21 to 35 years</td>
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<td>36 to 50 years</td>
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<td>Marital Status</td>
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<td>Single</td>
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<td>Married</td>
<td>74</td>
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<td>71</td>
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<td>6</td>
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</tr>
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<td>Contribution to Household Expenses</td>
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<td></td>
</tr>
<tr>
<td>Less than 25 percent</td>
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<td>43</td>
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<td>26 – 50 percent</td>
<td>36</td>
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<td>More than 50 percent</td>
<td>23</td>
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<td>23</td>
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<tr>
<td>Didn’t want to reveal</td>
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<td>0</td>
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<tr>
<td>Current Living Standard vs. 12 mos. Ago</td>
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<td></td>
<td></td>
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<tr>
<td>Improved</td>
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<td>Unchanged</td>
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<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Worsened</td>
<td>32</td>
<td>26</td>
<td>34</td>
</tr>
</tbody>
</table>


Table 4.4: Percentage of Individual Client Characteristics in the Sample

Although no significant differences exist when comparing the individual characteristics of the two cohort groups, a larger percentage of current clients are older, less educated, married or widowed, and feel their standard of living has improved compared to a year ago than exited clients (Tables 4.4 and 4.5).
<table>
<thead>
<tr>
<th></th>
<th>Total Sample (n=206)</th>
<th>Active Clients (n=68)</th>
<th>Exited Clients (n=138)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Years (mean)</td>
<td>3.9</td>
<td>4.2</td>
<td>3.6</td>
</tr>
<tr>
<td>Number of Years (median)</td>
<td>0.0</td>
<td>0.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>


**Table 4.5: Mean and Median Years of Formal Education**

Selected household characteristics are presented in Table 4.6. On average, borrowers have a long history in Bamako (30 years), are part of large households (13 members), and live in mid-size homes (6 rooms). These households are also characterized by a high dependency ratio. Active and exited clients differ in two key indicators: *dependency ratio* and the *value of negative household shocks*. Data for these variables are presented for each period, since they change over time.\(^{33}\) A curious outcome results. Active clients, on average, come from households with a higher dependency ratio and larger negative income shock value. This observation is true in both periods; however, the difference is only significant in period two. Although these results are in direct conflict to the discussion on risk above, another explanation is plausible. Given the interdependency of the household and the firm in the developing country context in which cash flows of

\(^{33}\) Data were collected at two points in time, once in October 1999 and once in February 2001.
both entities are frequently merged, active clients could in fact be using their credit as a consumption smoothing mechanism. If this is the case, then their opportunity cost of not borrowing is high, thus precluding them from exiting the borrowing relationship.

It should also be noted that although not presented in the tables below, no significant differences exist between current and exited clients in the following housing characteristics: material of flooring, walls, roof, possessing electricity and running water, and type of sewage system employed. Housing characteristics, such as these, are often used as proxies for determining wealth levels. In short, it appears there are no significant wealth differences between current and exited clients. This fact is important to keep in mind when discussing levels of household income shocks as discussed above. In short, wealthier households are better equipped to deal with negative income shocks. If wealth differences were present across comparison groups, then estimates on differences would be biased and misleading.
<table>
<thead>
<tr>
<th></th>
<th>Total Sample (n=206)</th>
<th>Active Clients (n=68)</th>
<th>Exited Clients (n=138)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>S.D.</td>
<td>Mean</td>
</tr>
<tr>
<td>Number of years in Bamako</td>
<td>30</td>
<td>12</td>
<td>31</td>
</tr>
<tr>
<td>Number of persons in household</td>
<td>13</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td>Number of rooms in house</td>
<td>6</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Dependency ratio – period 1</td>
<td>.76</td>
<td>.93</td>
<td>.77</td>
</tr>
<tr>
<td>Dependency ratio – period 2***</td>
<td>.95</td>
<td>1.14</td>
<td>1.47</td>
</tr>
<tr>
<td>Negative Shock ($) – period 1</td>
<td>140</td>
<td>195</td>
<td>159</td>
</tr>
<tr>
<td>Negative Shock ($) – period 2***</td>
<td>181</td>
<td>225</td>
<td>248</td>
</tr>
</tbody>
</table>

Source: OSU Survey 2001.  ***Significant at the 0.01 level.

Table 4.6: Mean and Standard Deviation for Client Household Characteristics

Selected business characteristics are presented in Table 4.7. Overall, borrowers’ enterprises are on average characterized as follows: small in size (less than one employee); in business for 11 years; managed by entrepreneurs with little experience (less than two years); and are experiencing profit growth during the two periods of the study. Significant differences between comparison groups emerge at several different levels. On average, active clients have significantly older businesses and possess more
experience than exited clients. In addition, they experienced a higher growth in profitability than exited clients; however, this difference is not significant. Overall, at the firm level, active clients have more human, institutional, and financial capital than exited clients, which may prove helpful in dealing with the risk associated with borrowing.

<table>
<thead>
<tr>
<th></th>
<th>Total Sample (n=196)</th>
<th>Active Clients (n=65)</th>
<th>Exited Clients (n=135)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>S.D.</td>
<td>Mean</td>
</tr>
<tr>
<td>Age (years)*</td>
<td>11.1</td>
<td>7.3</td>
<td>12.3</td>
</tr>
<tr>
<td>Size (number of employees)</td>
<td>0.8</td>
<td>1.2</td>
<td>0.7</td>
</tr>
<tr>
<td>Experience of owner (years)**</td>
<td>1.7</td>
<td>3.7</td>
<td>2.5</td>
</tr>
<tr>
<td>Profit Growth</td>
<td>3.5</td>
<td>13.5</td>
<td>5.1</td>
</tr>
</tbody>
</table>

Source: OSU Survey 2001. **, * Significant at the 0.05 and 0.10 levels respectively.

**Table 4.7: Mean and Standard Deviation for Client Business Characteristics**

When examining differences in business type, significant differences also emerge between comparison groups (Table 4.8). A larger percentage (77 percent) of active clients are engaged in petty trade and commerce than exited clients (57 percent). On the other hand, exited clients are conducting light productive activity (15 percent) more than active
clients (10 percent). However, exited clients more often went out of business than their active counterparts. Differences in business type across comparison groups are significant at the 0.05 level.

<table>
<thead>
<tr>
<th>Business Type**</th>
<th>Total Sample (n=206)</th>
<th>Active Clients (n=68)</th>
<th>Exited Clients (n=138)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light productive activities</td>
<td>13</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>Petty trade and commerce</td>
<td>64</td>
<td>77</td>
<td>57</td>
</tr>
<tr>
<td>Service activities</td>
<td>9</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>No business activity</td>
<td>14</td>
<td>9</td>
<td>17</td>
</tr>
</tbody>
</table>

Source: OSU survey 2001, **Significant at the 0.05 level.

Table 4.8: Percentage of Businesses by Business Type

Active and exited clients on average differ in their use of other financial services, mostly at the informal level, e.g., tontines, family and friends, traditional moneylenders, etc. (Table 4.9). In both periods, active clients used more additional sources of informal financing than exited clients, and this difference is highly significant in period two. Given
the newness of the group loan product in Bamako, it is hypothesized that clients may not know the true costs and properties of the loan until they experience them first hand. One could think of the group loan as an experience good. If this is the case, those with more experience in other financial arrangements (tontines, business credit, loans from family and friends) are better equipped to manage a group loan. This experience, in essence, helps clients make better group member selection, monitor other members more effectively, and deal with delinquent members more efficiently. Active clients have more borrowing experience, permitting them to quickly adapt to the new, group lending loan product. In essence, their learning curve of how group lending, in particular the joint liability mechanism, works in practice is flatter than those with less borrowing experience.

<table>
<thead>
<tr>
<th></th>
<th>Total Sample (n=206)</th>
<th>Active Clients (n=68)</th>
<th>Exitied Clients (n=138)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>S.D.</td>
<td>Mean</td>
</tr>
<tr>
<td>Formal Services Used – period 1</td>
<td>0.03</td>
<td>0.2</td>
<td>0.03</td>
</tr>
<tr>
<td>Informal Services Used – period 1</td>
<td>1.1</td>
<td>3.0</td>
<td>1.5</td>
</tr>
<tr>
<td>Formal Services Used – period 2</td>
<td>0.01</td>
<td>0.1</td>
<td>0.01</td>
</tr>
<tr>
<td>Informal Services Used – period 2***</td>
<td>0.6</td>
<td>0.8</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Source: OSU survey 2001. ***Significant at the 0.01 level.

Table 4.9: Mean and Standard Deviation of Other Financial Services Used
In Tables 4.10 and 4.11 client comparisons of solidarity group characteristics are presented. Active clients more frequently come from the same neighborhood, engage in the same business activity, are from the same family, and participate in the same tontine than exited clients; and some of these differences are significant. Most of these factors reduce screening and monitoring costs, which may explain why active clients have remained in the borrowing relationship. Active clients are in groups that engage in the same type of businesses than their exited counterparts. Although this appears to present a threat to the livelihood of the group due to correlated business risks, it also presents an opportunity. Active clients incur lower monitoring costs because of their technical familiarity with other members’ business activities.

Active clients also were more frequently in groups that came from the same tontine. As discussed earlier these clients possess more experience in dealing with joint financial arrangements, especially resolving problems of joint liability.
### Table 4.10: Mean and Standard Deviation for Solidarity Group Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total Sample (n=206)</th>
<th>Active Clients (n=68)</th>
<th>Exited Clients (n=138)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group size</td>
<td>6.3 3.2</td>
<td>5.8 2.1</td>
<td>6.5 3.7</td>
</tr>
<tr>
<td>Percent from same neighborhood</td>
<td>0.87 0.28</td>
<td>0.89 0.31</td>
<td>0.85 0.26</td>
</tr>
<tr>
<td>Percent with same business activity**</td>
<td>0.31 0.29</td>
<td>0.40 0.31</td>
<td>0.28 0.27</td>
</tr>
<tr>
<td>Percent from same family</td>
<td>0.25 0.27</td>
<td>0.29 0.30</td>
<td>0.23 0.25</td>
</tr>
<tr>
<td>Percent from same workplace</td>
<td>0.40 0.35</td>
<td>0.40 0.34</td>
<td>0.40 0.36</td>
</tr>
<tr>
<td>Percent in same Tontine**</td>
<td>0.38 0.39</td>
<td>0.45 0.44</td>
<td>0.34 0.37</td>
</tr>
</tbody>
</table>

Source: OSU Survey 2001. ** Significant at the 0.05 level.

In addition, exited clients more frequently experienced repayment problems within their group and more frequently had difficulty meeting repayment installments due to insufficient business cash flows (Table 4.11). These differences were significant at the 0.01 and 0.10 levels respectively. These factors indicate a low level of solidarity between group members and a general weakness of exited clients’ borrowing groups. This also may indicate that exited clients did not know their fellow group members as well as
current clients, and due to this lack of information about members’ types (behaviors) they were less informed about the true costs associated with borrowing via joint liability.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total Sample (n=206)</th>
<th>Active Clients (n=68)</th>
<th>Exited Clients (n=138)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group experienced repayment problems***</td>
<td>43</td>
<td>25</td>
<td>52</td>
</tr>
<tr>
<td>Regularly held group meetings</td>
<td>63</td>
<td>65</td>
<td>62</td>
</tr>
<tr>
<td>Business cash flow sufficient to cover repayment amount*</td>
<td>73</td>
<td>81</td>
<td>70</td>
</tr>
</tbody>
</table>

Source: OSU survey 2001. ***, * Significant at the 0.01 and 0.10 levels, respectively.

Table 4.11: Frequency of Selected Solidarity Group Characteristics

4.5 Concluding Remarks

Piyeli and its clients operate in a very fragile physical, social, and economic environment, typified by a rugged landscape and harsh climate; a weak infrastructure; an absence of basic social services; rudimentary labor markets; and volatile economic growth. Understanding this environment and the threats it poses to the viability of the MFO and clients’ business is essential in examining this issue on client exit. The design
and structure of the MFO is often a function of this environment, which in the end affects the types of services it offers its clients. Therefore, the environment affects clients both directly and indirectly. Understanding the physical, social, and economic environment is important, especially in correctly modeling the issue of client exit as well as interpreting the main results of this study. In the next chapter an econometric model examining client exit factors is present and results are discussed.
CHAPTER 5

APPLIED DURATION ANALYSIS AND CLIENT EXIT

5.1 Introduction

As demonstrated in the Chapter 3, time critically affects the borrower’s exit/stay decision. In this group lending model with imperfect information, a representative borrower updates her expectations about costs given her belief about her partner’s type, i.e., high ability or low ability. Over time, partner type is revealed. In the model, learning has value, particularly in the beginning periods of the relationship; however, as time passes the marginal value of new information decreases, having less of an impact on the borrower’s belief about her partner’s type. In this model, the representative borrower makes an optimal stay/exit decision in each period based on her outcome and her belief about her partner’s type. Over time, her probability of remaining in the borrowing group decreases due to diminishing returns of new information. However, her probability of survival is higher if she chooses a high ability partner than if she chooses a low ability partner. Parameter values of the model influence (positively and negatively) the borrower’s survival probabilities.
Empirically examining client exit decisions is the main objective of this chapter. Duration analysis is the most appropriate statistical method to analyze the survival of banking relationships. Drawing heavily upon the biomedical science and industrial engineering fields, economists have used their statistical methods to analyze economic problems due to duration data (Kiefer, 1988). The central feature of these techniques is the use of a conditional probability on an event taking place, e.g., client exits this period given that she was in last period. Economists have used these methods to examine employment and unemployment spells, occupational mobility, and adoption times of new technologies (Dolton and von der Klaauw, 1995; Kiefer and Neumann, 1979; Meitzen, 1986; Murnane and Olsen, 1989; Narendranathan and Nickell, 1985; Nickell, 1979; Preston, 1994; Munasinghe, 2000; Reinganum, 1983; Saloner and Shepard, 1995; Stoneman and Kwon, 1996). In the section that follows a brief description of duration methods is provided.

5.2 Duration Analysis

5.2.1 Probability Theory

This presentation closely follows Greene’s (1993) discussion on the theoretical background of duration analysis. Assume a cumulative distribution function, $F$, of a random variable $T$ is a function defined for each real number $t$ as follows:

$$ F(t) = \Pr(T \leq t) $$

Equation (5.1) specifies the probability that $T$ is less than or equal to $t$. In the client exit case, the random variable is the length of the borrowing relationship and $t$ is a particular
point in time. The length of $T$ is often referred to as a *spell* and the termination of the spell is known as the *event*. Therefore, equation (5.1) is the probability that the borrowing relationship stops before time $t$. Another way to look at this is to examine the probability that a spell is of at least length $t$, which is given by the *survival function*:

$$S(t) = 1 - F(t) = \Pr(T \geq t)$$  \hspace{1cm} (5.2)

Equation (5.2) is the probability that the length of the borrowing relationship is at least as long as $t$.

In economics it is particularly interesting to examine the probability that a spell will end in the next short interval, $t + \Delta$, given it has lasted $t$. The following *hazard function* is used to express this probability:

$$\lambda(t) = \lim_{\Delta \to 0} \frac{\Pr(t \leq T < t + \Delta \mid T \geq t)}{\Delta}$$

$$= \lim_{\Delta \to 0} \frac{F(t + \Delta) - F(t)}{\Delta S(t)}$$

$$= \frac{f(t)}{S(t)}$$  \hspace{1cm} (5.3)

where, $f(t)$ is the *density function*. The *CDF, survival, hazard, and density functions* are all related; however, for the purpose of determining the probability of a spell ending in the next short interval given that it has lasted up until time $t$, then one should model the hazard function. The hazard function also conveniently defines duration dependence (Kiefer, 1988). *Positive duration dependence* is the increasing probability that a spell will end shortly as it increases in length, whereas *negative duration dependence* is the
decreasing probability that a spell ends with time. *Increasing* and *decreasing hazard*, often used in statistics, are more appropriate expressions for these two dependency types.

Several specific distributions are available to characterize the error term in duration models. The distribution of the error term chosen is based upon the distribution of the random variable, $T$, the length of the borrowing relationship. Cox and Oakes (1984), Kalbfleisch and Prentice (1980), and Lancaster (1990) provide a thorough description of a broad list of distributions employed in duration analysis across many fields, *e.g.*, biomedical, engineering, economics, etc. Kiefer (1988), Greene (1993), and Allison (1995) review distributions most frequently used in economics. These include the exponential, Weibull, lognormal, gamma, and log-logistic distributions. These are distributions of a nonnegative random variable and each one displays very different behavior. For example, the exponential distribution is known as the “memoryless” distribution because the hazard rate is constant over time. The Weibull distribution displays increasing or decreasing hazard depending on parameter values. The hazard rate for the lognormal and the log-logistic first increase then decrease over time. Given these differences, one should cautiously choose a distribution so that it adequately captures the nature of the data. A good rule of thumb is to choose a distribution based on a particular economic theory, preliminary plotting of data, and its technical convenience for statistical inference (Cox, 1984; Kiefer, 1988). In addition, one should use specification analysis after the model has been fitted to ensure that it adequately describes the data at hand (Allison, 1995).
5.2.2 Incomplete Observations and Censoring

As is typically the case in duration analysis, some spell observations are incomplete, either due to censoring or truncation. A censored observation is the result of random factors of the subject under study, whereas a truncated observation is due to factors inherent in the study design (Hosmer, and Lemeshow, 1999).

An observation is right censored if the subject has not experienced the event in question by the end of the study period. In right-censored cases, it must be clear when the subject entered the state. An observation is left censored if the event has already occurred by the time observation begins on the subject. In this case, one only knows that the event occurred but does not have information on the subject’s survival period. An observation is left truncated if the subject comes under observation after some time in which she entered the state. This is also referred to as delayed entry (Hosmer and Lemeshow, 1999). A less common type of incomplete time information is right truncation. An observation is right truncated if the time for the event to occur is known for the subject.

Ignoring censoring leaves one with an upwardly biased estimate of the hazard rate. In other words, the conditional probability of an individual exiting a particular state in the next short interval is overstated (Kiefer, 1988). Incomplete observations exist in the duration data used in this study on client exit. In particular, the data contain both right-censored observations, namely those that were still borrowing at the end of the observation period 1/01. Of the 206 observations that comprise this sample, 68 (or 33
percent) are censored. Accounting for this type of incomplete data in the specific regression model estimation is discussed in detail in the following sections of this chapter.

5.2.3 Nonparametric Estimation

Typical descriptive methods used in linear regression analysis, such as difference of means and frequency tests, cannot be carried out when censoring is present in the data. Instead, estimation and graphical representation of the survivor and hazard functions are used to preliminarily analyze the data. These nonparametric methods dominated the survival research in the biomedical and engineering fields up to 1970 when parametric and semiparametric approaches began to take hold (Allison, 1995). Today, graphical methods are still useful for preliminary analyses of the data, computation of descriptive statistics like the median survival time or probabilities of survival limits (Allison, 1995), specification analysis for regression model building (Kiefer, 1988), and comparison of estimated survivor functions across groups.

To calculate the survivor function the Kaplan-Meier (K-M) or product limit estimator is used. The K-M estimator considers information from all observations available, both uncensored and censored. The estimator is obtained by multiplying a sequence of conditional survival probability estimators (Hosmer and Lemeshow, 1999). Each survival probability estimator is calculated using the number of individuals at risk of “exiting” and the number that actually did “exit” in a particular time interval. Specifically, the K-M estimator is defined as
\[
\hat{S}(t) = \prod_{j: t_j \leq t} \left[ 1 - \frac{d_j}{n_j} \right] 
\] (5.4)

where, \( t_j \) is the specific point in time, \( n_j \) is the number of individuals at risk for the event, and \( d_j \) is the number of individuals who die, i.e., exit the borrowing relationship, at time \( t_j \). The Kaplan-Meier estimator is used to calculate the cumulative survival function of the borrower population in the sample. This function is plotted below in Figure 5.1.

![Cumulative Survival Function of Borrowing Relationship](image)

**Figure 5.1:** Cumulative Survival Function of Borrowing Relationship
Figure (5.1) is the cumulative survival function of the 206 observations in the data set. Of the 206 observations, 33 percent were right censored, i.e., still active, at the end of the study. Each observation represents the length of the individual’s borrowing relationship. This is measured in months, meaning the number of months between the first day of the individual’s first loan until the maturity date of the individual’s last loan. Using the conditional probabilities of survival one can calculate the cumulative survival function for the sample population over the observation period. In Figure (5.1), the cumulative survival function is plotted on the vertical axis and the number of months survived is plotted on the horizontal axis, allowing one to observe the overall survival at any point in time over the observation period. For this borrowing population the following observations are made. First, the longest borrowing relationship length is at least 59 months. Second, roughly 80 percent of the sample survived through the third month of the borrowing relationship. Conversely stated, 20 percent of the groups left after the third month, roughly one loan cycle. This first level drop is the sharpest decline over the 60-month period. Third, about 27 percent of the sample remained in the borrowing relationship for at least 40 months. Overall, the median survival time for the borrowing population is 17 months. The median value of the borrowing relationship is used here as the measure of central tendency. It provides a more intuitive meaning than using the mean value given that some of the observations are right censored.

5.2.4 Parametric Estimation

In a fully parametric model, one has to determine a particular parametric distribution for the error term of the regression. For example in ordinary linear
regression, the assumption of a normal distribution is typically used to characterize the disturbance term. In survival analysis, many different distributions are invoked, depending on the nature of the distribution of duration time, $T$.

In modeling duration data, researchers are trying to accomplish two things at once. The model must describe the basic distribution of the survival time and characterize how that distribution changes as a function of covariates\(^{34}\) (Hosmer and Lemeshow, 1999). If the researcher is concerned with the shape of the hazard function and would like to know if it is increasing, decreasing, or remaining constant over time in addition to the effect of the covariates on the distribution, she should use a fully parametric model. In some cases it is not necessary to describe the basic distribution of the survival times, especially if you have to make several strong assumptions about it, not to mention the effect unobserved heterogeneity has on the shape of the hazard function. This effect often leads to erroneous interpretations about the data (Allison, 1995). In other cases it is sufficient to examine how the covariates affect the distribution of survival time. Models that focus on the latter are referred to as semiparametric models. In this section a brief explanation of the parametric and semiparametric methods are provided.

In duration analysis maximum likelihood is used to estimate a fully parametric model. This methodology is explained here, using client exit as an example. To estimate the probability that a client will end the borrowing relationship in the next short interval given that she has not in the current period, the density function $f(t, z)$ is used, where $t$ is

---

\(^{34}\) In duration analysis the term covariates is used to mean independent variables.
the duration of length \( t \), i.e., the length the client has remained in the borrowing relationship, and \( z \) is a vector of parameters that also affect \( t \). This density function is maximized using the following likelihood function:

\[
\hat{L}(t_i) = \prod_{i=1}^{n} f(t_i) = \lambda(t_i)S(t_i)z_i.
\]  

(5.5)

From Equation (5.3), one knows that the density function, \( f(t) \), is equal to the product of the hazard function, \( \lambda(t) \), and the survival function, \( S(t) \).

Taking the log of the likelihood function and accounting for right-censored observations, the likelihood function from Equation (5.5) now becomes:

\[
\ln L = \sum_{i=1}^{n} \left[ d_i \ln \lambda(t_i)z_i + (1 - d_i) \ln S(t_i)z_i \right]
\]  

(5.6)

where, \( d_i \) is defined as 1 if a client has exited and 0 otherwise. Parameter estimates are calculated by maximum likelihood estimation. The log likelihood function is defined using the appropriate distributions for the hazard, \( \lambda(t) \), and survival function, \( S(t) \), depending on the structure imposed on the data. In Table (5.1) a few popular distributions used in economics are displayed (Kiefer, 1988).

<table>
<thead>
<tr>
<th>Distributions</th>
<th>Hazard Function, ( \lambda(t) )</th>
<th>Survival Function, ( S(t) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exponential</td>
<td>( \gamma )</td>
<td>( \exp(-\gamma t) )</td>
</tr>
<tr>
<td>Weibull</td>
<td>( \gamma \alpha t^{\alpha-1} )</td>
<td>( \exp(-\gamma t^\alpha) )</td>
</tr>
<tr>
<td>Log-logistic</td>
<td>( \gamma \alpha t^{\alpha-1}/(1 + t^\alpha) )</td>
<td>( 1/(1 + t^\alpha) )</td>
</tr>
</tbody>
</table>

Table 5.1: Duration Distributions of Hazard and Survival Functions
An alternative to placing this much structure on the data necessary to estimate fully parametric models is semiparametric methods. As previously stated, if the focus of the research is examining the effect of the covariates on the hazard rate, then semiparametric methods are sufficient since no assumption needs to be made about the survival distribution. A description of these methods is provided in the next section.

5.2.5 Semiparametric Estimation

In duration analysis, semiparametric estimation methods are widely used today (Allison, 1995). In particular, the Cox Proportional Hazard Model (Cox, 1970) is the most popular semiparametric model and it is employed for the following reasons. First, it is more robust than fully parametric methods in that it can closely approximate the results for the correct parametric model without specifying a particular probability distribution to represent survival times (Allison, 1995). Second, Cox regression makes it relatively easy to incorporate time-dependent variables in the model (Allison, 1995). Third, even though the baseline hazard function is unspecified, one can still estimate the coefficients in the model that are used to calculate, the hazard ratio, the measure of effect (Kleinbaum, 1996). Fourth, when duration data is available and censoring is present, the Cox model provides more information than the logistical model in which survival is a dichotomous (0,1) variable (Kleinbaum, 1996).

An assumption of this model is that the ratio of the hazard functions is constant over time. The hazard function is the product of two functions. One function that characterizes how the hazard function changes as a function of survival time. The other function describes how the hazard function changes as a function of covariates (Hosmer
and Lemeshow, 1999). In proportional hazard models, the first function is of little importance. In essence, the covariates have a proportional effect on the overall hazard rate, shifting it up or down, but do not change the actual shape of the hazard function.

This discussion on the Cox Model specification follows closely Allison (1995). In this model the parameterization of the hazard function is as follows:

\[
h_i(t, x, \beta) = \lambda_0(t)e^{\beta_1 x_{i1} + \ldots + \beta_k x_{ik}}. \tag{5.6}\]

This means that the hazard for individual \( i \) is the product of two functions: the unspecified baseline hazard function, \( \lambda_0(t) \), and a linear function of \( k \) covariates, \( e^{\beta_1 x_{i1} + \ldots + \beta_k x_{ik}} \).

Taking the logarithm of both sides, the model is rewritten as:

\[
\log h_i(t, x, \beta) = \alpha(t) + \beta_1 x_{i1} + \ldots + \beta_k x_{ik} \tag{5.7}\]

where, \( \alpha(t) = \log \lambda_0(t) \). One can easily specify \( \alpha(t) \), the baseline hazard function, to estimate a fully parametric model; however, \( \alpha(t) \), can take any form whatever since it cancels out of the equation, thus not affecting the hazard function for individual \( i \). In essence, a proportional hazard rate or a relative risk ratio is calculated given that the hazard for any given person is a fixed proportion of the hazard for any other person. Applying this notion to Equation (5.7) one calculates the following ratio:

\[
\frac{h_i}{h_j} = \exp\left(\beta_1 (x_{i1} - x_{j1}) + \ldots + \beta_k (x_{ik} - x_{jk})\right) \tag{5.8}\]

As shown in Equation (5.8) the baseline hazard functions cancel and the ratio of the hazard functions is constant over time. This implies that the hazard functions for the two individuals should be parallel. Proportional hazard models are widely used in
economics because of the interpretation of the covariate estimates and the ability of adequately handling censored data. The relative risk ratio, or the hazard ratio is calculated by take the exponential of the coefficient estimates, i.e., $e^{\beta_i}$. A more complete discussion on the calculation and the interpretation of the estimated hazard ratios is provided in the empirical results section of this chapter.

5.3 Data

Information on individual, household, business, and borrowing group characteristics of 206 microentrepreneurs comprises the data set used to examine the factors that influence the length of the banking relationship. Using the Cox PH method explained above, the hazard of client exit is modeled. In particular, the borrower’s individual, household, firm, and borrowing characteristics are regressed onto the length of the borrower’s relationship with the MFO, measured in the number of loan cycles.

Data for this research was collected in two stages over a period of eighteen months (September 1999 – March 2001) in Bamako, Mali. The initial objective of the research was to assess the socio-economic impacts of financial services on microentrepreneurs/clients of the MFO; however, during the second phase of the study the survey instrument was expanded to include questions on the borrowing relationship. This resulted in an extremely rich data set consisting of information on individual, household and housing characteristics, income shocks, business profiles, borrowing and savings behavior, especially focusing on the effects of various aspects of group lending on the borrower as well as issues of client satisfaction.
Over the course of the study, the individuals in the sample were observed twice over a period of 18 months; however, due to the recall nature of the data, the actual length of the data collection period is 27 months. It is convenient to divide this period into two phases as shown below in Figure (5.2). The beginning of the period (11/98) is actually the end of Phase 1 recall. The first data collection (10/99) is also the end of Phase 2 recall, and the period ended with the second and final data collection (1/01).
In addition to the information gathered during field interviews, data were collected on the individual’s borrowing relationship length, namely the number of months from the first day of her first loan to the maturity date of her last loan. Figure (5.3) shows by including the duration data the observation period effectively expands to 60 months, given that the earliest loan for this sample was granted on 11/96 and the last maturity date confirmed was 11/01. In examining the distribution of durations, the longest duration experienced by an individual was in fact 59 months. This distinction is necessary to make, especially as it pertains to the nature of the data and their effect on the hazard function.
In duration analysis in general, and in this study in particular, two types of data are used to examine borrower relationship length, those that are *time invariant* and those that are *time variant* in nature. *Time invariant* data are constant over time or follow a set, deterministic path, *e.g.*, age, education. *Time variant* data vary over time, following a random (stochastic) path, *e.g.*, profits, revenue. Examples of time variant data used in this study are: *business profit, net asset value, value of household income shocks, the household’s dependency ratio, and the number of other financial services used.* Examples of time invariant data used in this study are: *age, education, business experience before starting economic activity, if borrowing group experienced repayment*
problems, and if borrowing group held meetings on a regular basis. Given that one is attempting to estimate the effect of time variant and time invariant covariates on the borrowing relationship length, it is important to examine entry and exiting times of the individuals.

In this study, individuals started and ended their borrowing relationship at random times. The distribution of durations can be categorized into the following different cases as exhibited in Figure 5.4 below:

![Diagram](image)

**Figure 5.4: Sample Breakdown of Different Duration Cases**
Case 1: Those began and ended before start of the data collection period.

Case 2: Those started before the data collection period began and ended in Period 1.

Case 3: Those started before the data collection period began and ended in Period 2.

Case 4: Those started before the data collection period and were still active at the end of the period.

Case 5: Those started and ended in Period 1.

Case 6: Those started in Period 1 and ended in Period 2.

Case 7: Those started in Period 1 and were still active at end of study.

Case 8: Those started and ended in Period 2.

Case 9: Those started in Period 2 and were still active at the end of study.

The duration length of each observation within each case differs in length or is the same if there are ties. Cases 4, 7, and 9 were still active at 1/01 because they had loans that did not mature until 11/01. It may appear odd that one would take into consideration cases that started and ended before the data collection period, but these cases are important to include because certain characteristics (those that do not vary with time) affect borrowing length, e.g. age, education. In this study, some of the data collected, namely time variant
data, are useful for only a portion of the full observation period, some of the data collected namely, *time invariant* data are valuable for the entire period. Figure 5.5 below captures this phenomenon.\textsuperscript{35}

\textbf{Figure 5.5: The Relationship of Time Variant and Invariant Data with Borrowing Length}

\textsuperscript{35} Given the design of this study it was not feasible to collect time variant data from the beginning of the individual’s borrowing relationship.
One has to consider this phenomenon when modeling the effect of time variant and invariant data on the borrowing relationship length. In this case, the time variant covariates are conditioned on if the individual was in or out in each period. This was accomplished through by creating interaction terms, namely interacting the covariates with dummy variables for each period, 1 if in during the period and 0 otherwise. This permits one to estimate the marginal effect of the covariate on duration conditional on the fact that the individual is in or out during the period.

5.4 Duration Distributions and Survival Functions

The duration distribution for this sample is exhibited in Table 5.2. This table provides information on the distribution of the actual duration of the borrowing relationship for all individuals in the sample, those that started before 11/98, those that started between 11/98 and 10/99, and those that started after 10/99. For the overall sample, the mean and median duration lengths are 18.4 and 16.0 months, respectively. The percent of durations that were censored is 33, or 68 individuals. This means that 68 clients were still active, i.e., had not exited the borrowing relationship, at the end of the study on 1/01.

Regarding the first two groups, those that started before 11/98 and those that started between 11/98 and 10/99, there exist some striking similarities and differences. First, the sample size is roughly the same at 91 and 94 clients, respectively, and both cohorts exhibit nearly the same median duration time at 18.5 and 18.0 months, respectively. Mean values of these groups differ due to the difference in censoring levels,
namely 23.4 percent and 40.7 percent for the first and second cohort groups, respectively. For those that began their relationship before 11/98, the first censored duration observation appears in 29-32 months category, whereas for those that began during 11/98 and 10/99, the first censored observation appears in 17-20 months category. Given these facts, one can make pure duration comparisons across these cohort groups up and through the fourth observed duration category, 13-16 months, without worrying about the biases present due to censored observations.

Examining the first observed duration category, less than 5 months, 21.3 percent of those that started before 11/98 dropped out of the borrowing relationship compared to 17.6 percent of those that started between 11/98 and 10/99. By the third observed duration category, 9-12 months, 41.5 percent of the first cohort group had dropped out compared to only 29.7 percent of those that began later. Differences in duration lengths begin to even out in the next duration category, 13-16 months, in which 48.9 percent of the first group compared to 45.1 percent of the second group had dropped out. To make cumulative duration comparisons across these two groups into the next and subsequent duration categories does not make much sense due to occurrence of censored observations in these periods for one and/or the other group. In general, censoring underestimates actual duration length of the observation. When censored, all the researcher knows is that the client survived until at least a given date. If the observation period was extended beyond 11/01 for those clients that entered during 11/98 and 10/99, then the percent censored would decrease and the median duration would increase. Again, the first censored observations do not appear until the 17-20 months period.

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In Group 3, those that started after 10/99, censoring observations appear in the 9-12 month category. Therefore, pure duration comparisons across groups can only be made up and through the 5-8 month category. Individuals in Group 3 dropped out more rapidly in the first eight months than either of the two other groups. This difference and the differences highlighted above may indicate a starting date bias, something that is addressed when econometrically modeling client exit. First, however, an examination of survival functions across key comparison groups is executed.
### Table 5.2: Distributions of Borrowing Relationship Length

<table>
<thead>
<tr>
<th>Observed Duration (Mos.)</th>
<th>All Individuals (n=206)</th>
<th>Group 1 Started before 11/98 (n = 94)</th>
<th>Group 2 Started 11/98 - 10/99 (n = 91)</th>
<th>Group 3 Started after 10/99 (n = 21)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Percent (1)</td>
<td>Cum Percent (2)</td>
<td>Cum Percent (3)</td>
<td>Cum Percent (4)</td>
</tr>
<tr>
<td>&lt; 5</td>
<td>19.9</td>
<td>19.9</td>
<td>21.3</td>
<td>21.3</td>
</tr>
<tr>
<td>5 – 8</td>
<td>8.7</td>
<td>28.6</td>
<td>8.5</td>
<td>29.8</td>
</tr>
<tr>
<td>9 – 12</td>
<td>8.3</td>
<td>36.9</td>
<td>11.7</td>
<td>41.5</td>
</tr>
<tr>
<td>13 – 16</td>
<td>14.1</td>
<td>51.0</td>
<td>7.4</td>
<td>48.9</td>
</tr>
<tr>
<td>17 – 20</td>
<td>7.8</td>
<td>58.7</td>
<td>3.3</td>
<td>52.1</td>
</tr>
<tr>
<td>21 – 24</td>
<td>12.1</td>
<td>70.9</td>
<td>12.8</td>
<td>64.9</td>
</tr>
<tr>
<td>25 – 28</td>
<td>7.8</td>
<td>78.6</td>
<td>2.1</td>
<td>67.0</td>
</tr>
<tr>
<td>29 – 32</td>
<td>8.7</td>
<td>87.4</td>
<td>6.4</td>
<td>73.4</td>
</tr>
<tr>
<td>33 – 36</td>
<td>2.9</td>
<td>90.3</td>
<td>5.3</td>
<td>78.7</td>
</tr>
<tr>
<td>37 – 40</td>
<td>2.9</td>
<td>93.2</td>
<td>6.4</td>
<td>85.1</td>
</tr>
<tr>
<td>41 – 44</td>
<td>2.4</td>
<td>95.6</td>
<td>5.3</td>
<td>90.4</td>
</tr>
<tr>
<td>45 – 48</td>
<td>2.4</td>
<td>98.1</td>
<td>5.3</td>
<td>95.7</td>
</tr>
<tr>
<td>49 – 52</td>
<td>1.0</td>
<td>99.0</td>
<td>2.1</td>
<td>97.9</td>
</tr>
<tr>
<td>53 – 56</td>
<td>.5</td>
<td>99.5</td>
<td>1.1</td>
<td>98.9</td>
</tr>
<tr>
<td>&gt; 56</td>
<td>.5</td>
<td>100.0</td>
<td>1.1</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td><strong>Mean</strong></td>
<td><strong>21.0</strong></td>
<td><strong>17.4</strong></td>
<td><strong>11.6</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Median</strong></td>
<td><strong>18.5</strong></td>
<td><strong>18.0</strong></td>
<td><strong>13.0</strong></td>
</tr>
<tr>
<td>Censored</td>
<td><strong>33.0</strong></td>
<td><strong>23.4</strong></td>
<td><strong>40.7</strong></td>
<td><strong>43.9</strong></td>
</tr>
</tbody>
</table>
The objective of comparing survival functions across key indicator groups is to preliminarily analyze the data as a function of survival time, *i.e.*, length in the borrowing relationship. The *Kaplain_Meier* estimator is used to calculate and compare survival functions across groups. The results from this descriptive analysis are used to develop the general model of client exit. As a starting point, five time invariant covariates are analyzed, namely *age, education, business experience, group repayment problems, and group meetings held*.

![Survival Functions of Age Groups (Young and Old)](image)

**Figure 5.6: Survival Functions of Age Groups (Young and Old)**
In Figure 5.6 the survival functions of two age cohorts, younger and older than 35 years of age, are compared. It is hypothesized that older women (those above 35 years) are more stable and established than their younger counterparts, mostly due to civil status and number of children she may have. A woman that is single without children is typically more mobile than a married woman with children. In addition, the societal expectations of a married woman are different than for single woman. In essence, she is expected to remain at home to take care of her husband and children.

Examining the effect of this covariate in isolation, it is evident that age affects the survival rate of the individual’s borrowing relationship, namely older women appear to stay in longer than their younger counterparts. Up until month 12, the two groups have approximately the same survival trend, at which point the groups begin to dramatically diverge. At month 36, 31 percent of the older population remained in the borrowing relationship compared to 17 percent of young borrowers. The median survival lengths for young and old populations are 14 and 21 months, respectively. The difference in survival functions of these groups is significant at the 0.05 level.  

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36 The Log Rank statistical test determines the significance level.
Figure 5.7 shows the survival functions for individuals with less than six years of formal education to those with more than six years. In the Malian educational system students are required to take a standardized test after the sixth year. Often those that do not pass choose not to retake the examination, (only permissible after repeating the sixth year again), and drop out of school definitively. This trend is more girls than boys.
Examining this covariate in isolation, it appears that education does not influence the rate that individuals exit the borrowing relationship. Both groups have very similar trends up until roughly month 30 when those with more education begin to drop out more rapidly than those with less education. Both groups possess the same median survival of 17 months, and the difference in their functions is not significant.

Figure 5.8: Survivorship of Business Experience of Individual
Figure 5.8 displays survival functions of individuals possessing business experience before starting their economic activity to those not any experience. It appears, when examining in isolation, that business experience influences the length of the borrowing relationship of individuals. Up to month 12, the two groups experience roughly the same trend, at which point those without business experience begin to dropout more rapidly than those with experience do. The median survival time of those with and without business experience is 24 and 16 months, respectively, and the difference in survival time is significant at the 0.10 level.

Figure 5.9: Survivorship of Individuals in Groups with Repayment Problems
Figure 5.9 exhibits survival functions of individuals in groups with and without repayment problems. There is a dramatic difference in survival time of individuals in problem groups to those in non-problem groups, namely those experiencing difficulty dropped out more rapidly than those that did not. The median survival of individuals in repayment problem groups to those in problem free groups is 22 and 14 months, respectively. The difference in survivorship experience is highly significant at the 0.01 level.

Figure 5.10: Survivorship of Individuals in Groups that Held Regular Meetings
Figure 5.10 displays survival functions of individuals in groups that held regular group meetings, signifying more cohesiveness and transparency, to those that did not meet on a regular basis. Although the above figure provides inconclusive evidence, group meetings appear to influence an individual’s survival rate to some degree. In the beginning of the duration (months) distribution, those that held meetings had a longer survival rate than those that did not have. However, this trend shifts near the end of the distribution when those that did not hold meetings fared better than those that did. The median survival time for those individuals in groups that held meetings to those that did not is 21 and 15 months respectively; however, at the 0.28 level the difference is not significant.

5.5 Econometric Specification

One of the main objectives of this study is to econometrically estimate the impact that different factors have on the length of the borrowing relationship. Duration analysis methods are chosen to accomplish this goal because they permit one to do just that, namely to estimate the relationship between the length of time until failure or event, i.e., end of borrowing relationship, and the factors affecting that length. Duration models are preferred to logistic models because they incorporate more information by using length of time as the dependent variable instead of a dichotomous variable on status, e.g., in or out of the banking relationship (Kleinbaum, 1996). Given this, a conditional probability is used to estimate the
likelihood that one will terminate the borrowing relationship in the next short interval given that she is in today instead of just a straight probability on her status today.

To build a comprehensive duration model on bank relationships in the context of this study one must first return to the conceptual model presented in Chapter 3. Recall from the conceptual model that the borrower compares her value of staying in the borrowing relationship to her value of exiting and using self-financing at the end of each loan cycle. In this finite horizon model, her value of remaining in is the expected utility gained today plus a discounted stream of her future expected utility, given her belief about her partner’s type today. Her expected utility is a function of her income, loan return, and borrowing costs (her own and those associated with her partner). If the expected utility of staying in is greater than the expected utility of exiting, she remains in the borrowing relationship. If the opposite is true, then she leaves, thus terminating the borrowing relationship. If they are equivalent, she is indifferent between staying and leaving.

Taking group lending into consideration, it is assumed that the borrower does not have full information about her fellow group member. After observing her partner’s actions, i.e., repay or default, she updates her expectations about her group member’s type and uses it to recalculate expected utility for the next period. In essence, with time she is able to make a more informed exit/stay decision based on the observations she has made, not only about her other group member, but also about her own business profits. In essence, the borrower uses a benefit-cost
framework to evaluate the value of the borrowing relationship. She compares the net benefits with borrowing to the net benefits without borrowing, i.e., exiting and using self-financing. As long as the former is greater than the latter, she perceives the borrowing relationship to have value and remains in. From the conceptual model the fundamental factors that affect her decision to remain in or exit out of the borrowing relationship are her income, loan return, her loan repayment, and the costs she bears if her fellow group member does not pay.

In addition to the conceptual model described above, it is important to consider other factors that may affect the client’s decision to remain or leave the borrowing relationship, such as individual, household, and environmental characteristics. Drawn from the stylized facts on client exit presented in Chapter 2, several household and environmental characteristics, such as idiosyncratic shocks, systemic shocks, MFO policy and organization design failures, and competition from other banks, are included in the econometric model. Individual differences in age, education, and business experience, are also accounted for in this modeling framework.

The following is a description of each variable in the duration model on borrowing relationships. Due to data limitations, it is not possible to directly test some of the outcomes from the theoretical model, namely the effect of the interest rate and rewards on the probability of survival. In addition, proxy variables are used to capture the ‘type’ of group members of the microentrepreneur. These variables are described in more detail below.
**Number of Loan Cycles**

The number of loan cycles that a group has completed is the dependent variable used in this model. Recall from the conceptual model that the optimizing agent is making her stay/exit decision at the end of period, i.e., loan cycle. These models use the conditional probability of having been alive the previous period to calculate hazard rate. In this case, it is the entrepreneur’s probability of survival, i.e., stay for the next loan iteration, given she’s received one loan in the current period.

**Business Variables**

In this model, average monthly profits is used to capture loan return from the conceptual model. In this setting, it is assumed that profitable firms have less difficulty repaying their loans than less profitable firms. In a sense, one could think of profitable (unprofitable) firms as high (low) ability firms. Therefore, it is hypothesized that profitable firms remain in the borrowing relationship longer than less profitable firms. Given this covariate changes over time, average monthly profits in period one and two are used.

**Loan Terms**

In the conceptual model loan size and interest rate affect the survival probability of the maximizing agent. Lower interest rates have a positive impact on survival, whereas larger loan sizes diminish it. Here, only loan size is examined.
since all entrepreneurs in the sample face the same interest rate of 36 percent per annum. Average loan size for the group is used here. These data were collected only once at the end of the second phase of the study.

**Group Dynamics**

To capture the effect of other group members’ nonpayment a proxy covariate, *group repayment problems*, is used. This covariate is a dichotomous variable, 1 for if individual’s group did experience repayment problems over the course of relationship, and 0 otherwise. The rationale behind choosing this proxy variable is that it indicates the borrower’s group type, *i.e.*, *high or low*. It is assumed that groups with more high ability types will have less repayment problems than low groups, and thus a borrower in a high ability group will incur less cost due to default of other members as compared to a borrower in a low ability group. From the conceptual model it is maintained that borrowers with low type partners have a small probability of survival. Therefore, it is hypothesized that the hazard of exit for borrowers in groups that experienced repayment problems over the length of the relationship is greater than for borrowers in groups without problems. The limitation of this proxy covariate is that it does not explicitly quantify the default costs incurred to the individual due to others non-repayment. Instead, it implicitly captures the negative consequences, *i.e.*, extra financial burden, of being in a group that experienced repayment problems relative to those in groups that did not.

Another group dynamic variable is *tontine experience with group members*. This is used to proxy how well the group members know each other, know each
other in the sense of “doing business or transacting” with them. It is hypothesized that those people in groups that have had prior experience in tontine activities with one another are better equipped to successfully engage in a joint liability loan contract. Therefore, the hypothesis is that members in groups with high experience in tontines with exit less often than those with low prior experience.

Another proxy for how well group members know each other is the variable on group meetings (regularly held group meeting). The hypothesis is that borrowers in groups that held meetings on a regular basis remain longer, i.e., their hazard of exiting is lower, relative to those borrowers in groups that did not.

**Competition**

In this study, it is important to examine the impact competition from other MFO has on client exit. Recall from the desk studies on client dropout reviewed, it appears competition from other financial institutions does in fact play a key role in a client’s exit/stay decision. This is especially true in mature microfinance markets, like Bolivia and Bangladesh. For example, Schreiner (2000) found that competition from Chilean financing companies caused the client dropout rate in one Bolivian MFO to double in 1997. In addition, Ongena and Smith (2001) found in their study on banking relationships of firms in Norway that multiple bank firms terminated banking relationships earlier than single bank firms.

In the econometric model, the number of other financial services used in period one and two are used to measure the degree to which clients are affected by competition. Data were collected on formal financial services, e.g., banks, MFOs,
cooperatives, NGOs, etc., and informal financial services, e.g., family, friends, traditional lenders, ROSCAs\textsuperscript{37} etc. Therefore, it may be interesting to separate the two types of services, formal and informal, to determine if they have any differential effects on client exit.

It is hypothesized that the number of other formal financial services used will directly impact the hazard rate of client exit, namely as the number of formal financial services used the likelihood of ending the borrowing relationship increases. On the other hand, it is hypothesized that informal services used will negatively impact the hazard of leaving, namely, as the number of informal services used increases the likelihood of MFO departure decreases. An increase in informal services used may indicate a larger pool of financial resources to draw upon in times of repayment trouble. In essence, one can think of other formal financial services used as a substitute and other informal financial services used as a complement.

\textit{Idiosyncratic Shocks}

Of the 21 desk studies on client exit reviewed, 57 percent of the reporting agencies stated that idiosyncratic (individual or household level) shocks, such as births, deaths, chronic illness, ceremonies (weddings/baptisms), fire, theft, etc., played a significant role in the termination of the banking relationship. They found that increases in idiosyncratic shocks positively affected the hazard rate, namely as value of the idiosyncratic shocks increased the likelihood of exit hazard increased.

For the time being the positive hazard hypothesis is maintained. However, it is important not to neglect the interdependence of household and firm in the

\textsuperscript{37} ROSCA is a rotating savings and credit association.
developing country context in which production and consumption decisions are made simultaneously (Bardhan and Udry, 1999). Given this interdependence, individuals in households that experience more income shocks may actually borrow more to smooth consumption and production activities. If this is true, then individuals in households that experience larger income shocks may remain longer in the borrowing relationships due to a greater liquidity need at both the household and firm level. In this case, the impact of idiosyncratic shocks on the likelihood of hazard would be negative. To measure this effect, the value of household income shocks in period one and two is used.

Systematic Differences

Several of the reporting agencies that conducted studies on client exit reported that shifts MFO policy and organizational design, such as changes on product design, screening and monitoring strategies, etc. appear to affect the client’s decision. To capture such changes quarterly dummy variables are included in the econometric model. These structural covariate dummies take the value of 1, if started in that quarter and 0, otherwise. Recall that Piyeli experienced excessive client growth shortly after a new director took over MFO operations. It is anticipated that the hazard rate of clients that entered the borrowing relationship before the excessive growth period will be different from those that started after this period. Typically, during a period of such high growth screening and monitoring mechanisms are weaker, allowing a more risky clientele to enter the MFO. The medium to long run effect is a reduction in portfolio quality. In fact, Piyeli did
experience a large jump in both default rates and exit rates roughly six months after
the start of the high growth period.

*Household Characteristics*

The number of people in the borrower’s household may affect the length of
time that she remains in the borrowing relationship. There is an inverse relationship
between the household’s *dependency ratio* of the individual and her hazard rate of exiting the borrowing relationship. Dependency ratio is defined as the number of people that are *dependent, i.e.,* those less than 15 and those older than 60 years old, on the number of active members of the household, *i.e.,* those between 15 and 60 years old. It is hypothesized that individuals in households with higher dependency ratios will exit less rapidly than individuals in households with lower ones. In this setting, the lines between the firm and the household are very blurred. Often entrepreneurs in the informal setting money, the individual may use her loan to address the needs of her children or other family members. If indeed this is true, her need for credit is high, thus prompting her to stay in the borrowing relationship.

*Individual Characteristics*

The *age* and *education* of the borrower are controlled for in this model. It is expected that age will have an inverse relationship on the individual’s hazard rate. Given the Malian society in which older women are much less mobile, more established, and wield much more power in the community than younger women, it is hypothesized that the hazard of older women exiting will be less than their younger counterparts.
On the other hand, it is expected that education will have a positive effect on the borrower’s hazard rate of exiting. Those with education have more outside opportunities than those without education. For example, an individual that can read and write is able to access other (semiformal and formal) financial sources more than someone who is illiterate. First, if other banks advertise through print, e.g., newspaper, magazine, billboards, a literate person will have the knowledge advantage over someone that is not literate. In addition, if other banks implicitly require their customers to read and write, then a literate person will more easily be able to access their services than an illiterate individual will. Therefore, it is hypothesized that the hazard of exit of individuals with more education is higher than the hazard of those with less education.

In addition to being able to access other financial services, a more educated person has an ability to access business training courses, e.g., bookkeeping/accounting, marketing, feasibility studies, cash flow management, technical trainings, etc., more than her less educated counterpart.

5.6 Empirical Results

The results of the general model on banking relationship length are presented in Table 5.3. As stated earlier, a semiparametric model, the Cox Proportional Hazard (PH) Model, is use to estimate the relationship between the length of the individual’s banking relationship, i.e., the number of loan iterations she has completed, and her business, group, individual, and household characteristics. In
the Cox (PH) Model estimates the log hazard function, so the sign of coefficient estimates determine if it has increasing or decreasing effect on the hazard function. In the Cox Model, the coefficient estimates are used to calculate the hazard ratio, thus having no real interpretative quality on their own. The Wald statistic is used to test the null hypothesis on each variable, which is equivalent to the ratio of the coefficient to its standard error squared. The hazard ratio is calculated as $\exp(B)$ for each covariate. If the covariate is dichotomous then the interpretation is relatively straightforward. It is the ratio of the estimated hazard for those individuals with the value of 1 to those with a value of 0, controlling for all other covariates (Allison, 1995). For quantitative covariates, subtract 1 from the hazard ratio then multiply by 100 to obtain the estimated change in the hazard rate per unit change in the covariate.
<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE</th>
<th>Sig.</th>
<th>Exp(B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ave. Monthly Profit – P1</td>
<td>-0.159</td>
<td>0.110</td>
<td>0.150</td>
<td>0.853</td>
</tr>
<tr>
<td>Ave. Monthly Profit – P2</td>
<td>-0.374</td>
<td>0.115</td>
<td>0.001***</td>
<td>0.688</td>
</tr>
<tr>
<td>Net Asset Value – P1</td>
<td>-0.024</td>
<td>0.045</td>
<td>0.594</td>
<td>0.976</td>
</tr>
<tr>
<td>Net Asset Value – P2</td>
<td>0.028</td>
<td>0.042</td>
<td>0.496</td>
<td>1.029</td>
</tr>
<tr>
<td>Business Experience</td>
<td>-0.035</td>
<td>0.226</td>
<td>0.877</td>
<td>0.966</td>
</tr>
<tr>
<td>Average Loan Size</td>
<td>-0.129</td>
<td>0.074</td>
<td>0.079*</td>
<td>0.879</td>
</tr>
<tr>
<td>Tontine Experience with Group Members</td>
<td>-0.200</td>
<td>0.269</td>
<td>0.457</td>
<td>0.819</td>
</tr>
<tr>
<td>Group Repayment Problems</td>
<td>0.391</td>
<td>0.212</td>
<td>0.065*</td>
<td>1.478</td>
</tr>
<tr>
<td>Held Group Meetings</td>
<td>0.028</td>
<td>0.228</td>
<td>0.904</td>
<td>1.028</td>
</tr>
<tr>
<td>Other Formal Sources Used – P1</td>
<td>-0.560</td>
<td>0.629</td>
<td>0.373</td>
<td>0.571</td>
</tr>
<tr>
<td>Other Formal Sources Used – P2</td>
<td>-0.212</td>
<td>0.683</td>
<td>0.756</td>
<td>0.809</td>
</tr>
<tr>
<td>Other Informal Sources Used – P1</td>
<td>-0.060</td>
<td>0.044</td>
<td>0.166</td>
<td>0.941</td>
</tr>
<tr>
<td>Other Informal Sources Used – P2</td>
<td>-0.390</td>
<td>0.156</td>
<td>0.012***</td>
<td>0.677</td>
</tr>
<tr>
<td>Total Shock Value – P1</td>
<td>-0.129</td>
<td>0.058</td>
<td>0.027**</td>
<td>0.879</td>
</tr>
<tr>
<td>Total Shock Value – P2</td>
<td>-0.072</td>
<td>0.055</td>
<td>0.188</td>
<td>0.931</td>
</tr>
<tr>
<td>Dependency Ratio – P1</td>
<td>0.141</td>
<td>0.127</td>
<td>0.267</td>
<td>1.151</td>
</tr>
<tr>
<td>Dependency Ratio – P2</td>
<td>-0.529</td>
<td>0.130</td>
<td>0.000***</td>
<td>0.589</td>
</tr>
<tr>
<td>Age</td>
<td>-0.213</td>
<td>0.205</td>
<td>0.298</td>
<td>0.808</td>
</tr>
<tr>
<td>Education</td>
<td>0.060</td>
<td>0.023</td>
<td>0.008***</td>
<td>1.061</td>
</tr>
<tr>
<td>Quarter 2 Start</td>
<td>0.420</td>
<td>0.779</td>
<td>0.590</td>
<td>1.522</td>
</tr>
<tr>
<td>Quarter 3 Start</td>
<td>0.234</td>
<td>0.794</td>
<td>0.768</td>
<td>1.263</td>
</tr>
<tr>
<td>Quarter 4 Start</td>
<td>0.666</td>
<td>0.798</td>
<td>0.404</td>
<td>1.947</td>
</tr>
<tr>
<td>Quarter 5 Start</td>
<td>0.652</td>
<td>0.830</td>
<td>0.432</td>
<td>1.919</td>
</tr>
<tr>
<td>Quarter 6 Start</td>
<td>0.415</td>
<td>0.881</td>
<td>0.638</td>
<td>1.514</td>
</tr>
<tr>
<td>Quarter 7 Start</td>
<td>0.737</td>
<td>0.787</td>
<td>0.349</td>
<td>2.089</td>
</tr>
<tr>
<td>Quarter 8 Start</td>
<td>-0.078</td>
<td>0.887</td>
<td>0.930</td>
<td>0.925</td>
</tr>
<tr>
<td>Quarter 9 Start</td>
<td>0.553</td>
<td>0.773</td>
<td>0.475</td>
<td>1.738</td>
</tr>
<tr>
<td>Quarter 10 Start</td>
<td>1.151</td>
<td>0.827</td>
<td>0.164</td>
<td>3.162</td>
</tr>
<tr>
<td>Quarter 11 Start</td>
<td>1.185</td>
<td>0.795</td>
<td>0.136</td>
<td>3.270</td>
</tr>
<tr>
<td>Quarter 12 Start</td>
<td>1.265</td>
<td>0.962</td>
<td>0.188</td>
<td>3.543</td>
</tr>
<tr>
<td>Quarter 13 Start</td>
<td>1.939</td>
<td>0.972</td>
<td>0.046**</td>
<td>6.952</td>
</tr>
<tr>
<td>Quarter 14 Start</td>
<td>-8.566</td>
<td>270.892</td>
<td>0.975</td>
<td>0.000</td>
</tr>
</tbody>
</table>

***, **, * significant at the 0.01, 0.05. and 0.10 levels respectively.

Table 5.3: Cox Proportion Hazard Regression Model Results
The hazard of ending the banking relationship is significantly affected by the following: business profits, average loan size, repayment problems of borrowing group, other financial services used, household income (negative) shocks, dependency ratio of household, and education as well as the starting date of the banking relationship.

Average monthly business profits in period 2 significantly impact the hazard rate of the individual. In fact, a $100.00 increase in monthly profit would reduce the hazard of ending the banking relationship in the next period by 31 percent. As expected, businesses that are more profitable remain in the banking relationship longer because they are able to maintain their loan requirements. Although the sign on average monthly business profit in period 1 is expected, it does not significantly impact client exit. The other business covariates, business experience and net asset value, also do not significantly affect the hazard of ending the banking relationship.

As hypothesized, being a member of a group with repayment problems, significantly affects the hazard of ending the banking relationship. In fact, during the study period individuals in risky groups are 1.48 more times likely to exit than those individuals in groups without repayment problems. This result is significant at the 0.10 level.

Competition from informal financial sources significantly affects the hazard rate of the client. In fact, one additional financial service used in period 2 decreases the hazard of leaving by 32 percent. This is significant at the 0.01 level. In addition
to loans from MFOs, like Piyeli clients are receiving money from other sources, mostly informal one, *e.g.*, family, friends, shopkeepers. These sources, however, are not pulling clients out of the MFO. Instead, it appears their services are complementing those of Piyeli.

Two household level covariates, *total shock value* and *dependency ratio*, significantly affect the hazard of ending the banking relationship. An increase of $100.00 in the *total income shock value in period 1* at the household level would decrease the individual’s hazard rate by 12 percent. Likewise, a full one-point increase, on a scale from 0 to 5, in the household’s *dependency ratio in period 2* would reduce an individual’s hazard of leaving by 41 percent. These results indicate that financial burdens of the household impact the borrowers stay/exit decision. If the individual does not have other financial options, the costs of exit increases as the household’s financial needs increase. Therefore, she will stay, as the needs of the household remain high.

As expected, *education* directly and significantly impacts the hazard of ending the banking relationship. An additional year of formal education increases the hazard rate by 6 percent. This supports the hypothesis that more educated individuals ended the banking relationship earlier than those with less education did. As previously stated, education increases both an individual’s financial and business opportunity sets.

Last, those individuals that started their borrowing relationship in the thirteenth quarter were 6.92 times more likely to exit than those that started in the
first quarter. During this quarter much of the Piyeli staff was mobilized to recuperate delinquent loans most likely due to the high growth period as explained above. Given this, it is very possible that their screening mechanisms for new clients suffered during this period. In addition, during this time Piyeli instituted a policy of paying outside agents to recruit new borrowing groups. This ‘outsider’ may not have been as cautious in selecting new members as Piyeli’s own staff would have been.

5.7 Conclusions

In this chapter client exit trends of microentrepreneurs in Mali were analyzed with the use of nonparametric and semiparametric duration methods. Overall, clients demonstrate a negative duration dependence, i.e., the longer they stay in the more likely they are to leave the borrowing relationship, thus verifying a key outcome of the theoretical model. Nonparametric survival function comparisons displayed distinct differences between cohort groups. Older clients, clients with more business experience, and those in groups with less repayment problems survive longer than their respective counterparts.

A semiparametric model, the Cox Proportional Hazard Model, estimated the effect of different covariates on the hazard rate of exiting the borrowing relationship. As projected from the postoptimality analysis of the theoretical model, profit and loan size affect the hazard of client exit. Other factors, such as if a client was in a group with repayment problems, if she used additional sources of credit, the dependency ratio of her household, and her education level all impact the hazard of a
client terminating her relationship. With the exception of repayment problems and education, most factors negatively impact hazard, \textit{i.e.,} increase survival.
CHAPTER 6

CONCLUSIONS

6.1 Introduction

The overall goal of this research was to better define and determine the factors that affect client exit in microfinance. To accomplish this goal, the first objective of this dissertation was to build a logical framework of stylized facts on client exit in attempt to better understand the current climate worldwide in regards to this issue. The second objective of this study was to theoretically model client exit behavior in joint liability contracts. The last objective of this study was to empirically examine the factors that significantly affect the length of time in the borrowing relationship. Below are the main conclusions from this research effort.

6.2 Main Conclusions

Client exit in microfinance is problematic worldwide to varying degrees and for various reasons. For many MFOs, clients cited they exited due to problems within the group, inappropriate loan sizes and terms, forced and inaccessible savings, poor staff quality and deficient operational policy. Regionally, African MFOs also cite idiosyncratic and systemic shocks as primary factors affecting exit. And Latin American and Asian MFOs state competition and client maturity as important contributors of exit.
Modeled in a dynamic, choice theoretic framework, an optimizing, utility maximizing agent is faced with a stay/exit decision at the end of each group loan cycle. Faced with uncertainty about her partner’s type, she has to evaluate her expected utility of staying in the borrowing relationship to that of exiting and using self-financing. Not knowing her partner’s type, i.e., high/low ability, she forms a belief about type after observing the business outcomes of her partner. With each new observation she updates her belief about her partner’s type and recalculates the value of staying in the borrowing relationship.

The dynamics of this model are interesting. To make this decision she compares her subjective belief about her partner being a high type, $p$, to a critical probability value, $\hat{p}$. The critical probability is the value at which firm is indifferent about staying in or exiting the group loan contract. If $p$ is greater (less) than $\hat{p}$, she stays (exits). The critical value, $\hat{p}$, is an increasing function of time which reflects the diminishing returns to learning. The longer firm remains in the contract the less impact new information has on her belief about her partner’s type and the less willing she is to remain with a low ability type partner. The outcomes of the model are influenced by the parameter values of the structure. Loan size, interest rate, relative risk aversion, and loan return all impact the critical probability, $\hat{p}$.

Critical probability values are increasing in loan size. At larger loan amounts the optimizing agent is less tolerant of staying with a low type. Although she benefits from the larger loan amount, this benefit is tempered by the fact that she will incur a large cost if her partner is unable to pay.
Similar to loan size, critical probabilities are increasing in interest rates. As loans become costlier, she is less willing to stay in a contract with a partner of low type. In fact, at certain interest rate values it is too costly for her to even enter the contract.

As one would expect, critical probabilities increase in relative risk aversion. The more risk averse firm, is the less tolerant she is about staying in a borrowing group with a low type partner. The more risk averse individual will exit sooner than the less risk averse person given her critical probability value will be higher.

Critical probabilities decrease in loan return. The optimizing agent is more willing to stay in the contract as loan return increases; however, she requires a minimum return to even enter the contract given the parameter values of this model. In addition to these outcomes, survival probability paths can be calculated for each partner, high and low. In general, the survival probability of the optimizing agent when she is with a high type partner is higher than when she is with a low type partner. These probability values are influenced by the parameters of the model. Given better loan terms, i.e., large loans at cheaper rate, the survival probabilities of with either type increases. In summary, better (worse) terms, i.e., larger (smaller) loan and lower (higher) interest rate, increase (decrease) survival probabilities. However, it appears that increasing loan size alone ultimately decreases the survival probabilities of the firm. These results are exacerbated at high levels of risk aversion.

Lastly, rewards appear to induce group stability. In short, rewards affect the behavior of an optimizing agent making stay/exit decisions. For some parameter values an agent will not enter into the contract when there are no rewards, but will when rewards
are introduced into the scheme. For other parameter values, the agent would enter the contract with or without rewards. There are still other parameter values, however, in which an optimizing agent would never engage in group loans irrespective of a set reward scheme.

Duration methods were used to examine client exit issues for the Malian MFO, Piyeli. Overall, clients demonstrate a negative duration dependence, *i.e.*, the longer they stay in the more likely they are to leave the borrowing relationship, thus verifying a key outcome of the theoretical model. Nonparametric survival function comparisons displayed distinct differences between cohort groups. Older clients, clients with more business experience, and those in groups with less repayment problems survive longer than their respective counterparts.

A semiparametric model, the Cox Proportional Hazard Model, estimated the effect of different covariates on the hazard rate of exiting the borrowing relationship. As projected from the postoptimality analysis of the theoretical model, profit and loan size affect the hazard of client exit. Other factors, such as if a client was in a group with repayment problems, if she used additional sources of credit, the dependency ratio of her household, and her education level all impact the hazard of a client terminating her relationship. With the exception of repayment problems and education, most factors negatively impact hazard, *i.e.*, increase survival.

### 6.3 Policy Implications

Summarizing the above main conclusions of this study, we see that loan terms matter, rewards matter, and picking the right partner matters. Loan terms affect the
stay/exit behavior of clients. Although clients may be induced into good repayment behavior in order to have access to larger loan amounts, these larger loans may induce group instability. An optimizing agent in a group lending contract may exit early when faced with larger loan sizes because of the increased expected costs due to her partner’s default. At larger loan levels joint liability becomes more burdensome for the borrower and may prompt clients to exit early.

Some form of reward, however, could induce stability as shown in the simulation exercises of Chapter 3. In this setting individuals in a group are granted access to individual loans after successfully completing $n$ cycles of group loans. This scheme may be very risky for the MFO due to the difficulty in separating good clients from bad clients. Implementing such a strategy could severely diminish the quality of the MFO’s portfolio. It is therefore recommended that any reward scheme be carefully constructed and tested before it is implemented.

Analogous to a bank not having full information about its clients, fellow group members face uncertainty about one another. Choosing good partners is imperative to the success of the group as a whole. Sometimes people that seem like obvious partners, e.g. friends, family members, are not always the most appropriate one to engage in joint liability contracts. If the group’s success is conditional on picking the ‘right’ type of members, MFOs should train clients in screening and monitoring skills.

Last, to deal appropriately with this issue, one has to first identify the reasons or the causes of this trend. Therefore, it is recommended that MFOs implement a policy to on collecting information from exiting clients. This could be carried out in a relatively efficient and low cost manner. For example a policy requiring a short exit interview for
clients that leave would be a good start. Valuable information could be garnered from exiting clients to be used to develop and shape future products and services. Other ways to gather information about why clients leave is through focused group and/or suggestion boxes.


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