



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

THE HAZARD OF CLIENT EXIT IN MICROFINANCE

By,

Maria E. Pagura, Research Associate

**The Rural Finance Program
Department of Agricultural, Environmental, and Development Economics
The Ohio State University**

Selected Paper for the AAEA Annual Meetings

July 28-31, 2002

Long Beach, California

Copyright © 2001 by Maria E. Pagura. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies. Any errors remain those of the authors.

THE HAZARD OF CLIENT EXIT IN MICROFINANCE

Maria E. Pagura

The Rural Finance Program

Department of Agricultural, Environmental, and Development Economics

The Ohio State University

Abstract

In this study it is shown that group lending is not always effective in dealing with the information and enforcement issues associated with financial intermediation. In particular, by transferring all screening responsibilities onto borrowers, efficiency is lost in the intermediation process, creating poor quality matches between borrowers and loan contracts. This results in high client exit. This phenomenon is especially exaggerated in environments in which group lending based on joint liability is a new lending technology in the financial market. Drawing upon theories of job matching and technology adoption, client exit is described in a choice theoretic framework. Basically, when faced with a decision of staying or exiting, a client compares her expected benefits of borrowing to her expected costs. She exits when the costs of borrowing are greater than the benefits of borrowing. Interesting exit/stay outcomes arise when joint liability is modeled into the choice. Using a hazard model, we show that different borrower/firms exhibit differences in duration dependence.

Introduction

By retaining clients, businesses tap one of the most lucrative sources of profitability. Simply stated, it is more costly to attract and cultivate new clients than it is to maintain existing ones. Client retention, however, continues to be a formidable challenge for most businesses, large and small. This is especially true for Microfinance Organizations (MFOs) that provide financial services to poor people in developing countries. These organizations are losing clients at high rates, ranging from 20 to 60 percent per year. At these rates, the microfinance industry faces a major challenge of attaining sustainability and surviving in the long run.

In the last year, client exit has become a hot topic among practitioners in this industry, especially since they are the ones experiencing the ill effects from losing existing clients¹. Although a handful of MFOs have explored this issue to some degree, few have attempted to theoretically model and empirically examine this phenomenon in detail. This study endeavors to accomplish this task. The overall goal of this research is to better define and determine the factors affecting client exit in microfinance. Drawing upon theories of job matching and technology adoption, client exit is described in a choice theoretic framework. Basically, when faced with a decision of staying or exiting, an MFO client compares her expected benefits of borrowing to her expected costs. She exits when the costs of borrowing are greater than the benefits of borrowing. Interesting exit/stay outcomes arise when joint liability is modeled into the choice. Over time group member behavioral characteristics are revealed to the borrower. She then uses this information to update her expectations about the costs of borrowing. Given the critical role that time plays in this decision, client exit is empirically examined using a duration model. Duration models are used to analyze the length of time an individual is in or has survived a certain state, in this case the length of time in a borrowing relationship. An objective of this study is to uncover the factors that significantly influence the length of that time.

The main contribution of this research will be to the microfinance field. The findings of this study will no doubt have major policy implications for many MFOs. By better understanding the factors

¹ *Client exit, attrition, and dropout* are used interchangeably throughout this document.

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, which in the long run will have a beneficial impact on overall sustainability. In addition, one would hope that this research would impel others to rigorously examine client exit in microfinance. Given the newness of this endeavor there exists much room for further exploration.

Why should one be concerned with high exit rates in MFOs? First, decreasing the rate at which people exit reduces costs, lowers risks, and increases productivity. Screening and monitoring costs are significantly lower for mature borrowers than for new ones. Repeat borrowers require less monitoring than new borrowers and the MFO, through a sustained relationship, has acquired much more information on the client, allowing them to make an informed and less risky, repeat lending decision. In addition, it is extremely inefficient and expensive for MFOs to lose clients, both in terms of lost investment already spent and in terms of forgone larger future interest income that more mature clients could have generated (Wright 2000). This hampers the sustainability of MFOs in the long run, and creates a continuing dependence on an already highly subsidized industry.

Secondly, are policymakers and, ultimately, taxpayers willing to support on a continuing generous basis an industry that is showing little signs of sustainability? This is doubtful given the lamentable outcomes of development strategies from the 1960s through the 1980s, which included subsidized credit targeted to poor farmers through state run development banks (Gonzalez-Vega and Graham, 1995). Much of the credit during that period was diverted to the politically strong and away from the intended target groups; repayment rates rarely reached 50 percent; and subsidies skyrocketed (Adams, Graham, and Von Pischke, 1984). Not wanting to repeat the same mistakes, donors are cautious about creating a subsidy dependent industry, especially one that they will not be able to sustain (Morduch, 1999). Given this warning, MFOs are forced to examine financial sustainability issues, like client exit, more seriously, if they want to survive.

Lastly, one should be concerned with this issue because finance matters. The development of financial markets and institutions is a critical and inextricable part of the growth process (Levine, 1997).

If microfinance can become truly sustainable, then the potential for it to affect economic growth in developing countries is promising. Currently, about 1.2 billion people globally live at or below the poverty line of one US dollar per day. The development of a sustainable financial industry that adequately serves this population is critical for poverty alleviation and economic growth.

After reviewing several MFO desk studies that examined client exit in some detail, one critical stylized fact emerges: clients leave due to group problems and overall dissatisfaction with joint liability of group lending (Painter and McKnelly, 1999; Wright et al., 1999; Kuwik and Mashaba, 2000; Churchill and Halpern, 2001). 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 the developing country context 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-Meza, 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 the notion of *joint liability* of this type of loan product, they most certainly will need time to learn about how the loan product 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 these questions.

The main hypothesis of this study is that client exit is affected by the borrowing costs incurred by the borrower as well as the healthiness of her business. Given that group lending is new to the microfinance market under study, a client's expected costs may be very different than the costs she actually incurs. As time passes the client *learns* more about the behavior of her fellow group members as well as other costs associated with group lending, such as weekly meetings, monitoring costs, and general loan maintenance costs.

It is hypothesized that clients that are in groups which incur high default costs over time exit more rapidly, than those with lower default costs. Drawing upon search and matching theory, this phenomenon is modeled in the following manner. A firm (from here on *firm* and *microenterprise* are used interchangeably) enters into a group loan contract with incomplete information on several aspects of contract quality, such as the true costs of the loan, i.e., screening, monitoring and joint liability costs, whether the microentrepreneur finds working in a group is fruitful, and if the repayment schedule is truly suitable to her cash flow needs. The arrival of bad information on these aspects of the quality of the loan contract prompts her to exit and seek better opportunities elsewhere. Because the discovery of much of

this bad information is likely to occur during the initial stages of the borrowing relationship, she will have a higher probability of quitting at the beginning of a contract match. With time, a borrower decides to remain since her good credit record affords her better terms and conditions. She is not enticed to borrow with another microfinance organization offering similar terms and conditions since it is assumed that her creditworthiness is nontransferable. This is a valid assumption in a developing country context where well functioning credit bureaus are almost nonexistent. Hence, she has less of an incentive to exit with the passage of time to preserve and profit from her reputation capital.

In addition, it is hypothesized that different microenterprises, e.g. healthy and unhealthy, exhibit different patterns of borrowing behavior over their life cycles. In particular, the borrowing tenure effect will be negative for a healthy firm, i.e., the longer the client remains in the borrowing relationship the less likely she will exit, whereas an unhealthy firm will demonstrate a positive tenure effect, namely the longer the client remains the more likely she will be to exit.

Healthy and unhealthy firms will behave differently in this setting. It is assumed that all firm/borrowers are credit constrained². It is also assumed that a healthy firm is serious about establishing a long term borrowing relationship since she most likely is more informed about the advantages of continuous debt financing. Therefore, if the healthy firm initially remains, then with time she will be less likely to exit as terms and conditions improve. On the other hand, an unhealthy firm may not have well-developed borrowing preferences or expectations due to her lack of *experience* in debt financing. Therefore the initial period of the borrowing contract is even more of a learning process for an unhealthy, e.g., inexperienced, borrower. A decision about the quality of the match cannot occur until this process is complete. She is more likely to exit with time due to her inability to maintain the commitments of her contract over time. In essence, the level of unhealthiness is revealed to the lender and other group members in her failure to observe the specifications of the contract over time. Two things may occur 1) the borrower may realize that she cannot meet the requirements of future loan contracts and bows out

² Liedholm and Mead (1998) through extensive surveys reported credit constraints as an important obstacle for entrepreneurs in five West African countries.

voluntarily; or 2) she continues to borrow until she defaults because all of her resources to service the debt contract have been exhausted.³

Conceptual Model

Since client exit has rarely been analyzed in the context of banking and finance, this literature offers no obvious formal economic models that could be adapted for this microfinance application. It is therefore logical to explore exit issues in other fields, such as labor economics. In this field, economists have examined and modeled worker and career exit rates based on search, human capital, and turnover theory (Meitzen, 1986; Murnane and Olsen, 1988; 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 (1988) 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 others' 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

³ It assumed that repayment is based on the borrower's *ability to repay* and not her *willingness to repay*.

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 learns about her partner's type over time. As her partner's type is revealed, the firm updates her expectations about her partner's riskiness and future default costs associated with the updated information on risk. The firm then uses these updated expectations regarding costs to make her exit/stay decision.

Assume that this economy is made up of heterogeneous, anonymous, relatively mobile, and credit constrained borrowers.⁴ Assume a representative firm_{*i*} wants to invest in a project. To do this she needs to invest one unit of money into the project, but does not have the necessary physical collateral required by formal banks to obtain a loan.⁵ Instead, she engages in a group-lending contract in which she is jointly liable for her own repayment as well as her co-members' payment in the event they default. To simplify the model assume she forms a group with one other member, firm_{*j*}. The pool of potential borrowers from which to choose her group member is made up of two types of firms, safe firms and risky firms as defined below. Assume that firm_{*j*} is safe with probability, λ_j , and the firm is risky with probability, $1 - \lambda_j$.

*Beginning of Period *t**

This is a two period model. In the beginning of period *t*, firm_{*i*} forms a group with either a risky or safe firm_{*j*}. As previously stated, since borrowing groups are created at random and firms do not know each other's type ex ante, the following partnerships can occur: {(S,S) (S,R) (R,S) (R,R)}. Once the group is formed, each member is required to contribute a portion of their wealth, ω , to a joint savings account. In addition, each firm borrows loan amount, *l*, which is invested into her project at the beginning of period *t* and the loan amount plus interest, *R*, is paid back at the end of the period. For obvious reasons it is assumed that the wealth fraction is less than the loan amount received.

⁴ This is similar to Armendariz de Aghion and Gollier's (2000) assumption.

⁵ In this context the firm is the borrower.

$$\text{A.1} \quad \omega < l$$

It is also assumed that a safe firm's project succeeds with probability $(1-\alpha)$ and fails with probability, (α) , whereas a risky firm's project succeeds with probability $(1-\rho)$ and fails with probability, (ρ) . When a project succeeds, firm_{*i*}, whether safe or risky, receives profits, π_{it} , and nothing when it fails. This is summarized as follows:

$$\text{A.2} \quad 1-\alpha = \text{probability firm succeeds given she is safe;}$$

$$\text{A.3} \quad \alpha = \text{probability firm fails given she is safe;}$$

$$\text{A.4} \quad 1-\rho = \text{probability firm succeeds given she is risky;}$$

$$\text{A.5} \quad \rho = \text{probability firm fails given she is risky.}$$

Assume also that the probability of failing for safe firms is less than the probability of failing for risky firms.

$$\text{A.6} \quad \alpha < \rho$$

In addition, assume that if a firm's project succeeds, then she pays back her loan in full. If it fails, she gains no income and defaults. This assumption focuses on the borrower's *ability* to pay and not her *willingness*, thus precluding strategic default.

At the beginning of period t firm_{*i*} calculates the net profit that she expects to receive at the end of period t with borrowing, $E(\Pi_{it})$, and her expected net profit at the end of the period without borrowing, $E(\tilde{\Pi}_{it})$.

$$E(\Pi_{it}) = E(\pi_{it}) - E(\sigma_{it}) - \theta - R \tag{1}$$

$$E(\tilde{\Pi}_{it}) = E(\tilde{\pi}_{it}) \tag{2}$$

Expected net profit with borrowing at the end of period t is a function of expected profits, $E(\pi_{it})$, minus the expected costs if firm_{*j*} defaults, $E(\sigma_{it})$, transaction costs, θ , and firm_{*i*}'s own loan repayment, R ,

principal plus interest owed. Expected net profit without borrowing at the end of period t , $E(\tilde{\Pi}_{it})$, is just her expected revenue minus business costs, not including those associated with borrowing.

In equation (1), firm $_i$'s expected profit, $E(\pi_{it})$, when the firm is safe is:

$$E(\pi_{it|safe}) = \alpha(0) + (1 - \alpha)\pi_{it} \quad (3)$$

and,

$$E(\pi_{it|risky}) = \rho(0) + (1 - \rho)\pi_{it} \quad (3')$$

when firm $_i$ is risky.

In addition, firm $_i$'s expected cost due to firm $_j$'s default at the end of period t is as follows:

$$E(\sigma_{it}) = (\lambda_j \alpha + (1 - \lambda_j)\rho)R \quad (4)$$

Equation (4) is the probability that firm $_j$ is safe times the probability that she fails given she's safe plus the probability that firm $_j$ is risky times the probability that she fails given she's risky. The loan amount to repay is then multiplied by this new probability value to obtain the final expected cost due to j 's default. Remember, firm $_i$ does not incur any default costs if firm $_j$ succeeds. At this stage, the probabilities of success or failure are not firm specific. One could think of them as exogenous shocks to the firm. What one does know is that risky firms have a greater chance of failure, given an adverse shock, than safe firms, as stated earlier in assumption A.6.

Placing equations (3) and (4) into equation (1), firm $_i$'s expected net profit at the end of period t given she's safe is as follows:

$$E(\Pi_{it|safe}) = (\alpha(0) + (1 - \alpha)\pi_{it}) - (\lambda_{jt}(\alpha) + (1 - \lambda_{jt})\rho)R - \theta - R \quad (5)$$

Lastly, it is assumed that firm_i's expected net profit at the end of period t with borrowing, $E(\Pi_{it})$, is greater than her expected profit without borrowing, $E(\tilde{\Pi}_{it})$, irrespective if the firm is safe or risky.⁶

$$A.7 \quad E(\Pi_{it}) > E(\tilde{\Pi}_{it})$$

End of Period t

At the end of period t , both firms have realized profits. Given business outcomes, i.e. success or failure, firms pay or default on their loans. Assume for the time being that firm_i is safe and that her project succeeded in period t . Given firm_j's behavior, firm_i updates her belief about firm_j's type and uses this new information to calculate her expected net profits for period $t+1$. She uses the following updating rule to recalculate firm's safe (λ) and risky ($1-\lambda$) probabilities:

$$\lambda_{jt}^i = \lambda_{jt-1} + \frac{1}{t(t+1)D_{t-1}}$$

where,

$$D_{t-1} = -1, \text{ if } j \text{ defaults in } t-1;$$

$$1, \text{ if } j \text{ pays in } t-1.$$

In essence, λ_j is firm_i's subjective probability about firm_j's type. As more information is revealed to her, she reevaluates her subjective probability using the above updating.

Beginning of Period $t+1$

At the beginning of period $t+1$, using the updated subjective probability, λ_j , firm_i recalculates her profits that she expects to receive at the end of period $t+1$. Firm_i expected net profit for $t+1$ given she is safe is as follows:

$$E(\Pi_{it+1|safe}) = (\alpha(0) + (1-\alpha)\pi_{it+1}) - (\lambda_{jt+1}(\alpha) + (1-\lambda_{jt+1})\rho)R - \theta - R \quad (6)$$

⁶ M^cKinnon (1973), using a traditional Fisherian diagram, shows how external borrowing permits an entrepreneur to break out of the traditional mold of stagnation to higher production levels by investing in new technology. This higher production allows the entrepreneur to increase consumption in period one and repay the loan in period two.

She then compares this value, $E(\Pi_{it+1|safe})$, to her expected net profits at the end of period $t+1$ without borrowing, $E(\tilde{\Pi}_{it+1|safe})$. Firm_{*i*} uses the following rules to make her stay/exit decision:

$$\text{If } E(\Pi_{it+1|safe}) > E(\tilde{\Pi}_{it+1|safe}), \text{ then firm}_i \text{ stays} \quad (7)$$

$$\text{If } E(\Pi_{it+1|safe}) < E(\tilde{\Pi}_{it+1|safe}), \text{ then firm}_i \text{ exits} \quad (8)$$

$$\text{If } E(\Pi_{it+1|safe}) = E(\tilde{\Pi}_{it+1|safe}), \text{ then firm}_i \text{ is indifferent} \quad (9)$$

between staying or exiting

If borrowing ceases to exist at the end of period $t+1$, one might pose the following question regarding the incentive for firm_{*i*} to pay her loan as well as her partner's loan. If there is no future borrowing at the end of period $t+1$, then what motivates firm_{*i*} to pay in the event that firm_{*j*} defaults at the end of the period? Assume that firm_{*i*}'s losses of not paying are greater than what she gains if she also defaults at the end of the period. This is characterized as follows:

$$\text{A.8} \quad \omega + SC_{it+1} > 2R$$

where,

$$\omega \quad = \text{wealth contribution paid back at the end of } t+1;$$

$$SC_{it+1} \quad = \text{social costs incurred from defaulting};$$

$$2R \quad = \text{total loan payment when partner defaults.}$$

Assuming A.8 holds, firm_{*i*} has an incentive to pay, $2R$, even if borrowing ceases to exist at the end of period $t+1$. This is a strong assumption, however, in developing countries much value is placed on social ties and relationships. If people outside of firm_{*i*}'s borrowing group observe her behavior, they may be inclined to exclude her from future business ventures or similar financing activities, such as a rotating saving club. If firm_{*i*} is extremely credit constrained, then being excluded from such saving clubs, could have very high costs.

Example Exit/Stay Cases

Case 1: Both Firms Succeed

In the following discussion a couple of different decision outcomes are examined. In the first case, both firm_i and firm_j succeed at the end of period t . It is pretty obvious that firm_i decides to stay at the beginning of $t+1$ given her expected net profit, $E(\Pi_{it+1})$, at the end of period $t+1$ has increased. Firm_i recalculates her subjective probability about firm_j's riskiness given the new information that has been revealed to her at the end of period t . Assume firm_i feels that she has a 50-50 chance of choosing a safe partner in the beginning of period t given that she has no information about her ex ante. Therefore, she updates her subjective probability for period $t+1$ as follows:

$$\text{Firm}_i\text{'s subject probability about firm}_j\text{ in period 1: } \lambda_{j1} = \frac{1}{2} + 0$$

$$\text{Firm}_i\text{'s subject probability about firm}_j\text{ in period 2: } \lambda_{j2} = \frac{1}{2} + \frac{1}{2(3)(1)} = \frac{2}{3}$$

Given her new expectation on firm_j's riskiness she updates her calculation on expected net profits for period 2, namely:

$$E(\Pi_{i2}|_{safe}) = (\alpha(0) + (1-\alpha)\pi_{i2}) - \left(\frac{2}{3}\alpha + \frac{1}{3}\rho\right)R - \theta - R$$

as compared to expected net profit at the beginning of period 1:

$$E(\Pi_{i1}|_{safe}) = (\alpha(0) + (1-\alpha)\pi_{i1}) - \left(\frac{1}{2}\alpha + \frac{1}{2}\rho\right)R - \theta - R.$$

Recalling assumption A.6 and assuming that profit, π_{it} , increases or remains constant over time, then firm_i's expected net profits with borrowing in period 2 are greater than her expected net profits with borrowing in period 1.

Assume that expected net profits without borrowing remains constant over time, namely:

$$\text{A.9} \quad E(\tilde{\Pi}_{it}) = E(\tilde{\Pi}_{it+1}).$$

Given assumption A.9 and the fact that expected net profits with borrowing increases or remains the same over time then firm_i decides to stay because:

$$E(\Pi_{i2}|_{safe}) > E(\Pi_{i1}|_{safe}) > E(\tilde{\Pi}_{i2}).$$

Case 2: Firm_i Succeeds and Firm_j Fails

This is the case in which firm_i succeeds and firm_j fails and defaults at the end of period t . Firm_i pays, $2r$, given that she has succeeded. She is now faced with an exit/stay decision at the beginning of period $t+1$. To make this decision she recalculates her expected default costs at the end of period $t+1$ given the new information she has received about firm_j's type at the end of period t . As before, she uses her updating rule to calculate her subjective probability about firm_j's type in period $t+1$, λ_{jt+1} .

Firm_i's subject probability about firm_j in period 1: $\lambda_{j1} = \frac{1}{2} + 0$

Firm_i's subject probability about firm_j in period 2: $\lambda_{j2} = \frac{1}{2} + \frac{1}{2(3)(-1)} = \frac{1}{3}$

As before she updates her calculation on expected net profits for period 2 given her new expectation on firm_j's riskiness, namely:

$$E(\Pi_{i2}|_{safe}) = (\alpha(0) + (1-\alpha)\pi_{i2}) - \left(\frac{1}{3}\alpha + \frac{2}{3}\rho \right) R - \theta - R$$

as compared to expected net profit at the beginning of period 1:

$$E(\Pi_{i1}|_{safe}) = (\alpha(0) + (1-\alpha)\pi_{i1}) - \left(\frac{1}{2}\alpha + \frac{1}{2}\rho \right) R - \theta - R.$$

This time firm_i's decision is not so clear-cut. In fact, her decision depends on the relative value of profit, π_{it} , and her expected default costs. It is true that expected default costs in period 2 are greater than those in period 1, however, it is ambiguous if period 2 costs are great enough to incite firm_i to exit. Therefore, she bases her exit/stay decision on the following conditions:

If $E(\Pi_{i1}|_{safe}) > E(\Pi_{i2}|_{safe}) > E(\tilde{\Pi}_{i2})$, firm_i stays.

If $E(\Pi_{i1}|_{safe}) > E(\tilde{\Pi}_{i2}) > E(\Pi_{i2}|_{safe})$, firm_i exits.

The outcomes of the cases discussed above are presented in the following figure.

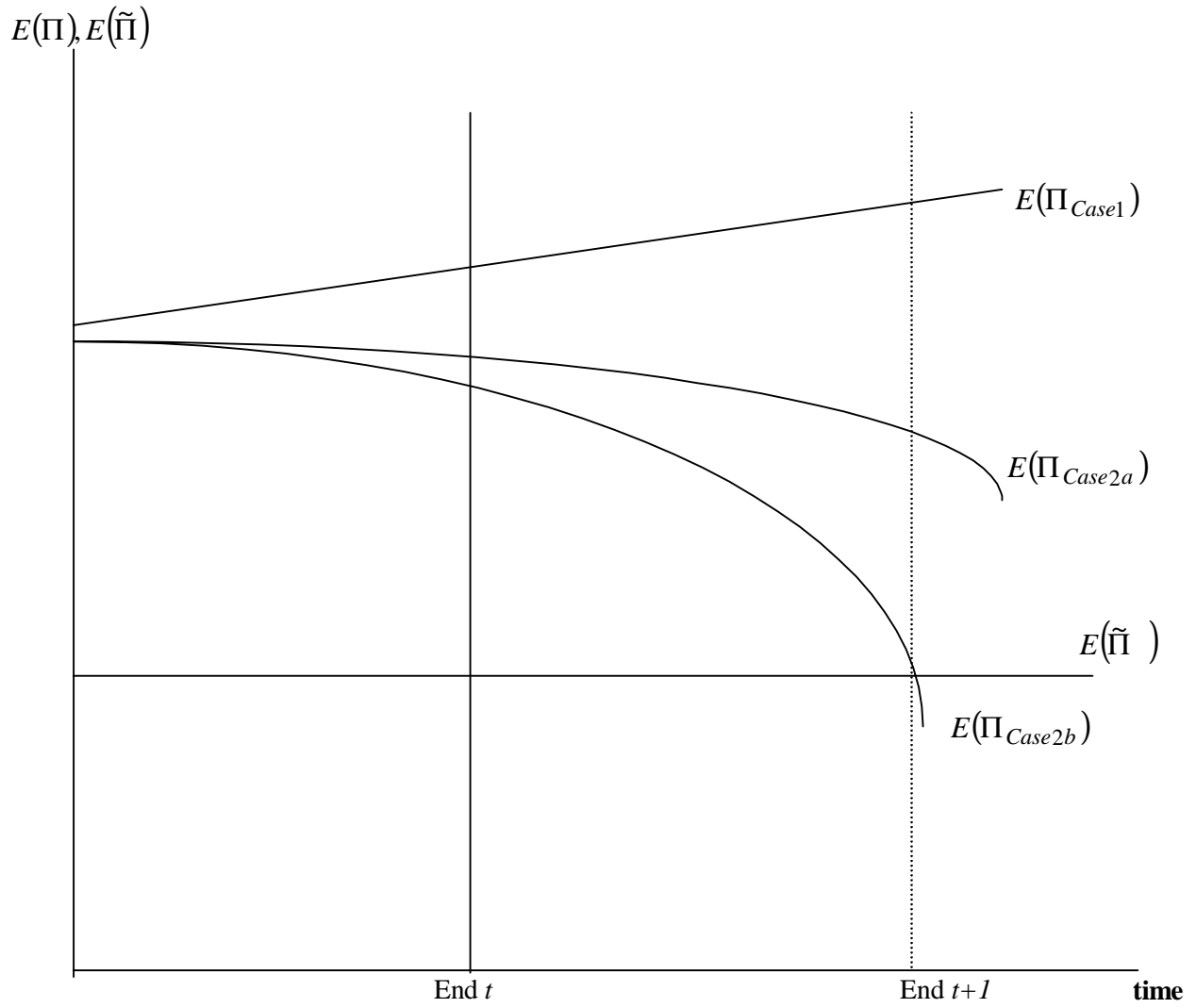


Figure 4.1: Example Exit/Stay Outcomes

Time and the Updating Rule

Firm_{*i*}'s updating rule has an interesting feature when placed in the infinite horizon context, namely that it heavily rewards (penalizes) firm_{*i*}'s pay (default) behavior in the first period. In subsequent periods, punishment (reward) decreases (increases) over time. In essence, first impressions about firm_{*i*} matter and are hard to reverse in the future. There exists a decreasing marginal effect to the amount of knowledge gained over time. The following graphs depict four different scenarios over time.

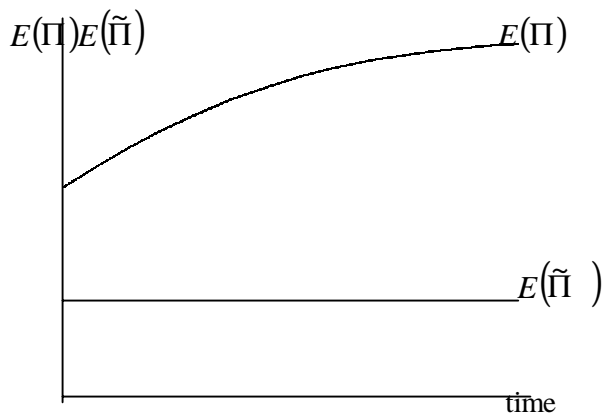


Figure 4.2

Firm_{*i*} never defaults. Firm_{*i*}'s expected net profit continues to increase over time. Firm_{*i*} never exits.

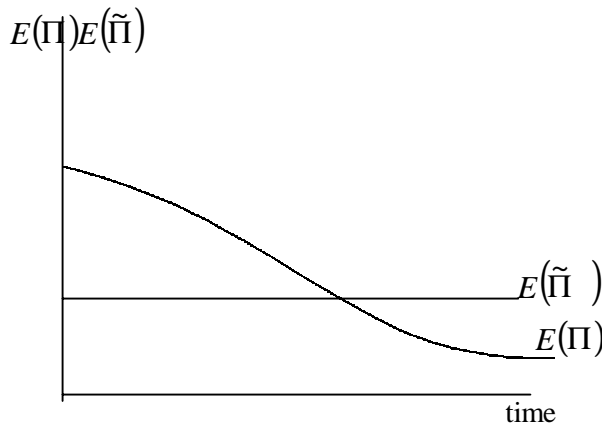


Figure 4.3

Firm_{*i*} always defaults. Firm_{*i*}'s expected net profit continues to decrease over time. Firm_{*i*} exits when $E(\Pi) < E(\tilde{\Pi})$.

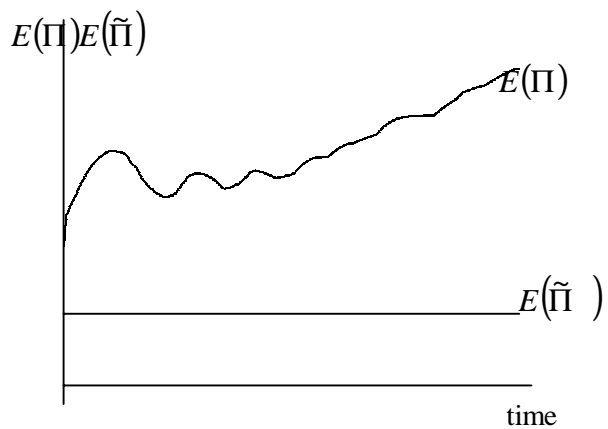


Figure 4.4

Firm_{*i*} may have default difficulties early on but quickly gets on a path of continual repayment. Since firm_{*i*}'s expected net profit increases over time, she remains.

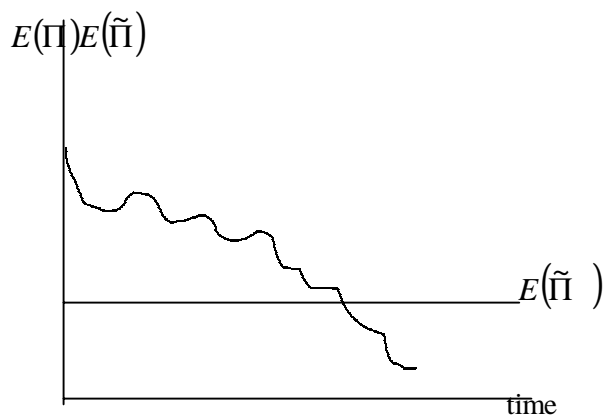


Figure 4.5

Firm_{*i*} defaults more than she pays, leading firm_{*i*}'s expected net profit on a downward path. She exits as soon as $E(\Pi) < E(\tilde{\Pi})$

In summary, firm_{*i*} is faced with the following four possible exit/stay scenarios at the beginning of period $t+1$:

Firm_{<i>i</i>}	Pays	Defaults
Firm_{<i>j</i>}	Pays	Defaults
Pays	Stays	Uncertain
Defaults	Uncertain	Exits

Figure 4.1: Firm_{*i*}'s Decision Matrix

In the first case, where both firms are successful and pay their loan, firm_{*i*} stays because she has incurred no default costs and, more importantly, her expected profits in the next period have increased given her more optimistic view about firm_{*j*}'s safeness.

In the second scenario where both firms fail, firm_{*i*} has no reason to calculate future expected net profits since neither she nor her partner can pay for their loans. In this case, both firms exit.

In the other two cases, interesting ambiguities arise. In the case where firm_{*i*} pays and firm_{*j*} defaults, firm_{*i*}'s exit/stay decision depends on how much she penalizes her for default and how close firm_{*i*}'s expected net profits with borrowing are to her expected net profits without borrowing. In the last case, firm_{*i*} has no exit/stay decision to make given she has failed.

Data and Econometric Analysis

As demonstrated in the previous section, time critically affects the borrower's exit/stay decision. Over time borrower type is revealed. In group lending with imperfect information, a representative borrower updates her expectations about costs due to her partner's default probability. As time passes the marginal value of this information decreases, having a lesser impact on the probability of the borrower's exit. Examining the length that an individual is in a particular state, e.g., borrowing relationship, is the central feature of duration analysis that is used to empirically study client exit issues.

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 occurring, i.e., 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; Lancaster, 1979; Meitzen, 1986; Murnane and Olsen, 1988; 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 probability theory underlying duration analysis is provided. Next, an empirical model is proposed to examine client exit in Mali, followed by a brief discussion on some of the estimation challenges that one may encounter in using these techniques.

Probability Theory and Duration

This presentation follows closely 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:

$$F(t) = \Pr(T \leq t) \tag{10}$$

Equation (10) 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. Therefore, equation

(10) is the probability that the borrowing relationship stops before time t . Sometimes it is also interesting to examine the probability that a spell is of at least length t , which is given by the *survival function*:

$$S(t) = 1 - F(t) \quad (11)$$

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:

$$\begin{aligned} \lambda(t) &= \lim_{\Delta \rightarrow 0} \frac{\Pr(t \leq T < t + \Delta | T \geq t)}{\Delta} \\ &= \lim_{\Delta \rightarrow 0} \frac{F(t + \Delta) - F(t)}{\Delta S(t)} \\ &= \frac{f(t)}{S(t)} \end{aligned} \quad (12)$$

where,

$f(t)$ is the density function. The hazard function conveniently defines duration dependence. *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. More appropriate expressions for these two dependency types are the statistical terms *increasing hazard* and *decreasing hazard*.

The exponential, Weibull, lognormal, and log-logistic distributions are popular choices to use in duration analysis. These are all distributions for a nonnegative random variable and each displays very different behavior. For example the exponential distribution is known as the “memoryless” distribution because the hazard rate is constant overtime. The Weibull distribution displays increasing or decreasing hazard depending on parameter values. And 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.

Estimating Client Exit

General Model

The manner in which the hazard rate is constructed depends upon the expected duration dependence. For this model, increasing (decreasing) hazard means that the longer a client remains in the borrowing relationship, the higher (lower) the probability becomes that she will exit in the current period. In order to construct an appropriate hazard function it is critical to select a distribution that adequately describes the data at hand. Choice of distribution is often based on a particular theory, convenience, and some preliminary plotting of data (Kiefer, 1988). To date, the choice of distribution has not been made. It is presumed (but not verified) that the data demonstrate an increasing hazard in the early stages followed by decreasing hazard. If this is indeed the case, then the lognormal or the log-logistic distributions may be appropriate choices as a starting point for estimation.

To estimate the probability that a client will exit 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 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:

$$\hat{L} = \prod_{i=1}^n f(t_i z) \quad (13)$$

As is typically the case in duration analysis, some spells are not completed at the end of the period. A way to deal with this complication is by using the technique called censoring. If spells are uncompleted at the end of the period, then they are right censored. To account for right-censored variables, the likelihood function now becomes:

$$\ln L = \sum_{i=1}^n [d_i \ln f(t_i z) + (1 - d_i) \ln S(t_i z)] \quad (14)$$

where d_i is defined as 1 if a client has exited and 0 otherwise. Parameter estimates are calculated by maximum likelihood estimation.

Dependent Variable

Typically in duration analysis, spell length, in this case the length of time in the borrowing relationship, is the dependent variable under study. Calendar time is usually chosen as the scale measure of duration length; however, there are instances when that scale may not be the most appropriate choice. As in this study, is it more appropriate to measure duration length in number of months in the relationship or the number of loan iterations that the client has experienced? At this time it is still uncertain which scale measure is more appropriate. Therefore, it is proposed that both measures be empirically specified and tested.

Independent Variables

As previously stated above, other factors in addition the parameters of the distribution may affect the hazard rate of exit. As modeled in the theoretical section, it is perceived that the individual's exit decision is affected by the costs she incurs due to other members' default. To capture this in the empirical model, a default cost proxy is constructed, which is explained in detail below. In addition to this variable, the client's exit decision is modeled as a function of her business profits, transaction costs, and repayment amount. Proxies for these variables will be included in the empirical model as explained below. In addition to these variables, there are other variables that are included in the model based on the stylized facts uncovered in the literature on client exit in microfinance. In the discussion that follows a brief description of each variable is provided as well as a hypothesis on the hazard rate effects.

1. **DCOST_{*i*}** - This is the default cost that client_{*i*} incurs over time. This is constructed using default data on the group over time weighted more heavily if the client personally did not have any default problems. As DCOST_{*i*} increases the hazard of the borrowing spell ending increases.
2. **TRANSCOST_{*i*}** – This is a variable to capture the transaction cost incurred by client_{*i*}. Although it is not endogenous in the theoretical model, it also plays a critical role in provoking exit. Due to data limitations transaction costs over time is not analyzed; instead, a proxy representing the absolute value over the period is constructed. It is

hypothesized that the value of these costs provoke exit, namely the larger the transaction cost value the more likely she is to exit.

3. **EXPINFORMAL_i** – This is a variable to determine the impact of the client’s prior experience in similar financing mechanisms on the exit rate. Those that have more experience in engaging in rotating savings groups may be better adept at choosing members for borrowing group. Either an experience dummy or an absolute value for the number of savings groups the client has engaged in over the study period is used. It is hypothesized that the more experience she has the better she will be about choosing group members and the longer she will stay in the borrowing relationship.
4. **REVHIGH_i** - The number of months that the client’s business revenue was high during the period. Due to data limitations it is not possible to examine the effect of changes in business revenues over time; however, a proxy for revenue flows can be constructed for the study period. This variable is an absolute number of months that the client’s business revenues were high. As REVHIGH_i increases, hazard decreases.
5. **BUSTYPE_i** – Dummy variables for business type will be constructed to examine the effect of the business nature on the hazard rate of exit. As a starting point, dummies for service, small trade, and productive actives are constructed. A more detailed analysis of the business activities needs to be carried out to determine the most appropriate categorization of businesses. One possibility is to differentiate between high and low growth firms. Using this approach, one would think that high growth firms would stay in longer, given their need for capital investment as compared to their stagnant counterparts.
6. **HSHOCKS_i** – Another variable that might affect client exit is the client’s household vulnerability to economic shocks. Given the interdependency between firms and households in developing countries, clients in households that had experienced shocks during the study period will be more likely to exit. The number of economic shocks that

the household of client_{*i*} faced during the period is used. Therefore, as $HHSHOCKS_i$ increases, hazard increases.

7. **WAGERS_{*i*}** – In contrast, as the number of wage earners in client_{*i*}'s household increases, it is hypothesized that client exit hazard decreases, given that she has a larger pool of financial resources from which to draw upon in times of need.
8. **AGE_{*i*}** – The age of the client may or may not influence exit. A younger client may be more mobile and less settled than her older counterpart, which could adversely affect the exit hazard rate. Also, age in this Malian environment could play an interesting role given that age *matters* in Mali, namely the young have to defer to the old. It is unclear how this will play out on the exit rate; however, one could imagine many scenarios in which power struggles within the group lead to repayment problems and eventual default. On the other hand, a younger client may be more dynamic in her borrowing activities and very savvy about running her business. In this case, age would be inversely related to the hazard rate. Much more analysis is needed before making formal hypothesis on the effect of age.
9. **EDUCATION_{*i*}** – Education level is controlled for by a variable representing the number of years of formal education.

In addition to the independent variables highlighted above, some of the terms and conditions of the loan contract over time will be incorporated into the model, namely repayment frequency and length. As these conditions improve, it is hypothesized that clients will exit less.

References

- Adams, D., D.H.Graham, and J.D. von Pischke. *Undermining Rural Development with Cheap Credit*. Boulder, CO: Westview Press, 1984.
- Armendariz de Aghion, B., and C. Gollier. "Peer Group Formation in an Adverse Selection Model." *The Economic Journal*. 110(July2000): 632-43.
- Besley, T., and S. Coate. "Group Lending, Repayment Incentives and Social Collateral." *Journal of Development Economics*. 46(1995):1-18.
- Conning, J. "Joint Liability, Peer Monitoring, and the Creation of Social Collateral." IRIS Working Paper #165. Institutional Reform and the Informal Sector. University of Maryland College Park, 1999.
- Dolton, P., and W. von der Klaaw. "Leaving Teaching in the UK: A Duration Analysis." *The Economic Journal*. 105(March 1995): 431-44.
- Ghatak, M. "Screening by the Company You Keep: Joint Liability Lending and the Peer Selection Effect." *The Economic Journal*. 110(July 2000): 601-631.
- _____. "Group Lending, Local Information and Peer Selection." *Journal of Development Economics*. 60(1999): 27-50.
- Ghatak, M. and T.W. Guinnane. "The Economies of Lending with Joint Liability: Theory and Practice." *Journal of Development Economics*. 60(1999): 195-228.
- Gonzalez-Vega, C., and D.H. Graham. "State-owned Agricultural Development Banks: Lessons and Opportunities for Microfinance." *GEMINI Technical Report No. 89*. USAID, June 1995.
- Greene, W.H. *Econometric Analysis*. New York: Macmillan Publishing Company, 1993.
- Kiefer, N.M. "Economic Duration Data and Hazard Functions." *Journal of Economic Literature*. 26(June 1988): 646-679.
- Kiefer, N.M., and G.R. Neumann. "An Empirical Job Search Model, with a Test of the Constant Reservation-Wage Hypothesis." *Journal of the Political Economy*. 87(February 1979): 89-107.
- Laffont, J.J., and T. N'Guessan. "Group Lending with Adverse Selection." *European Economic Review*. 44(2000): 773-784.
- Lancaster, T. *The Analysis of Transition Data*. New York: Cambridge University Press, 1990.
- Levine, R. "Financial Development and Economic Growth: Views and Agenda." *Journal of Economic Literature*. 35(June 1997): 688-726.
- Madajewicz, M. "Capital for the Poor: the Role of Monitoring." Harvard University Working Paper. 1997.
- Meitzen, M.E. "Differences in Male and Female Job-quitting Behavior." *Journal of Labor Economics*. 4 (1986): 53-83.

- Morduch, J. "The Microfinance Promise." *Journal of Economic Literature*. 37(1999):1569-1614.
- Munasinghe, L. "Wage Growth and the Theory of Turnover." *Journal of Labor Economics*. 18(April 2000): 204-220.
- Murnane, R.J., and R.J. Olsen. "The Effect of Salaries and Opportunity Costs on Duration in Teaching: Evidence from Michigan." *The Review of Economics and Statistics*. 71(May 1989): 347-352.
- Narendranathan, W., and S. Nickell. "Modelling the Process of Job Search." *Econometrics*. 52(July 1984): 29-49.
- Nickell, S. "Estimating the Probability of Leaving Unemployment." *Econometrica*. 47(September 1979): 1249-66.
- Paxton, J. "Determinants of Successful Group Loan Repayment: An Application to Burkina Faso." PhD Dissertation. The Ohio State University. 1996.
- Preston, A.E. "Why Have All the Women Gone? A Study of Exit of Women from the Science and Engineering Professions." *The American Economic Review*. 84(December 1994): 1446-1462.
- Reinganum, J. F. "Technology Adoption under Imperfect Information." *The Bell Journal of Economics*. 14(Spring, 1983): 57-69.
- Rodriguez-Meza, J. "Group and Individual Microcredit Contracts: A Dynamic Numerical Analysis." PhD Dissertation. The Ohio State University. 2000.
- Saloner, G., and A. Shepard. "Adoption of Technologies with Network Effects: An Empirical Examination of the Adoption of Automated Teller Machines." *The RAND Journal of Economics*. 26 (Autumn 1995): 479-501.
- Stoneman, P., and M.J. Kwon. "Technology Adoption and Firm Profitability." *The Economic Journal*. 106(July 1996): 952-962.
- Wright, G.A.N. *Microfinance Systems: Designing Quality Financial Services for the Poor*. New York: The University Press Limited, 2000.